An archaeological evaluation at

Lowesmoor Trading Estate, Worcester. 2002

Contents

LIST OF FIGURES

LIST OF PLATES

An archaeological evaluation at
Lowesmoor Trading Estate, Worcester. 2002

Summary
Following a proposal for redevelopment a total of ten archaeological trial trenches were excavated on the site of Lowesmoor Trading Estate, Worcester (NGR SO 8525 5510). The evaluation was commissioned by ASI Heritage Consultants, on behalf of Chelverton West Ltd. Birmingham University Field Archaeology Unit undertook the evaluation fieldwork.

The site lies within the historic core of the Roman and medieval city and the evaluation took place in line with the archaeological policies in the City of Worcester Local Plan. A desk-based assessment suggested that Lowesmoor Trading Estate may contain significant Roman and medieval deposits and the remains of 19th Century Bone China manufacturing associated with the former Grainger's Porcelain Works. The trial trenching at Lowesmoor Trading Estate combined with earlier work locally, suggested a high potential for the survival of Roman and medieval remains. Evidence for 19th Century porcelain manufacture comprised the remains of brick built industrial structures, kiln furniture and waste pottery.

1.0 Introduction

This report details the results of ten trial trenches excavated at Lowesmoor Trading Estate, Worcester (Figs.1 & 2). The evaluation was carried out by Birmingham University Field Archaeology Unit on behalf of Chelverton West Ltd, in advance of a planning proposal for redevelopment to Lowesmoor Trading Estate. At present the site comprises a compact and busy mixed-use trading estate. The standing buildings are brick-built and of a 19th and 20th Century date. At least three of the buildings include large cellars. Some of the buildings are in a poor state of repair (Heaton 2001). The modern surface at Lowesmoor Trading Estate comprises asphalt, concrete, hardcore and compacted topsoil.

The trial trenching was based on a specification prepared by ASI Heritage Consultants (Heaton 2002) and was subsequent to a partial evaluation carried out in 1990 (Brown 1990). This evaluation addressed the potential of the subsurface deposits only. The archaeological potential of the standing buildings was addressed by a desk-based assessment (Heaton 2001).

The site covers an area of approximately 3ha. Development proposals entail the refurbishment of some of the buildings. Others would be demolished to provide car parking and access space for the construction of new buildings. Current proposals include internal modifications to the present buildings, and the construction of new buildings of portal construction based on concrete pad foundations. The exact depth of ground disturbances of these foundations and associated service connections has yet to be finalised. This evaluation attempts to provide a deposit model for the entire site based on the limited amount of information provided. It is understood that deposits some areas of the site may not be affected by development proposals.

1.1 Limitations to coverage

The specification for evaluation works (Heaton 2002) identified some of the restrictions to the evaluation design, 'land for which access has not been agreed cannot be evaluated at present'. The number and location of trial trenches was severely limited by standing buildings. The specification for works proposed the excavation of trial pits within the interiors of Units 1, 2 and 5 (Trenches 16, 17 and 18). The remainder of the proposal for works focused on evaluating available space to the exterior of buildings. This meant that in total only 5.5% (about 1500sqm) of the site was available for trial trenching. Of that, about 83sqm was actually achieved (5.5% of the available area or 0.3% of the total area). This represents a very small sample of the total development area.

The Written Scheme of Investigation proposed the excavation of eighteen trial trenches. Once service plans had been obtained and individual property owners contacted, only a total of ten of these trenches were either practical to excavate, or were accessible. The trenches were located with regard to the restriction of standing buildings, live services, vehicle access and the requirement to investigate individual areas within the site.

Restrictions to the full investigation of the trial trenches are listed below.

- Standing buildings occupying the majority of the site. Evaluation works were restricted to the small areas of open ground.

- Major services, particularly in the areas of Trenches 1, 3, 5 and 11. These included water, gas, electric and the presence of electrical substations immediately to the south of Trenches 1 and 5.

- Some of the tenants were unaware of archaeological works prior to the involvement of BUFAU and refused access to units within the required time scale.

- Tenants requirement for constant vehicular access to industrial units.

- The health and safety implications of the nature and depth of overburden in some areas. The Written Scheme of investigation suggested overburden to a depth of between 0.6m and 1m. In some cases the depth of overburden was more than 2m. It was considered that deep excavation would have implications for the integrity adjacent buildings.

