



Stove House Five, Lion Salt Works, Marston, Northwich, Cheshire West

Archaeological Excavation



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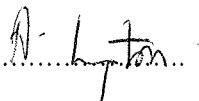
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SUMMARY

Cheshire West and Chester Council has secured a significant funding package to enable to repair and restoration of the Lion Salt Works in Marston, near Northwich (centred on NGR 367109 375470). The Lion Salt Works is the last surviving inland open-pan salt works in England, and the immense archaeological and historical significance of the site is reflected in its designation as a Scheduled Monument (No 1020841). The component structures, including the pan houses, a salt store, brine tank, bore holes, pump house, boiler house, manager's office, and a smithy, have further statutory designation as Grade II listed buildings, and also lie within the Marston Conservation Area.

The salt works commenced operation in 1856, and remained in commercial use until 1986, when closure was necessitated largely as a result of the loss of its main markets in West Africa during the civil war in Nigeria. The works was acquired subsequently by Vale Royal Borough Council to prevent the demolition and ultimate loss of the site, with an intention that it should become a working museum. In 1993, the management of the site was passed to the Lion Salt Works Trust, which was set up by Cheshire County Council and Vale Royal Borough Council. However, the buildings have continued to deteriorate, and the site was placed on English Heritage's 'Buildings at Risk Register'. The present scheme will ensure the restoration of the buildings, and the development of the site into an important heritage attraction.

In order to satisfy Scheduled Monument and listed building consents for the necessary repair and development works, Cheshire West and Chester Council commissioned Oxford Archaeology North to undertake a programme of archaeological investigations on the site. This included the excavation of the footprint of Stove House Five, the above-ground elements of which were dismantled in 2009. The excavation was carried out in January 2013, and was intended to compile a detailed record of any buried remains of archaeological interest prior to the proposed development works.

The excavation revealed the well-preserved remains of nineteenth- and twentieth-century structures. Six distinct phases of activity were identified during the excavation: the initial establishment of the Alliance Works in 1856; the construction of the Alliance Works pan smithy and associated boiler/engine house in the early 1860s; the development of the Lion Salt Works in 1894 and, specifically, the construction of the fisheries pans and associated chimney and flues; the laying of cast-iron pipes in 1938 to replace the brine shaft pumping mechanism beneath the brine tank; the construction of Stove House Five in 1965; and activity on site following the closure of the Lion Salt Works in 1986.

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The excavation was undertaken by Graham Mottershead, Lewis Stitt and Phil Cooke. The report was written by Graham Mottershead and Ian Miller, and Mark Tidmarsh prepared the illustrations. The finds were examined by Christine Howard-Davis. The project was managed by Ian Miller, who also edited the report.

1. INTRODUCTION

1.1 CIRCUMSTANCES OF THE PROJECT

- 1.1.1 Cheshire West and Chester Council has secured a significant funding package to enable to repair and restoration of the Lion Salt Works, the last surviving inland open-pan salt works in England and a Scheduled Monument (No 1020841). The works comprises numerous buildings, including the pan houses, a salt store, brine tank, bore holes, pump house, boiler house, manager's office, and a smithy, which are all afforded statutory designation as Grade II listed buildings.
- 1.1.2 The salt works commenced operation in 1856, and remained in commercial use until 1986, when closure was necessitated largely as a result of the loss of its main markets in West Africa during the civil war in Nigeria. The works was acquired subsequently by Vale Royal Borough Council to prevent the demolition and ultimate loss of the site, with an intention that it should become a working museum. In 1993, the management of the site was passed to the Lion Salt Works Trust, which was set up by Cheshire County Council and Vale Royal Borough Council. However, the buildings have continued to deteriorate, and the site was placed on English Heritage's 'Buildings at Risk Register'. The present scheme will ensure the restoration of the buildings, and the development of the site into an important heritage attraction.
- 1.1.3 In order to satisfy Scheduled Monument and listed building consents for the necessary repair and development works, Cheshire West and Chester Council commissioned Oxford Archaeology North to undertake a programme of archaeological investigations on the site. This included the excavation of the footprint of Stove House Five, the above-ground elements of which were dismantled in 2009. The excavation was carried out in January 2013, and was intended to compile a detailed record of any buried remains of archaeological interest prior to the proposed development works.

1.2 SITE LOCATION AND GEOLOGY

- 1.2.1 The Lion Salt Works lies on the east side of Ollershaw Lane (the B5075) and immediately to the south of the Trench and Mersey Canal in the village of Marston (Plate 1), which is situated some 2km to the north-east of Northwich, Cheshire (centred on NGR 367109 375470). The works occupies a level site at a height of approximately 25m above Ordnance Datum (aOD), from where ground level falls gently in a south-westerly direction towards the valley of the River Weaver. The site forms an important historic component of the Marston Conservation Area, within which it lies.



Plate 1: Aerial view of Marston and the Lion Salt Works prior to the repair works, with arrow marking the position of Stove House Five

- 1.2.2 Geologically, the area is underlain by the Mercia Mudstone Group, and the brine is extracted from the Northwich Halite Formation (formerly known as the Lower Keuper Saliferous Beds). Historical brine pumping in the Northwich area has resulted in large-scale subsidence at ground level, and subsequent flooding of these areas has resulted in formation of large but shallow pools, such as Neumann's Flash, to the west of Marston.

1.3 TECHNOLOGICAL BACKGROUND

- 1.3.1 The inland salt industry in England rose in prominence during the medieval period, and ultimately supplanted the traditional processes of producing salt from sea water. The inland industry exploited brine springs that occurred immediately above rock salt beds, which existed in the Cheshire-Shropshire Basin, and parts of Worcestershire, Staffordshire, Lancashire and Somerset.
- 1.3.2 During the later medieval period, pumps began to be inserted into natural brine springs and pits to increase the supply of brine. Developments in pumping technology led to the introduction of steam-powered pumps, and later to the use of diesel, compressed air and electrically-powered pumps. The brine was stored in brine tanks or cisterns from where it passed by gravity into evaporating pans. These pans, initially of lead but later of riveted iron sheets, could be housed either indoors in a pan house or outdoors, although generally fine pans which heated brine to a higher temperature would be housed indoors while common pans used for producing common or fishery salt would be housed outdoors.
- 1.3.3 Once evaporated the salt would be dried in stove houses then placed in warehouses which were attached to the pan house. Common pans were generally longer than fine pans, and consisted of a brick furnace upon which the pan rested with flues carrying heat below the pan to a chimney. Pan houses consisted of dwarf brick walls supporting a timber structure with roofs constructed with central vents to allow steam to escape. The attached stove houses were brick built to retain heat with the hot gasses from the furnace beneath the pan being directed below the stove house through flues to a chimney. Lump salt would be lofted to a room above the stove room for storage or grinding. This upper room may also contain a crushing mill where crushed salt would be fed by chute into bags before being stitched and sealed.
- 1.3.4 Following the discovery of rock salt near Northwich in 1670, numerous mines were sunk to depths of approximately 45m into the upper bed of rock salt, a lower bed remaining undiscovered at that time. Each mine was served by a two-stage shaft for access, winding and ventilation. Winding in the top shaft was done by means of a horse gin while a windlass served the bottom shaft. The shafts would have been covered by a roofed timber structure to keep them dry with the gin circle or gin house close by.
- 1.3.5 Following the discovery of a lower bed of rock salt in 1779, all new mining operations were transferred to the deeper level. Steam engines were used for winding rock salt and pumping water out of the mines and by the nineteenth century were widespread. The most prominent structure at the surface was the timber headgear positioned over the shaft. Adjacent was an engine room that housed the steam engine which powered the winding operations, and an integral or adjoining boiler house. Associated surface buildings would include stores for keeping the mined rock salt dry, crushing mills, offices, stables, a smithy, workshops and housing. Where feasible, lower bed mines were frequently sunk next to the pre-existing canal network to facilitate bulk transport, and from the mid-nineteenth century most mines were connected to the developing railway infrastructure.

1.4 BACKGROUND TO THE LION SALT WORKS

- 1.4.1 The first salt works was erected on the site by John Thompson in 1856, which became known as the Alliance Salt Works. This works was sold to the Salt Union in 1888. Following disagreements between John Thompson and the Salt Union, John and his son Henry Ingram Thompson sunk a new brine shaft, later to form part of the Lion Works, adjacent to the Alliance Works. The Alliance Works continued to operate until its shaft collapsed in 1898, after which it was abandoned.
- 1.4.2 The Lion Works expanded rapidly and, by 1900, three fine pan houses used for making common salt had been constructed, together with stove houses, a brine tank, smithy, salt store, office, and four common or fishery pans used for making coarse salt. In 1947 the four common pans were demolished and replaced by a new fine pan, which was housed in Pan House No 4. A new bore hole with a steam engine and boiler replaced the earlier brine shaft. In 1958 Pan House No 5 was erected. Two years later Pan House No 2 was refurbished by constructing a mechanically raked pan, Pan No 1 was demolished, and a submersible electric brine pump was installed into a new brine bore hole drilled close to the first shaft.
- 1.4.3 The salt-making process began with brine being pumped from underground and stored in the brine tank from where it was fed by gravity into the evaporating pans. The pan houses are lightly constructed timber sheds covering the iron pans. This allowed the heat and steam to escape as the brine was heated by the fires lit in brick furnaces beneath the pans. As the brine evaporated salt crystals formed and were moulded into blocks then to be taken to the stove house to dry. Once dry the salt could be 'lofted' through hatches to the second floor for storage, cutting, or to be crushed and bagged.



Plate 2: Removing salt crystals from the evaporating pan at Lion Salt Works

1.5 LION SALT WORKS SITE DESCRIPTION

- 1.5.1 **Pan Houses:** the Lion Salt Works incorporated five pan houses, each comprising three elements: the pan where the brine was evaporated above a furnace and flue; the stove or hot house containing flues and drying areas; and a loft used as a storehouse, warehouse or packing floor. Pan House No 1 has a curved brick wall at its south-west corner, reflecting the constricted space utilised for the first salt pan situated in the coal yard of the now demolished Red Lion Hotel. A passage still exists beneath the stove house which gave access from the hotel to the canal. Pan House No 2 is orientated to receive coal from the canal with loading doors on the north side which allowed salt to be tipped directly into canal boats. Pan House No 3 is orientated to receive coal from a railway siding immediately to the south. Rail lines are used to brace the walls externally and also to hold down other rail lines which support the warehouse floor to Stove House No 3. Pan House No 4 (Plate 2) has a steel framework to support its roof and makes use of the external wall of Pan House No 3 on its west side. By replacing the four fishery pans the construction of Pan House No 4 in 1947 reflected changes in the salt market. Internally it contains an *in-situ* crushing mill used to break up salt blocks. Pan House No 5 was constructed after all other open-pan salt works in Britain had been demolished.
- 1.5.2 **Brine Shafts and Tank:** the brine tank is situated to the east of Pan House No 2 (Plate 2), together with a bore hole sunk in the 1960s, and a sealed brine shaft dating to the 1890s. The tank is constructed of riveted iron plates, sits on a brick base, and holds 30,000 gallons (136,500 litres) of brine. Beneath the brine tank is a boiler which replaced an original Galloway boiler.
- 1.5.3 **Pump House:** the pump house is situated adjacent to the south-east corner of Pan House No 4, and contains a horizontal steam engine. The steam required by the engine was raised in a Cornish boiler, supplied by William Lord of Bury in 1891; this was located in a boiler house situated to the south of the pump house. The steam engine was linked to a bell crank brine pump, known as a nodding donkey.
- 1.5.4 Other features of the brine pump assemblage include a hand-cranked derrick winch, a return water pump, a heat exchange cylinder and a brick support for a water tank. The steam winch was used to pull salt vans and coal wagons along the railway siding because the curves of the track were too tight for engines to reach the site.
- 1.5.5 **Manager's Office:** situated to the south of the pump house, the manager's office is a timber-framed structure with brick nogging or panels, and is typical of many local buildings which utilise this design in an attempt to withstand ground subsidence which is a common feature of the area due to collapse in the vast underground salt workings.
- 1.5.6 **Smithy:** the smithy lies to the south-west of the manager's office, and comprises a three-bay timber structure with slate roof with a fourth bay added to the south end for the use of a joiner. Many original features survive, including a line shaft-powered circular saw, guillotine and hearth.

2. METHODOLOGY

2.1 EXCAVATION

- 2.1.1 The programme of archaeological investigation allowed for the excavation of a single trench, which was targeted on the footprint of the former Stove House Five (Fig 2). All information identified in the course of the site works was recorded stratigraphically, using a system adapted from that used by the Centre for Archaeology Service of English Heritage, with sufficient pictorial record (plans, sections and photographs) to identify and illustrate individual features. All contexts were recorded using *pro-forma* sheets, which comprise a written detailed description and interpretation of each structure and deposit encountered. All written recording of survey data, contexts, photographs, and artefacts were cross-referenced from *pro-forma* record sheets using sequential numbering.
- 2.1.2 A full and detailed photographic record of individual contexts was maintained and similarly general views from standard view points of the overall site at all stages of the evaluation were generated. Photography was undertaken using a digital camera, and all frames included a visible, graduated metric scale, where necessary.

2.2 FINDS POLICY

- 2.2.1 Finds' recovery and sampling programmes were carried out in accordance with best practice (following current Institute for Archaeologists guidelines), and subject to expert advice in order to minimise deterioration. All artefacts recovered from the evaluation trenches were retained. In addition, a limited programme of palaeo-environmental sampling was carried out in accordance with the guidelines provided by English Heritage's guideline documents *Environmental Sampling* (2002) and *Science for Historic Industries* (2006). Samples were collected for pedological, palaeo-environmental, and chronological assessment.

2.3 ARCHIVE

- 2.3.1 The results of the fieldwork will form the basis of a full archive to professional standards, in accordance with current English Heritage guidelines (*The Management of Archaeological Projects*, 2nd edition, 1991) and the *Guidelines for the Preparation of Excavation Archives for Long Term Storage* (UKIC 1990). The project archive represents the collation and indexing of all the data and material gathered during the course of the project. The deposition of a properly ordered and indexed project archive in an appropriate repository is considered an essential and integral element of all archaeological projects by the IfA in that organisation's code of conduct.