2.0 Methodology

Ten trial trenches were excavated to provide information regarding the character and state of preservation of any archaeological remains (Fig. 2). This was in accordance with the Standards and Guidance of the Institute of Field Archaeologists (IFA 2000). The excavation of two of these trial trenches (Trenches 8 and 10) were suspended prior to reaching depths at which archaeology might be expected due to the presence of modern services.

The modern asphalt and concrete layers were cut with a rotary floor-cutting saw where appropriate. Mechanical excavation was carried out using a JCB Excavator

fitted with a toothless ditching bucket supervised by an appropriately qualified archaeologist. Machine excavation continued to the upper surface of the drift geology or interpretable *in-situ* archaeological deposits. In some cases excavation of trenches was subject to alteration due to the presence of live services and health and safety considerations. Any alterations to the specification were made with on-site consultation between the city archaeologist, archaeological consultant and BUFAU.

A detailed context record on individual pro-forma record cards was maintained and all features were photographed using both colour and monochrome film, supplemented by digital images. Sections and plans of excavated features were drawn at a scale of 1:50, 1:20 or 1:10 as appropriate. Where no archaeological deposits were identified, a record of the stratigraphy was made. In addition, a limited geoarchaeological survey was undertaken by Terra Nova Ltd (Jordan 2002, Appendix 1), this was augmented by the results of a preliminary manual auguring survey carried out by BUFAU (Appendix 2). These records constitute the site archive, which is currently stored at Birmingham University Field Archaeology Unit.

While the Written Scheme of investigation provided for a sub-sampling strategy, no layers requiring sub-sampling were encountered. All dateable artefacts were recovered from both the overburden and discreet features.

A single context number was allocated to each layer and fill. Features were allocated a single context number prefixed by the letter F. To aid clarity, context and feature numbers sequences were allotted in association with trench numbers. For instance the modern ground surface of Trench 2 was allocated the context number 2000 etc. A full stratigraphic matrix for each excavated trench is provided below (Appendix 4).

3.0 Evaluation Results

For the purposes of the evaluation results the development area has been divided into five areas (A to E, Fig. 8). These represent a variation in archaeological deposits and illustrate areas where evaluation works were not possible.

3.1 Natural geology

The natural subsoil recorded in Trench 2 and Trench 12 consisted of mixed clays, sands and gravels. In Trenches 7, 9 and 14 similar natural mixed clays, sands and gravels were recorded during the manual auger surveys. These deposits were recorded at depths ranging from 18.73m OD to 19.67m OD (Appendix 2). In Trenches 4, 6 and 10 the manual auger surveys identified alluvial clays but were terminated prior to the natural geology.

3.2 Alluvial deposits

With the exception of Trenches 2, 3 and 12, the natural subsoil was overlain by alluvial clay deposits. These alluvial clay deposits were encountered at depths ranging from 19.29m OD to 20.62m OD. An analysis of these alluvial deposits has been provided in Appendix 4 (Jordan 2002).

3.3 Overburden and modern disturbances

Deposits between the alluvial layers and the modern ground surface typically consisted of layers of sandy loams and ash mixed with Post-Medieval and later 19th Century building debris up to 2.0m in depth. Trench 3 was excavated through a cellar cavity that had been backfilled with modern building debris. The level of the modern ground surface ranged from 21.05m OD to 22.05m OD and varied from asphalt, concrete, hardcore and compacted topsoil up to 0.2m in depth.

Modern disturbances were recorded in Trenches 3, 8 and 10. In Trenches 8 and 10 deposits were truncated by electricity cables, water, sewage and gas mains. As a consequence machine excavation was terminated.

3.4 Archaeological Deposits

This provides a summary description of archaeological deposits. A detailed site narrative appears in Appendix 3.

3.5 Trench 2 (Fig. 3, Plates 1 & 2)

Maximum dimensions: Length 10m - Width 1.6m – Depth 2.6m
Orientation: East to West

The natural subsoil was cut by two features (F201 and F202) which were recorded within a sondage (SO1). Due to health and safety requirements, these features were not hand excavated. F201 comprised elements of a possible pit or linear feature measuring 0.9m x 1.3m. F201 was filled by brown sandy silt (2008) with frequent inclusions of iron slag, pebbles and charcoal flecks. To the west of F201 was a northwest-southeast aligned linear feature (F202) measuring approximately 0.2m x 1.2m. This contained small pebbles, charcoal flecks and tile (2007). Immediately above F201 and F202 was a medium brown clayey silted layer (2005) 0.8m in depth that contained post-medieval pottery, fired clay/daub, mortar, iron slag and one sherd of medieval pottery. One residual sherd of 12th / 13th Century pottery was recovered from a later layer (2002).

Context Number	Context Description	Depth / AOD	Context type
2000	Modern surface (concrete)	21.33m AOD	Layer
2001	Sandy silt and building debris 0.5m in depth	21.25m AOD	Layer
2002	Grey/black clay with silt, 0.6m in depth	20.75m AOD	Layer
2006	Brickwork for F200	21.25m AOD	Build
F200	North-south aligned brick wall	21.25m AOD	Wall
2003	Dark brown clay silt with brick and tile fragments, 0.3m in depth	20.15m AOD	Layer
2005	Medium brown clayey silt, 0.8m in depth	19.85m AOD	Layer
2007	Medium brown sandy silt	19.05m AOD	Fill
2008	Medium to dark brown sandy silt with frequent iron slag and	19.05m AOD	Fill

	charcoal.		
F202	Cut, 0.2m x 1.2m, filled by 2007		Linear
F201	Cut, 0.9m x1.3m, filled by 2008		Possible pit
2004	Natural, orange, reddish-brown and greenish mixed clays and sands with occasional pebbles.	18.73mAOD	Natural geology

Interpretation
The two features (F201 and F202) cut into the natural subsoil may represent early industrial activity due to the presence of proportionally large amounts of iron slag in F201. It is probable that contamination from upper layers occurred during the machine extraction of the bulk samples, and this may explain the recovery of post medieval pottery from 2008. The medium-brown clayey silted layer (2005) probably represents a former ploughsoil layer although the presence of post-medieval finds suggests this is not the dark earth encountered at other sites in Worcester.

3.6 Trench 3 (Fig. 4, Plates 3 & 4)

Maximum dimensions: Length 5.0m - Width 1.6m – Depth 2.0m
Orientation: East to West

This trench was moved due to presence of live services. For health and safety reasons (unstable overburden, and standing buildings), this trench was not excavated to the natural subsoil.

The earliest features comprised elements of a brick built cellar (F300) in the form of a springer wall 3.6m in length and 1.7m in height. F302 comprised elements of brick-built footings upon which stood two courses of very large regularly cut stone blocks (3004) 2.7m long and 1m high. The stone blocks measured between 0.6 x 1.3m and 0.4 x 0.8m and were probably cut from Oolitic Limestone. The masonry had been pointed in places with cemented mortar. A steel support propped the central portion of the masonry.

Context Number	Context Description	Depth / AOD	Context type
3000	Modern surface (asphalt)	21.33m AOD	Layer
3001	Sub-surface (concrete)	21.23m AOD	Layer
3002	Building debris, 2.0m in depth	21.03m AOD	Fill
3003	Brickwork for F300	20.83m AOD	Build
F300	Brick cellar	20.83m AOD	Structure
3004	Masonry for F301	20.83m AOD	Build
F301	Masonry foundations	20.83m AOD	Structure
3005	Brickwork for F302	19.53m AOD	Build
F302	Brick foundations	19.53m AOD	Structure

Interpretation
The structures within this trench (F300, F301 and F302) appear contemporary, and due to the presence of cemented mortar, date to the late 19th Century. The masonry (F301) may have provided the base for heavy equipment. These structures are

possibly associated with the 'pump room' of the former vinegar works (James Dinn *pers comm*, Fig. 6).

3.7 Trench 4 (Plate 5)

Maximum dimensions: Length 5.0m - Width 1.6m – Depth 1.4m
Orientation: East to West

This trench was rotated by 90° and moved to the east of its intended position in order to mitigate vehicle access problems. Due to the proximity to standing buildings, and the unstable nature of the overburden, it was not possible to fully excavate this trench to level of the natural subsoil. Further sampling below the lowest machine level was undertaken using a manual auger.