- 2.3.2 The archive for the archaeological work undertaken at the site will be deposited with the Lion Salt Works Project Archaeologist for incorporation with the site archive. This archive can be provided in the English Heritage Centre for Archaeology format, both as a printed document and on computer disks as ASCII files (as appropriate). The archive will be deposited with the Lion Salt Works within six months of the completion of the fieldwork.
- 2.3.3 A synthesis (in the form of the index to the archive and a copy of the publication report) will be deposited with the Cheshire Historic Environment Record, maintained by Cheshire Archaeology Service in Chester. A copy of the index to the archive will also be available for deposition in the National Archaeological Record in London.

3. RESULTS

3.1 INTRODUCTION

- 3.1.1 A single trench placed across the entire footprint of Stove House Five was subject to controlled archaeological excavation. The excavation was carried out in three stages. In the first instance, the trench was excavated to a depth of 600-700mm below the current ground surface (Fig 2). After all remains of archaeological significance at this level were recorded, further excavation was carried out to a depth of *c* 1.0–1.2m below modern ground level (Fig 3). All features were recorded at this level, and the trench was then excavated to a final depth of *c* 1.5m below the current ground level.
- 3.1.2 The majority of the excavated structures had been constructed utilising hand-made bricks. The bricks used in the smithy buildings were almost certainly original, although those in the salt works structures had been re-used, probably on more than one occasion, and thus could not be used to indicate a date.

3.2 STOVE HOUSE FIVE

- 3.2.1 The earliest features on the site were the two land drains (**2105** and **2107**). These were cut into a layer of clay, which almost certainly represented the natural geology. The natural geology, and land drains (**2105** and **2107**), were overlain by another deposit of clay (**2083**), which probably represented levelling of the site associated with the initial development of the Alliance Salt Works in 1856; fragments of pottery recovered from layer **2083** have been dated to the mid-nineteenth century (*Section 4 below*). The land drains were similarly associated with this initial industrial development of the site.
- 3.2.2 The remains of two brick buildings were exposed in the centre of the excavated area. These buildings are first shown cartographically on the 1868 sale plan, and appear on all subsequent maps of the site until 1954, including an aerial view dating to 1947. It seems likely that these buildings were the remains of the Alliance Works pan smithy, and an associated small boiler/engine house.
- 3.2.3 The south-western building (Building 1) comprised two main rooms, measuring 7.8 x 4.0m, with smaller additional rooms to the south-east and north-west (Plate 3). All of the component walls comprised hand-made bricks bonded with crumbly, lime-based mortar. The large main room to the south-west measured 4.3 x 4.0m, and was bounded by walls **2047** and **2060**, which were both two courses wide. The building retained the remnants of a tiled floor (**2058**), laid on a bedding of ash and crushed brick (**2059**). Set into the south-west wall of the room was a brick-built fireplace (**2062**), which was 1.15m wide and 0.65m deep. An area of tiles in front of the fireplace may have been a later addition.



Plate 3: General view of the smithy (Building 1), looking west



Plate 4: Firebrick-lined hearth, looking north-west

- 3.2.4 The main room in the north-eastern part of the building was bounded by walls **2060**, **2061**, **2051** and **2047**. It measured 3.5 x 2.75m, and had an entrance through wall **2051** at its north-eastern corner. The south-western two thirds of the room had a brick floor (**2054**), with the remaining third showing evidence of a tiled surface (**2055**), both of which had been laid on a bedding layer of ash and crushed brick (**2080**). A fireplace (**2056**) had been built against the north-western wall, constructed from brick with a cladding of refractory bricks (Plate 4), suggesting that the fireplace was operating at a much higher temperature than that of a normal domestic hearth.
- 3.2.5 Set into the south-eastern wall at floor level was a 2.35 x 0.5m sandstone block (Plate 5), which incorporated a rectangular recess carved into it for a machine setting. At its south-western end were four small holding down bolts, and at the north-eastern end it had two holes drilled into of 100mm and 30mm diameter respectively.
- 3.2.6 A service trench (**2110**) containing a lead pipe (**2108**) was exposed immediately to the south-east of the building. The pipe was evidently plumbed into the smaller of the two holes in the block and the remains of a ceramic drain were observed below it leading from the larger hole.



Plate 5: Building 1 south-east room looking north-east, showing the hearth on left and machine bed on right

- 3.2.7 The room occupying the north-western part of the building measured 2.45 x 0.98m, and was bounded by walls **2047** and **2061**. The remains of a wooden beam (**2049**) set in the floor at its north-eastern end represented a doorway into the building. This room incorporated a brick floor (**2048**).

- 3.2.8 Two smaller rooms had been added to the north-west of the main rooms. The south-western of these measured 3.2 x 1.3m, and was bounded by walls **2057**, **2045**, **2043** and **2044**, and had a brick floor (**2046**). This floor continued into the north-eastern smaller room, which measured 2.1 x 1.3m, and was bounded by walls **2047** and **2044**. The north-western wall had been partially built over by the furnaces for the fisheries pans, suggesting that the north-western outbuildings had been demolished when the Lion Salt Works was established, but the rest of the building remained in use, passing eventually from the Alliance Works to the Lion Salt Works. The north-eastern end of this room had also been subject to some disturbance, represented by layer **2042**, so that it was not possible to tell if there was originally a north-eastern wall to room. However, it seems possible that the room may have ended in line with the wooden door beam **2049**, and may have been open fronted.
- 3.2.9 The remains of a small cobbled yard (**2072**), and a brick-built outshut comprising walls **2068**, **2070** and **2071**, was exposed to the south-east of Building 1 (Plate 6). The yard only survived in the southern corner of the building complex, but may have continued originally to the south-west, where disturbed cobbles were excavated. The brick outshut measured 2.2m square, contained a brick floor (**2069**), and was open to the north-east.



Plate 6: Brick outshut and cobbled next to Building 1 looking north-east

- 3.2.10 Water pipe **2108** ran below the cobbles and the outshut, and appeared to be an original feature rather than a later addition. To the east of the outshut, and cut by drain **2017**, were three discrete patches of cobbles (**2073**). These may have represented the remains of an access road, which originally afforded access to the building.



Plate 7: The brick-built foundations of Building 2 looking east



Plate 8: North-western wall of Building 2, with Building 1 in background, looking south-west