This trench was machine excavated and manually augured to a combined depth of 2.8m. Manual auguring ceased within a layer of light brown clay (4006) 1m in depth. This was overlain by a layer of clean medium brown clay (4005) 0.3m in depth. Immediately above lay a dark brown clayey silted deposit (4004) with inclusions of red brick fragments and coke 0.45m in depth.

Context Number	Context Description	Depth / AOD	Context type
4000	Modern surface (asphalt) 0.12m in depth	21.23m AOD	Layer
4001	Sub-surface (hardcore) 0.35m in depth	21.11m AOD	Layer
4002	Black and grey ash and sandy loam deposit 0.3m in depth	20.76m AOD	Layer
4003	Medium brown sandy loam deposit with building debris 0.3m in depth	20.46m AOD	Layer
4004	Dark brown silty clay with occasional building debris and coke 0.45m in depth	20.16m AOD	Layer
4005	Clean medium brown clay 0.3m in depth	19.71m AOD	Layer
4006	Clean light brown clay	19.41m AOD	Layer

3.8 Trench 6 (Fig. 4, Plate 6)

Maximum dimensions: Length 5.0m - Width 1.6m Depth 1.5m
Orientation: East to West

This trench was moved to the east due to the proximity to standing buildings. Sampling below the lowest machine level was undertaken using a manual auger. In the early stages of machine excavation, brick features were initially believed to be associated with a modern storm drain and subsequently some 'over-machining' took

place with regard to the brickwork structures (F600 and F601). Although at a reduced level, the nature and extent of these features was recorded.

The brickwork of F601 (6008) comprised a machine-cut red brick wall bonded with limed mortar and laid in header and stretcher courses, on an east-west alignment. This was butted by a block of brickwork (F600) measuring 0.36m x 0.25m. The construction of F600 (6007) comprised cemented mortar.

In the western half of the trench was a layer of dry-laid red bricks (6003, not illustrated) 0.07m in depth. These were sealed by layers of ash (6002) and demolition debris (6001) containing, kiln furniture, saggars, post-medieval pottery, mortar, burnt material and coke.

Context Number	Context Description	Depth / AOD	Context type
6000	Modern surface (concrete) 0.05m in depth	21.82m AOD	Layer
6001	Demolition debris 0.7m in depth	21.77m AOD	Layer
6002	Grey-blue clay and ash 0.08m in depth	21.07m AOD	Layer
6003	Brick floor surface 0.07m in depth	20.99m AOD	Layer
6004	Ash and coke 0.1m in depth	20.92m AOD	Layer
6007	Brickwork for F600	20.82m AOD	Build
F600	Brick wall (pier)	20.82m AOD	Structure
6008	Brickwork for F601	20.82m AOD	Build
F601	Brick wall (panel)	20.82m AOD	Structure
6005	Silty dark brown loam with occasional building debris and coke 0.5m in depth	20.82m AOD	Layer
6006	Brown clay with charcoal inclusions 0.35m in depth	20.32m AOD	Layer
6010	Medium brown-grey sandy clay 0.3m in depth	19.97m AOD	Layer
6011	Mixed red-brown and yellow-grey sandy clay	19.67m AOD	Layer

Interpretation

The brick wall (F601) and abutting block of brickwork (F600) probably represent the remains of a pier and panel wall. F600 may have been the base of a later under-floor ceramic drainage system. The brickwork of F601 (6008) is probably mid to late 19th Century and is earlier than the dry-laid bricks (6003) which are the remains of a floor surface. A thin deposit of clay and ash (6002) may be waste from porcelain production. The presence of 19th Century pottery and saggars in the layers overlying the structures suggests these structures are connected with the former Grainger's Porcelain Works.

3.9 Trench 7 (Fig 2, Plate 7)

Maximum dimensions: Length 5.0m - Width 1.6m – Depth 1.6m
Orientation: Northeast to Southwest

Manual auguring ceased at the top of a layer of natural sand and gravel (7006) 2.5m below the modern ground surface. This was sealed by alluvial deposits (7005 and 7004). A deposit of black silt mixed with ash (7003) was overlain by an irregular layer of dry-laid red bricks (7002).

Context Number	Context Description	Depth / AOD	Context type
7000	Modern surface (asphalt) 0.1m in depth	22.02m AOD	Layer
7001	Sub-surface (hardcore) 0.2m in depth	21.92m AOD	Layer
7002	Irregular brick surface 0.15m in depth	21.72m AOD	Layer
7003	Black sandy loam mixed with ash and building debris 0.85m in depth	21.57m AOD	Layer
7004	Brown clay with stone inclusions 0.2m in depth	20.42m AOD	Layer
7005	Green clay 0.6m in depth	20.22m AOD	Layer
7006	Natural sand and gravel	19.62m AOD	Natural geology

Interpretation
The crude layer of red bricks (7002) may have formed a rough floor, possibly forming a backyard surface to properties formerly fronting onto St Martins Gate (Fig. 6).

3.10 Trench 9 (Fig. 5, Plates 8 to 12)

Maximum dimensions: Length 10m - Width 1.6m – Depth 1.2m
Orientation: North to South

A vaulted cellar F900 was aligned north-south and was rendered internally with a cemented mortar. A small square vent in the brickwork connected the cellar to a brick-built flue or channel (F909). A square vent was also present in the vaulted roof interior (Plate 8).

The curvilinear covered drainage channel (F909) was of brick construction (9017) and included some yellow firebricks with a vitrified appearance. The base was formed by a single course of red floor tiles. This was overlain by a north-south aligned brick-built wall F908 (Plate 9).

To the east of F900 was a mixed dry-laid brick surface edged by a single course of dry laid bricks (F907, Plate 10). To the east of F907 were a series of stone and brick floor surfaces (9016, 9021 and 9022, Plate 10).

F900 was abutted to the north by two substantial adjoined blocks of brickwork (F901). This abutted on the northern side by the surviving elements of an east-west aligned wall (F903).

To the north of F903 was an east-west aligned brick-built culvert (F902, Plate 11) filled by layers of ash and grey, green and white silted clays (9018). This lay within a cut (F906) that was backfilled with crushed coke and ash (9003).

At the northern end of the trench were two brick walls aligned north-south (F904 and F905). F904 consisted of bonded red brick, and F905 consisted of two skins of bonded yellow firebricks. Lying against these walls was a mixed deposit of general demolition and industrial debris, pottery and kiln furniture (9002). This was sealed by a single layer of dry-laid red and blue bricks (9008).

Context Number	Context Description	Depth / AOD	Context type
9000	Modern surface (concrete) 0.25m in depth	21.88m AOD	Layer
9001	Building debris up to 0.6m in depth	21.63m AOD	Layer
9008	Brick floor surface 0.07m in depth	21.03m AOD	Layer
9002	General demolition and industrial debris up to 0.45m in depth	20.58m-20.23m AOD	Layer
9022	Blue-brick floor surface 0.1m in depth		Layer
9021	Mixed common brick floor surface 0.3m in depth		Layer
9016	Irregular blue-stone floor surface 0.1m in depth		Layer
9018	Fill of F902 0.6m in depth		Fill
9006	Brickwork of F902		Build
F902	Brick-built culvert		Structure
F906	Cut for F902		Cut
9003	Fill of F906		Fill
9020	Fill of F909		Fill
9017	Brickwork of F909		Build
F909	Brick and tile drain		Structure
9014	Brickwork of F907		Build
F907	Brick floor surface		Layer
9015	Brickwork of F908		Build
F908	Brick wall		Structure
9010	Brickwork of F904		Build
F904	Brick walling (kiln)		Structure
9011	Brickwork of F905		Build
F905	Brick walling (kiln)		Structure

9004	Brickwork of F900		Build
F900	Brick-built cellar		Structure
9005	Brickwork of F901		Build
F901	Brick-built piers		Structure
9007	Brickwork of F903		Build
F903	Brick wall		Structure
9013	Green-brown clay 0.95m in depth	20.61m AOD	Layer
9019	Natural red sand and gravel	19.66m AOD	Natural geology

Interpretation
The features identified, such as a drainage channel (F909), a culvert (F902), and the common red-brick and firebrick constructions (F904 and F905) suggest several phases of industrial activity, most of which almost certainly relate to the former Grainger's Porcelain Works. The cut for the culvert (F906) was filled with crushed coke (9003), possibly a by-product of pottery firing. The culvert (F902) itself probably served to carry away waste-water and clay residue from clay processing areas.