- 3.2.11 An L-shaped section of brick walling, which represented the remains of a smaller building (Building 2), lay to the north-east of the Building 1 (Plates 7 and 8). This section of wall ran 1.8m was aligned south-west/north-east, in line with the wall **2047** of Building 1, and then returned to the north-west for a distance of 3.1m. It had been truncated at its north-western and south-eastern ends. The south-western wall of Building 2 was probably represented by wall **2052**, although only fragmentary remains survived. Building 2 would have measured at least *c* 4.9 x 2.9m.
- 3.2.12 It is possible that a short, L-shaped section of walling (**2087**) had also formed part of this building, although this had been largely removed by a brick and stone plinth (**2041**), which had been inserted to support one of the cast-iron pipes between the ‘nodding donkey’ and the brine shaft. This would indicate that Building 2 went out of use and was demolished by 1938, when the ‘nodding donkey’ was put into use.
- 3.2.13 Interior features were limited to the remains of a brick floor in the eastern corner of the building, and two rectangular blocks of stone (**2077** and **2078**), situated to the south-east. Block **2078** had two holding down bolts set into its upper surface, and resembled the foundation bed for an engine or other item of heavy machinery. It is tempting to suggest that they housed a small steam-power plant associated with the smithy, and whilst firm evidence is lacking, the demolition of Building 2 in the second quarter of the twentieth century may have reflect a change from steam to other forms of power generation.
- 3.2.14 Further excavation of this part of the site revealed the remains of a brick structure beneath Building 2. This comprised a brick-built chamber, measuring 2.1 x 2.4m and 0.4m deep, with a 0.98m wide channel extending 2.1m to the north-west (Plate 9). This structure resembled a flywheel pit associated with a small steam engine located within the outshut on the side of Building 2.
- 3.2.15 A brick floor surface (**2050**) was revealed between wall **2051** at the north-eastern end of Building 1, and wall **2052** at the south-western end of Building 2. Surface **2050** appeared to extend between the two buildings, terminating at the entrance into Building 1 marked by wooden beam **2049**. The south-eastern end of this surface had been destroyed by later activity, represented by layer **2113**.
- 3.2.16 A spread of compacted black cinders (**2020**) was excavated to the south-west of Building 1. This seemingly represented a repair or replacement of cobbled yard **2072** (Section 3.2.9 above). Excavation demonstrated that layer 2020 was *c* 400mm thick, and overlay compacted grey clay **2020**. Layer **2020** was cut by a 370mm diameter circular borehole (**2063**) for a dipping well.



Plate 9: Brick flywheel pit uncovered during groundworks, looking north

3.2.17 The final stage of mechanical stripping revealed that layer **2083** covered most of the northern part of the excavation area, and may have represented a levelling deposit as it overlay the natural geology. Most of the artefacts recovered from layer **2083** dated to the mid-nineteenth century, which is consistent with the initial development of the site for the Alliance Salt Works. Layer **2083** sealed two land drains (**2105** and **2107**), which similarly derived from the initial preparation of the site in the mid-nineteenth century. Drain **2105** was aligned south-west/north-east for 12.1m, and was cut by later drains **2009** and **2011**. Drain **2107** took an L-shape route, extending 2.75m north-west from drain **2105**, and then returning to the south-west where it was cut by drain **2009**.

3.2.18 The excavation area was largely enclosed by a two-course wide wall of machine-made bricks (**2001**), which formed a square structure measuring 18.8 x 18.5m, although excavation extended slightly beyond this footprint to the north-west and south-west (Plate 10). The position of wall **2001** corresponded with the footprint of Stove House Five depicted on historical mapping. Wall **2001** had been built on a concrete foundation (**2002**) that splayed out a further 100mm from the wall.



Plate 10: Outer walls are Stove House Five, with Buildings 1 and 2 in the centre and the Fisheries Pans in the background, looking west

3.2.19 A brick-built manhole (**2111**) measuring 0.83 x 0.63m had been inserted through the wall on its south-eastern side, affording access to a ceramic drainage pipe that ran beneath the wall. Another manhole (**2004**) was exposed in the south-western part of the excavation area, immediately beyond wall **2001**. Manhole **2004** measured 1.2 x 1.1m and comprised machine-made bricks (Plate 11). It acted as a junction for three ceramic drainpipes (**2007**, **2009** and **2011**). Drain **2007** approached from the north-west, drain **2009** from the south-east, and drain **2011**, which showed some evidence of brick lining, from the north-east.

3.2.20 All of these drains were filled with mixed clay, and contained ceramic drain pipes. At the north-western end of drain **2007** was a square ceramic drain cover (**2005**). Drain **2011** had been truncated by a previously unknown rectangular trench (**2013**), which probably represented an archaeological trench excavated by a local group but not recorded (C Hewitson pers comm). Another similar drain (**2017**) lay parallel to drain **2011** along the south-eastern edge of the excavated area. All of the drains respected wall **2001**, suggesting that they were associated with the construction of Stove House Five.



Plate 11: Manhole 2004, looking north-west

- 3.2.21 A series of brick walls exposed along the north-western side of the excavation area formed a rectangular structure that almost certainly represented the remains of the south-western fisheries salt pan depicted on historic mapping. The main wall (**2024**) of this salt pan ran north-east/south-west for 16.2m, and was three courses wide (Plate 12). At the south-western end wall **2022** continued to the north-west for a distance of 3.8m, where brick wall **2021** extended to the south-west. A short stub of internal walling (**2023**) ran south-west from wall **2022** (Plate 13). These walls formed a 3.8m wide chamber at the south-western end of the structure. The south-western end of this chamber had been destroyed by the insertion of drain **2007**, and thus its original length could not be determined accurately. The north-eastern end of wall **2024** extended beneath later wall **2001**, where it was truncated; the entire north-western part of the structure had evidently been removed. Nevertheless, it is likely that the 3.8m width of the north-west chamber represented the full original width of the fisheries pans.
- 3.2.22 Limited manual excavation across wall **2024** provided a vertical section of the sequence of deposits within the fisheries pans (Plate 14). Inside the main structure was a 30mm thick lens of compacted mixed clay and sand with abundant stone and brick fragments (**2018**). Outside the main structure, and in the area of the pan furnaces, was a 35mm thick band of mixed clay with brick fragments (**2019**), which retained some evidence of heating. Below this on both sides was a 150mm thick layer of smooth, black ashy clay (**2082**), into which wall **2024** had been cut, with an 80mm thick layer of compact cinders and crushed brick (**2081**) below. Below this was a layer of compact grey clay with abundant fragments of brick, stone and slate (**2083**), which was also observed across the south-western part of the excavated area immediately above the natural clay.



Plate 12: Fisheries salt pan, showing wall 2024 extending along the centre of the excavated area, with the remains of the furnaces on the left, looking south-west



Plate 13: The north-western end of the fisheries pan, looking north-west



Plate 14: Limited excavation across wall 2024, looking south-west

3.2.23 Extending south-eastwards from the exterior elevation of wall **2024** was a series of brick walls, all of which had been truncated by drain **2011**. Walls **2025**, **2026** and **2032** were the most substantial, each four brick courses wide, and probably represented the main walls of a series of furnaces used to heat the fisheries pans. Walls **2027-2030** appeared to be the remains of internal partitions within the furnace structures. Walls **2037-2040**, situated on the opposite side of drain **2011**, were all that remained of the outer south-eastern wall of the furnaces. It is likely that a row of square-section wooden posts (**2064-2067**) that lay parallel and to the south-east of the fisheries pans were the remains of a wooden boundary fence separating the Lion Salt Works from the Alliance Salt Works.

3.2.24 The remains of a rectangular chimney (**2033**) fitted apertures for two flues were revealed immediately to the north-east of the fisheries pans (Plate 15). The chimney comprised a 2.0 x 1.8m brick inner structure surrounded by an outer shell of concrete, into which a cast-iron pipe was set around the internal brick structure. A 0.95m wide brick flue (**2034**) extended into the chimney from the east, probably from the boiler below the brine tank. This flue had been blocked subsequently with brick (**2112**), probably when the 'nodding donkey' was installed in 1938. The second flue (**2114**) was 1m wide and entered the chimney from the north-west, probably from the furnaces associated with a second fisheries pan. This flue was not blocked, indicating that it remained in use until the fisheries pans were demolished between 1947 and 1954. Neither the chimney nor the flues were excavated entirely during the excavation. Immediately to the north of flue **2034** was a rough brick surface (**2086**), which may have formed part of a surface surrounding the brine shaft and the associated pipes.