The cellar (F900) is clearly associated with a drainage channel (F909) and is therefore probably contemporary with the porcelain factory. The cemented render on the vault interior would have aided waterproofing while an aperture cut into the roof may have channelled water from the floor above. Many of these features were probably intended to be subterranean and were sealed by several phases of floor surfaces (9008, 9016, 9021 and 9022).

The use of specialised bricks is apparent and it is likely that the truncated common red-brick and yellow firebrick structures (F904 and F905) are the remains of a pottery kiln typical of 19th Century contexts. Figure 6 shows the Ordnance Survey 1884 map overlain by the evaluation trenches. Features F904 and F905 at the northern extent of the trench appear to relate to two circular structures described on the plan as kilns.

Excavation in Trench 9 has highlighted an excellent survival of the remains of a complex system of brick-built structures. These features are within the area of the former porcelain works and almost certainly relate to porcelain manufacture. The majority of the brick-built structures within this trench were dateable to the mid - late 19th Century.

3.11 Trench 10

Maximum dimensions: (sondage) Length 1.2m - Width 1.6m – Depth 1.05m
Orientation: East to West

Context Number	Context Description	Depth / AOD	Context type
10000	Modern surface (compacted topsoil)	21.05m AOD	Layer
10001	Dark brown sandy loam truncated by modern services 1.0m in depth	21.00m AOD	Layer
10002	Medium grey-brown clay 0.2m in depth	20.00m AOD	Layer

10003	Medium brown-grey clay 0.15m in depth	19.80m AOD	Layer
10004	Medium brown-grey clay with charcoal inclusions 0.05m in depth	19.65m AOD	Layer
10005	Medium brown-grey clay and sand 0.2m in depth	19.45m AOD	Layer
10006	Medium red-brown and yellow-grey sandy clay	19.25m AOD	Layer

This trench was not fully excavated due to the presence of live services. A sondage (SO3) was excavated between the services to facilitate augering.

A disturbed layer of dark brown sandy loam (10001), 1.0m in depth contained five saggar fragments and several 19th Century unglazed porcelain wasters. Other ceramic material included examples of fragmentary moulded, transfer-printed and blackware vessels (see Hancocks below).

Unglazed porcelain cup wasters, decorative moulded plate fragments and a handle were recovered from the overburden in Trench 10. Five fragments of saggar were recovered with some thimble debris from the sondage. While this material dates to the 19th Century and is probably associated with the porcelain works, the trench lies outside the area of the works defined by the 1884 map.

3.12 Trench 12 (Plate 13)

Maximum dimensions: Length 7.0m - Width 1.6m – Depth 3.1m
Orientation: East to West

Context Number	Context Description	Depth / AOD	Context type
12000	Modern surface (hardcore) 0.15m in depth	22.05m AOD	Layer
12001	Sub-surface (loose bricks) 0.15m in depth	21.90m AOD	Layer
12002	Dark brown – black ash and demolition debris up to 0.1m in depth	21.75m AOD	Layer
12003	Medium brown sandy loam and ash with demolition debris 0.2m in depth	21.65m AOD	Layer
12004	Light - medium brown sandy loam with post-medieval building debris 1.7m in depth	21.45m AOD	Layer
12005	Natural orange and brown clays and sands with occasional pebbles	18.95m AOD	Natural geology

Trench 12 was moved to the northeast to avoid a static trailer. Due to the unstable nature of the overburden and the proximity of buildings, it was not possible to machine excavate the entire trench to the level of the natural subsoil.

The natural subsoil (12005) was recorded within a sondage (SO2). This comprised mixed orange/brown clays and sand. No features were observed within the base of the sondage. This was overlain by a loose deposit of light to medium brown sandy loam (12004) with Post-medieval inclusions such as red brick fragments, slate and tile 1.7m in depth.

Interpretation
Trench 12 was situated in a small raised area that had obviously been built up by the dumping of general demolition material. However the alluvial layers noted elsewhere on site were not apparent here, and it was clear that the natural ground surface was marginally higher than to the south. A light to medium brown sandy loam deposit (12004) may represent a former post-medieval ploughsoil. No evidence of 19th Century cellaring or truncated deposits was obsevcrved.