Plate 15: Chimney 2033 and blocked flue 2034, looking west

- 3.2.25 The eastern end of flue **2034**, and the north-eastern end of drain **2011**, had been damaged by modern activity, represented by layer **2035**. This was one part of a large area of disturbance comprising deposits **2035**, **2042**, **2053** and **2113**, which cumulatively represented modern disturbance to buried remains across much of the northern part of the excavated area.
- 3.2.26 The upper layers encountered in the excavation area comprised a series of mixed demolition and dumping layers (**2000**, **2089-2100**). These layers all derived from the dumping of material in the area following the dismantling of Stove House Five in 2009.

4. FINDS

4.1.1 A small assemblage of artefacts was recovered during the excavation of Stove House Five. Most was in good condition, if somewhat fragmentary, and there was little sign of abrasion, suggesting that there had been little post-depositional disturbance. Many of the finds were, however, stained by, or on occasion completely covered by an opaque black deposit, which has not been identified. The distribution and range of finds is tabulated below (Table 1), and the assemblage is summarised.

Cxt	Clay tobacco pipe	Pottery	Metal	Wood	Tile	Shell	Glass	Trivet	Totals
2018	5	30	1	0	0	0	9	0	45
2019	11	21	0	1	5	0	5	1	44
2020	7	42	5	0	0	1	6	0	61
2081	9	11	0	0	0	0	0	0	20
2082	10	22	0	0	0	0	1	0	33
2083	39	63	0	0	1	0	0	0	103
Totals	81	189	6	1	6	1	21	1	306

Table 1: Quantification of material categories by context

4.1.2 Pottery vessels comprised the largest element of the assemblage, some 68% by fragment count. There is a limited range of mid-late nineteenth-century and later fabric types and forms, with most being utilitarian refined white earthenwares, mainly table flatwares, but also cups and bowls. Many of the whitewares are plain, and they include more prosaic vessels like chamber pots, evidenced by handle fragments from **2019** and **2020**. Refined white earthenwares appear at the turn of the nineteenth-century and continue in use to the present day. Many of the fragments are under-glaze transfer-printed, the majority in blue, but with a good representation of brown, red and black transfers, suggesting a date after *c* 1835, when red/pink was perfected (Neale 2004, 140) although it was not immediately popular, and this material is likely to be later. Industrial Slipwares are also present, the majority blue and white banded bowls, but there is also a fragment of Mocha ware with so-called serpentine decoration, from **2083**. The latter is a nineteenth-century style, probably not introduced before *c* 1810 (Rickard 2006, 63), but in general terms Industrial Slipwares continued in production into the second quarter of the twentieth century (*op cit*).



Plate 16: Stamped stoneware bottle

- 4.1.3 Kitchen wares and stoneware storage vessels form a relatively small part of the pottery assemblage, with only a few fragments of the former, most from black-glazed redware pancheons. A single rather thinner, hard-fired fragment of black-glazed redware, from **2018**, could be marginally earlier than the majority of the pottery, perhaps being of eighteenth-century date, but there is nothing else in the assemblage to suggest a date any earlier than the second half of the nineteenth century. Two joining fragments of a brown stoneware bottle are stamped 'Ralph Milner: late Edmund Taylor: Oldfield Lane: Salford' (Plate 16). Ralph Taylor, a surgeon, qualified in 1840, teaming up with Edmund Taylor shortly afterwards, and continuing the practice after Taylor's death until his own in 1882 (weastcemeteryheritagetrail.co.uk), and this bottle clearly dates to after the death of Taylor.
- 4.1.4 Although there is a considerable number of clay tobacco pipe fragments, there is only one complete bowl, and two small fragments. Again the bowls point to a mid-late nineteenth-century date, with that from **2019** dating *c* 1840-60, and other fragments (from **2082** and **2083**) being probably later. The glass falls broadly into the same date-range, with a 'blob-top' bottle from **2020** dating *c* 1840 to *c* 1910 (McKearin and Wilson 1978). It must be noted, however, that a complete dark green bottle from the same context, embossed 'stergene' cannot be earlier than 1948, when the brand was introduced (Room 1982, 164). A fish or meat paste jar from **2020** is in a style used in the 1920s to 1950s, again point to mid-twentieth-century deposition.

- 4.1.5 There is single industrial object of interest (Plate 17). A glazed porcelain spur, used in the production of glazed earthenware (Hamer and Hamer 2004) came from **2019**. It is clearly a machine-made example, and may be unused. Machine production of these objects began in 1846 (Goodwin and Barker 2009, 55) and continues to the present day. The presence of such a specialised object does, presumably, suggest some connection with the pottery industry, although its nature must remain obscure.



Plate 17: Porcelain stilt

- 4.1.6 Finally, there is a small group of tiles, with three plain ‘dust-pressed’ floor tiles from **2019**, and a single fragment of roof tile from **2083**. The ‘dust-pressed’ means of manufacture was invented in the 1840s (Campbell 2006), and patented in 1863 (stokemuseums.org.uk), and again this points to a later nineteenth-century date. A fragment of squared wood, also from **2019**, has nothing to indicate its purpose or date.
- 4.1.7 Thus it can be seen that the finds represent largely domestic waste, deposited on the site from the late nineteenth century to perhaps as late as the 1950s, and suggesting only a very slow accumulation

5. DISCUSSION

5.1 INTRODUCTION

5.1.1 The excavated remains exposed within the footprint of Stove House Five can be attributed to six discrete phases of activity. These can be linked to the principal nine phases in the development of the site identified in the desk-based assessment that was compiled during an early stage in the project (Matrix Archaeology 2011):

- *Phase 1: The Symme Fields (Eighteenth century);*
- *Phase 2: The Red Lion Hotel (Early nineteenth century);*
- *Phase 3: Thompson's Alliance Salt Works;*
- *Phase 4: Thompson's Lion Salt Works (1894);*
- *Phase 5: Expansion of the Lion Salt Works (1899-1937);*
- *Phase 6: Further expansion of the Lion Salt Works (1938-47);*
- *Phase 7: Addition of Pan Houses Four and Five (1954-65);*
- *Phase 8: Closure and formation of Lion Salt Works Trust (1986-2009);*
- *Phase 9: Phase 1 Enabling Works (2009-11).*

5.1.2 The Phase 1 activity identified in the desk-based assessment includes the earliest known documentary reference to the site, drawn from title deeds dating to 1641 and describing a plot of 22 acres known as 'Symme Field', and the construction of the Trench and Mersey Canal, which was completed in 1777. Phase 2 activity pertained to the initial development of the Red Lion Hotel and a group of cottages on Ollershaw Lane, thought to have been erected in the early nineteenth century. However, none of the physical remains exposed during the course of the excavation could be attributed to these initial phases, the earliest structures seemingly being associated with the Alliance Salt Works (Phase 3).