3.13 Trench 14 (Plate 14)

Maximum dimensions: Length 5.0m - Width 1.6m – Depth 1.7m
Orientation: Northwest to Southeast

Context Number	Context Description	Depth / AOD	Context type
14000	Modern surface (asphalt) 0.05m in depth	21.09m AOD	Layer
14001	Sub-surface (hardcore) 0.3m in depth	21.04m AOD	Layer
14002	Building debris and ash 0.3m in depth	20.74m AOD	Layer
14003	Brown sandy loam and ash with post-medieval building debris 0.4m in depth	20.34m AOD	Layer
14004	Reddish-brown sandy loam with post-medieval building debris up to 0.4m in depth	19.94m AOD	Layer
14005	Reddish-brown silted clay 0.45m in depth	19.49m AOD	Layer
14006	Green and brown clay 0.55m in depth	19.04m AOD	Layer
14007	Natural red sand and gravel	18.49m AOD	Natural base

The trench was located close to standing buildings belonging to an adjoining property. Due to the unstable nature of the overburden it was not possible to excavate this trench to level of the natural subsoil. The natural subsoil comprised red sand and gravel (14007) and was encountered at a depth of 2.4m. The natural subsoil was overlain by layers of alluvium (14006 and 14005). The alluvium was overlain by a layer of reddish brown sandy clay (14004) with red brick and tile inclusions up to 0.4m in depth.

Interpretation
Alluvial layers (14006, 14005), are similar to those noted elsewhere. Layers sealing this (14003 and 14004) appeared to be post-medieval in origin.

4.0 Geoarchaeological Survey
The proximity of trenches to standing buildings, live services and the depth of the overburden meant that it was not possible to mechanically excavate to the natural sub-soil except for Trenches 2 and 12. After consultation with the city archaeologist and the archaeological consultant it was decided that an auger survey would be used to establish the nature and depth of the underlying deposits. The results of this preliminary survey identified two trenches (Trench 6 and Trench 10) suitable for further study. This survey was undertaken by Terra Nova Ltd, the results of which appear below (Jordan 2002, Appendix 1).

5.0 The Finds *by Annette Hancocks*

Table 001: Quantification of finds * porcelain wasters present.

Trench	Context/ Find type	Ceramic: Tile	Mortar	Marble	Saggars	Post-Medieval pottery	Medieval pottery	Fired clay/daub	Slag	Glass: Bottle	Animal Bone
2	U/S										2g
2	2002						1				
2	2005		1			1	1	1	162g		
2	2007 (F202)	1									
2	2008 (F201)					2			236g		
6	6001	1			13	30*				2	
7	7004	2									
9	U/S	1			3	15*					
9	Overburden				1	1					
9	9003				6	34*					
10	Sondage (10001)				5	50					
14	14002			2					20g		
14	14003					7					
14	14004	6				1					
14	14006	1									9g
Totals		**12**	**1**	**2**	**28**	**141**	**2**	**1**	**418g**	**2**	**11g**

Factual data
A small, but significant finds assemblage was recovered from six of the evaluation trenches. Of particular note were the finds recovered from Trenches 2, 6 and 9. These are discussed in more detail below. The majority of this material was hand collected with a small amount collected by machine bucket owing to the depth of the trenches on site.

With the exception of material recovered from the unstratified and overburden areas, which demonstrated some contamination, the remainder of the assemblage derived from securely dated contexts. Where possible a *terminus post quem* has been provided.

Statement of potential
Trench 2 has two layers of redeposited material defined by layers 2002 and 2005. Both deposits contain sherds of medieval pottery of 12th/13thCentury date. These are associated with a single sherd of un-diagnostic Post-medieval pottery, some tap and iron smelting slag and animal bone, implying the earlier material is residual.

By association with the medieval and Post-medieval ceramics the 'slag' has not come from a secure Roman context. If redeposited it does not warrant further analysis at this stage.

Significant quantities of pottery saggars and thimbles associated with kiln debris were recovered from Trenches (6001) and Trench 9 (U/S and 9003). These were found in association with small groups of porcelain wasters. Some of these were fused and warped together as a result of a failed firing. Identifiable forms included plates and cups from context 9003. A near complete transfer-printed plate and eggcup was also recovered from this deposit which dates to the 19th Century.