5.2 PHASE 3: THE ALLIANCE SALT WORKS

5.2.1 The earliest features exposed during the excavation comprised two land drains (**2105** and **2107**), which were cut into the natural clay geology and overlain by layer **2083**. These drains and the overlying layer of clay probably derived from the preparation of the site to enable the development of the Alliance Salt Works in 1856, immediately to the south-east of the excavation area. A nineteenth-century date for these remains is also suggested from the group of finds recovered from layer **2083** (*Section 4 above*). Other excavated remains that may be ascribed to this mid-nineteenth-century phase of development include the pan smithy for the Alliance Salt Works, the footprint of which is shown on the sale plan of 1868 (Plate 18).

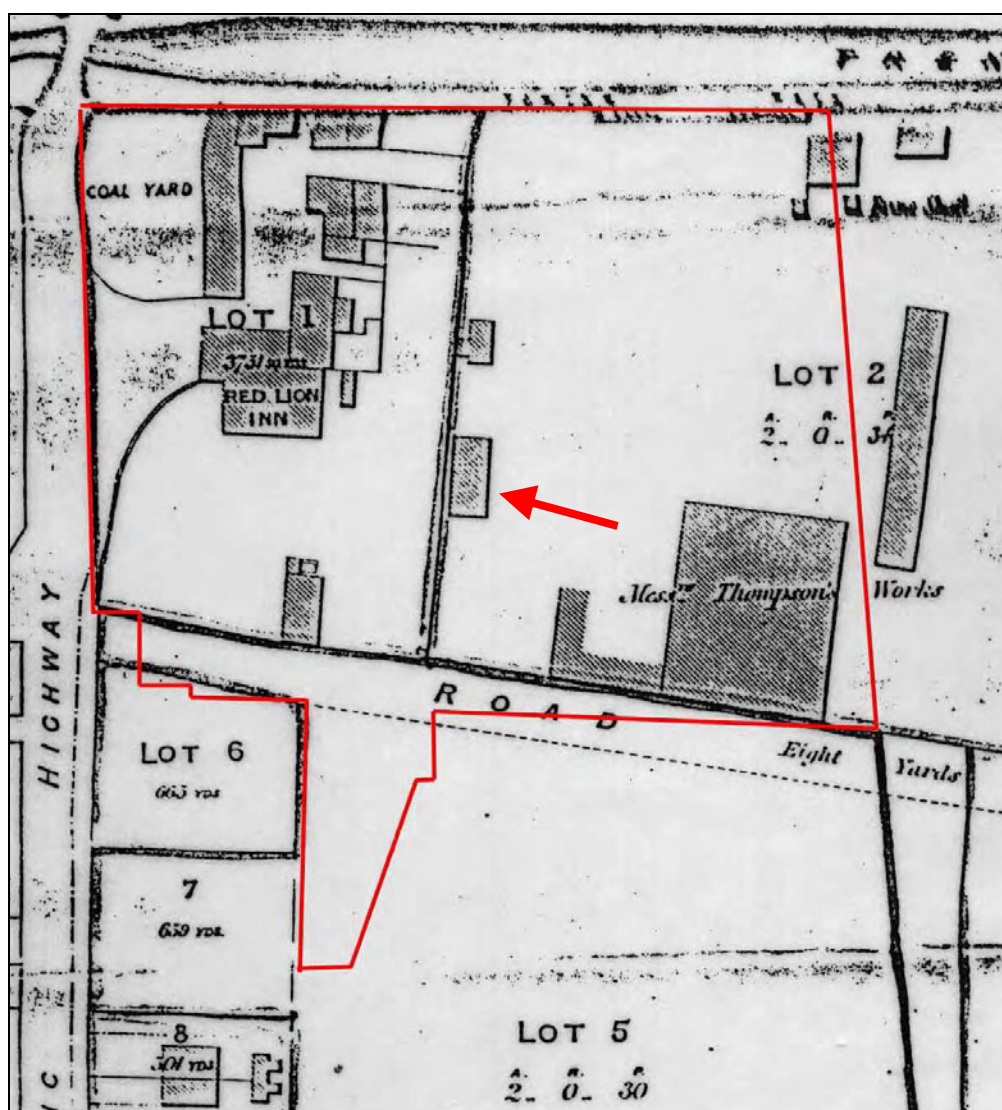


Plate 18: Extract from the sale plan of 1868, showing the boundary of the study area and an arrow marking the pan smithy

- 5.2.2 The structural remains of the pan smithy comprised hand-made bricks bonded with lime-based mortar, consistent with a mid-nineteenth-century construction date. Similarly, the two tiled floors were constructed from tiles manufactured using a process invented in the 1840s and patented in 1863, adding weight to an interpretation of the remains having been constructed in the mid-nineteenth century.
- 5.2.3 The principal smithy building (Building 1) comprised two main rooms, together with two smaller rooms and an outshut. The north-eastern main room contained a stone foundation bed for an item of machinery, which was serviced with a water supply and drainage, and a hearth. The latter incorporated refractory bricks, suggesting that it had been designed to withstand temperatures that were considerably higher than those generated in a domestic fireplace. It is thus likely to represent the remains of a small furnace, consistent with those employed typically for smithing. The remains of the two open-fronted rooms are consistent with workshops or storage areas.

5.2.4 It seems possible that Building 2 may have been intended to house a small steam-power plant associated with the smithy and ancillary structures. In particular, a boiler may have been located inside the building, perhaps raising the steam required by a small engine situated mounted onto the stone blocks (2077 and 2078) excavated within the footprint of a wooden outshut to the south-east of Building 2. Supporting evidence for this interpretation can be drawn from the brick structure that resembled a flywheel pit for a small engine that was exposed at depth in this part of the site (*Section 3.2.14 above*).

5.2.5 The excavated remains of the Alliance Salt Works smithy incorporated a fireplace hearth in the south-west corner of Building 1. This appeared to have been inserted into existing fabric, suggesting that the building had been remodelled for a different function, possibly office or even domestic use. The Alliance Works closed in 1898, and it is likely that the Lion Salt Works took over this building a few years earlier, as the smaller rooms exposed in the north-western part of the excavated area were demolished to accommodate the construction of the fisheries pans and the wooden boundary between the two works between 1890 and 1898.

5.3 PHASES 4 AND 5: THE LION SALT WORKS (1894) AND INITIAL EXPANSION (1899-1937)

5.3.1 The fisheries pans and associated chimney, flues and brick surface were all established by 1890-98. Four fisheries pans were built, producing coarse salt for the fish and meat preservation industries. The structure uncovered within the excavation area undoubtedly represented the remains of the north-eastern fisheries pan and associated furnaces. The chimney served the furnaces of the fisheries pans and the original pumping mechanism for the brine shaft. This comprised a single boiler and horizontal engine, situated within the brick building below the brine tank.

5.3.2 Flue 2034 was connected to the boiler, whilst flue 2114 served the north-western fisheries pan. The brick surface associated with the chimney and flue 2034 was probably part of a hard-standing surface surrounding the brine shafts and pipes.

5.3.3 The cartographic evidence indicates that Building 2 was demolished between 1910 and 1938, which is corroborated to some extent by the archaeological evidence. The remains of this building were cut by a brick pipe plinth that was constructed to serve the 'nodding donkey' that was installed in 1938.

5.4 PHASE 6: FURTHER EXPANSION OF THE LION SALT WORKS (1938-47)

5.4.1 In 1938, the original steam pump for the brine shafts was replaced with the 'nodding donkey' to the south-west. This rendered the boiler and engine below the brine tank redundant, and resulted in the blocking of flue 2034. The flues from the pan furnaces were still in use at this time, and thus flue 2114 would have remained open.

- 5.4.2 The south-eastern and north-eastern fisheries pans were demolished between 1947 and 1954, with the north-western and south-western pans seemingly continuing in use until 1960. It is likely that the chimney was also demolished after this date.
- 5.4.3 Cast-iron pipe **2003** ran from the ‘nodding donkey’ to the brine shaft, forming part of the pumping mechanism for the shaft. The routes of other pipes can be traced across the site from the position of several stone and brick plinths, which acted as foundation blocks for carrying the pipes above ground. Several other pipes were exposed across the site carried above ground by, several of which can be seen standing around the Nodding Donkey. One of these plinths (**2041**) was uncovered within the excavated area, and is contemporary with pipe **2003**.

5.5 PHASE 7: ADDITION OF PAN HOUSES FOUR AND FIVE (1954-65)

- 5.5.1 Stove House Five, represented in the excavation area by wall **2001** and concrete footing **2002**, was built in 1965, the last open salt pan to be built in Britain and remaining in use after all other open pans had gone out of production. It appears that a series of drains were laid immediately prior to construction with two south-west/north-east-aligned internal drains running into a drainage system surrounding the pan house. The construction resulted in the demolition of the remaining Building 1. The brick structure of the stove house had partially collapsed following the closure of the works in 1986, and was eventually dismantled in 2009 and the ground cleared and levelled.
- 5.5.2 Building 1 is visible on an aerial photograph 1947, and is also shown on the Ordnance Survey map of 1954. It seems likely that it was demolished to enable the development of Stove House Five in 1965.

5.6 PHASES 8 AND 9: LION SALT WORKS TRUST (1986-2009) AND PHASE 1 ENABLING WORKS (2009-11)

- 5.6.1 The single small trench (**2013**) that cut drain **2011** is likely to be an archaeological intervention during the late 1990s or early 2000s by a local society under the direction of Andrew Fielding. As this probably did not turn up any significant finds, having been inadvertently placed over a drain from the 1960s, it was unrecorded. The several disturbance layers on the site were included modern drinks cans, crisp packets and other refuse within their fills, and seem to have resulted from the dismantling of the pan house and ground clearance in 2009.

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ILLUSTRATIONS

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Figure 3: Plan of the excavated remains exposed at depths of 1.0-1.2m

Figure 4: Site development phase plans

Figure 5: Sections

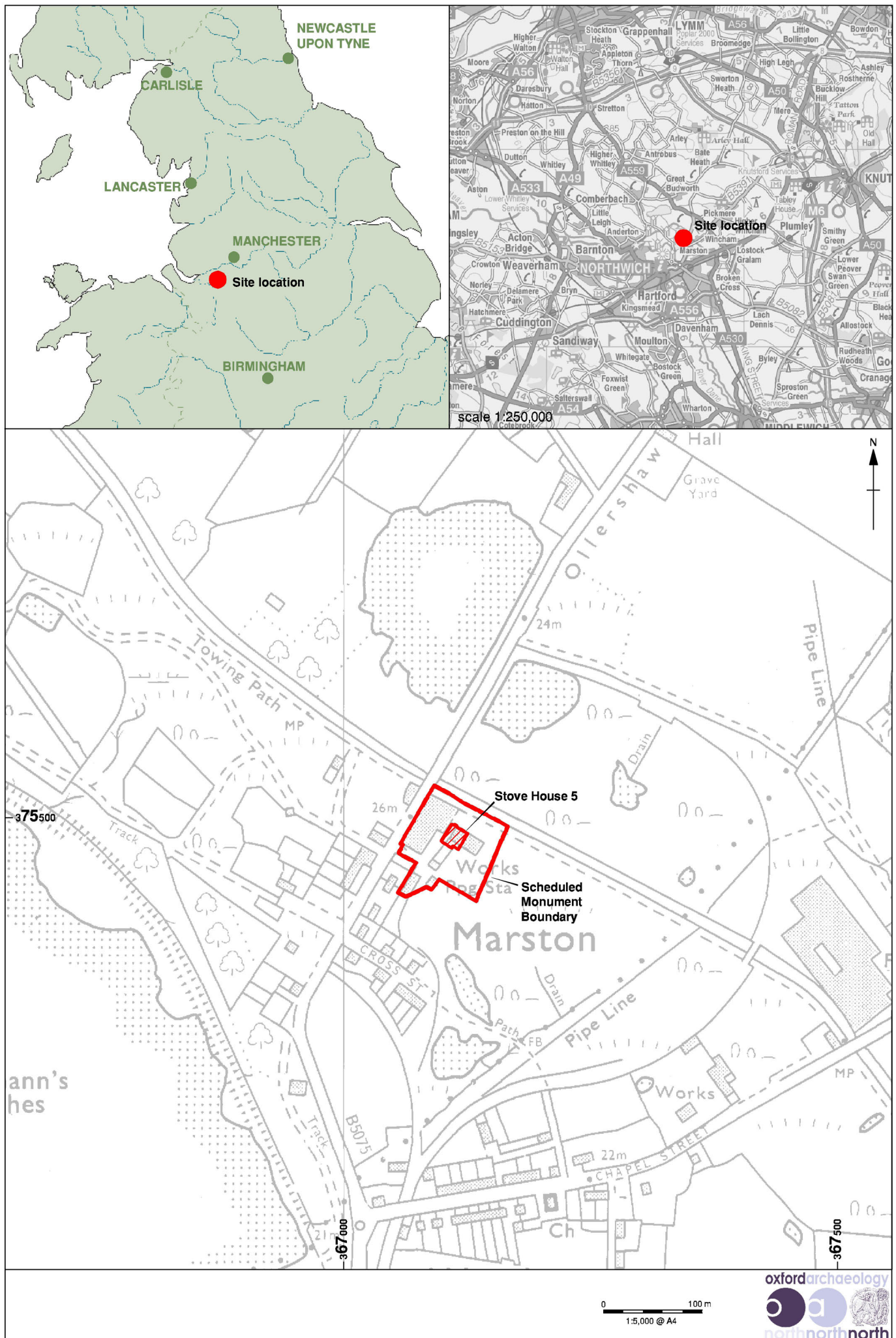


Figure 1: Site location

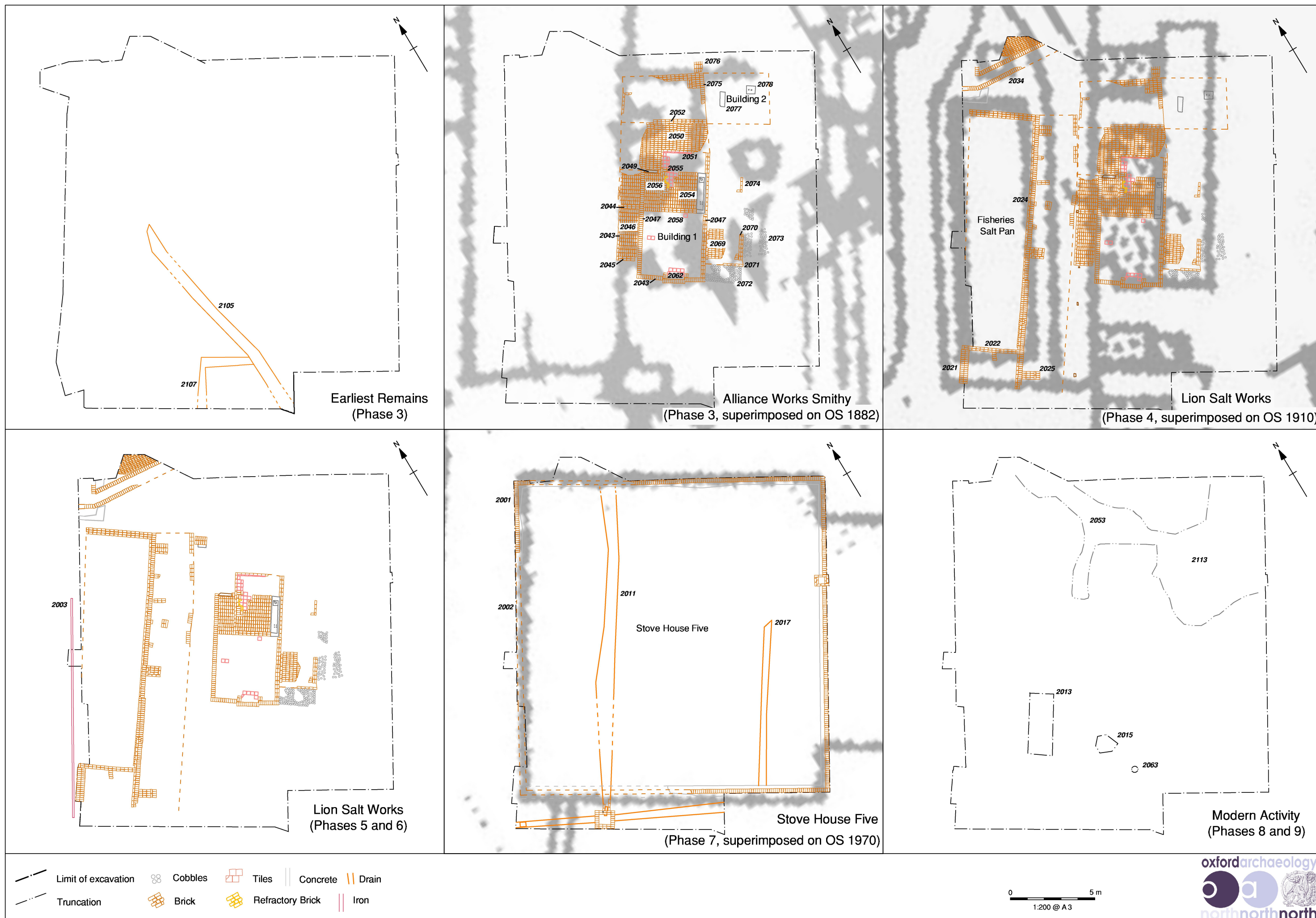


Figure 4: Site Development Phase Plans

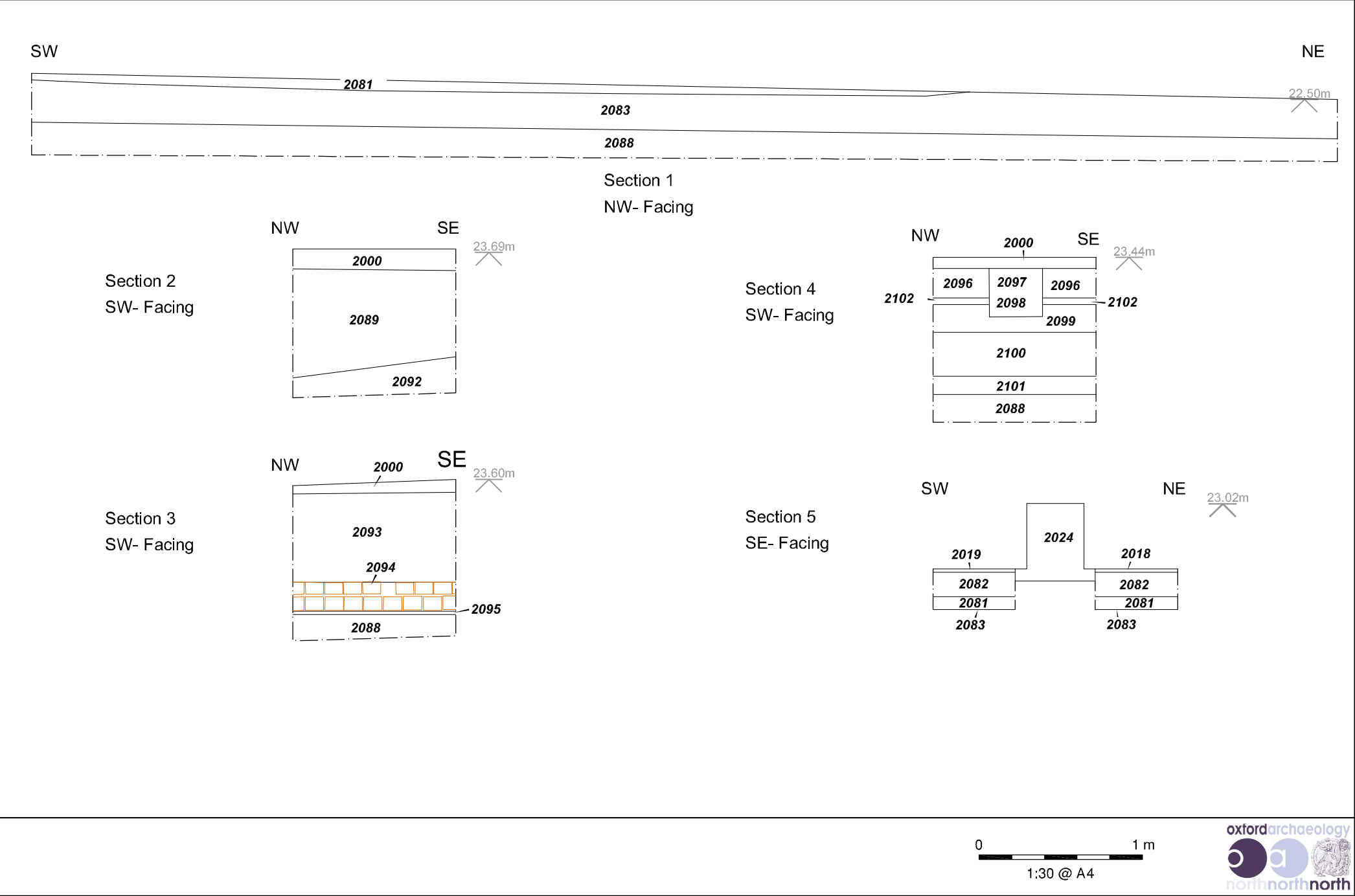


Figure 5: Sections