Small quantities of waster unglazed porcelain cups were recovered from Trench 10. Decorative moulded plate fragments and a handle was also recognised. This material was associated with a transfer-printed vessel and some blackware. Five large fragments of saggar were recovered with some thimble debris from the sondage. This material dates to the 19th Century.

The finds recovered from Trench 14 (14002) comprised two marble columns, which show signs of machine cutting and drilling. This type of material would more than likely have been used by a stone mason. Other material deriving from this Trench included a substantially complete blackware bowl of 18th/19th-Century date from 14003.

Recommendations
It is recommended that if any further work is undertaken on the site that the small corpus of material recovered should be incorporated into the overall scheme of artefact recording. While the presence of a Worcester porcelain kiln is particularly significant, as the assemblage currently stands it is recommended that no further detailed analytical work be undertaken.

Storage and curation
The finds archive comprises 2 boxes of material and 15 assemblage summary sheets. Upon completion and subject to the permission of the landowner the archive will be deposited with Worcester City Museum.

6.0 County Furnishings Evaluation (Fig.7)
An earlier evaluation was undertaken within the development area (Brown 1990). This was located in the car park belonging to County Furnishings between Silver Street to the west and Lowesmoor to the north (NGR SO 8520 5511). Part of the evaluation area was at 36 Lowesmoor Trading Estate and comprised a disused warehouse. This data has been re-examined and incorporated into this report as outlined in the brief (Heaton 2002). This provides an interpretative summary.

Trench 1a
Orientated east-west, 15m x 2m

Machined to what was assumed to be the natural at a depth of approximately 1.20m. No features of Roman origin were identified, although sherds of Roman pottery and iron smelting slag were recovered.

One clay-lined pit of possible medieval origin was recorded cutting into the natural deposits. This produced 35 sherds of pottery dated to the 14th Century.

The remainder of features, encountered at a depth of approximately 0.50m below the current ground level (between 20.24m and 21m OD), were thought to date from the 17th to 19th Centuries These included pits, wells and three structures constructed from roof tile fragments. Trench 1 also produced a large assemblage of plain, glazed and decorated floor tile dating to the medieval period. Some of this material, although re-deposited, were interpreted as wasters from a near-by medieval tile kiln.

Trench 2a
Orientated north-south, 4m x 2m

Trench 2a was excavated to a depth of approximately 1.4m. A sondage was excavated at the southern extent of the trench to a total depth of 2.4m. The natural ground surface was not recorded. The earliest feature was a cellar that utilised broken roof tiles and appeared to have been in-filled at some point in the 17th Century. The evaluation would suggest that 17th Century deposits were evident to within approximately 0.70m of the present ground surface.

While the date of the cellar cannot be certain, the pottery evidence suggests this went out of use during the 17th Century. This building does not respect current property boundaries and is clearly earlier than the existing buildings.

Trench 3a
Orientated north-south, 7m x 2.3m

Machined to an orange-brown clay loam at a depth of approximately 1.20m from the current ground surface. This was tentatively identified as a natural deposit.

The earliest deposits in Trench 3a were several inter-cutting pits producing sherds of pottery dated to the late 17th Century.

Trench 4a
Orientated north-south, 9m x 1m

At a depth of 1.2m an area of buff sand with few gravel inclusions appeared to represent a natural deposit, although this was not closely examined. The remainder of deposits in Trench 4a consisted of a well, a brick wall and a cellar. All these features were considered to be 19th Century in origin.

Discussion
Significant quantities of Severn Valley ware and Black Burnished ware in medieval and later contexts imply that the absence of Roman activity may be due to truncation by later activity. Iron smelting slag recovered from medieval contexts is probably residual and is more consistent with slag recovered from Roman contexts at other sites in Worcester.

One feature dated to the medieval period recorded in Trench 1a, may be associated with structures fronting onto Silver Street to the east. The clay lined pit and the presence of decorated floor tile wasters suggest that small scale industry may have formed a significant part of back plot activity. It is also considered possible that this area may contain the remains of a medieval tile kiln.

The County Furnishings evaluation highlighted a growth in occupation from the 17th to the 19th Century. While activity associated with medieval settlement appears to be focused along the eastern side of the development area, there is a clear expansion to the west (Trench 2a) during the late 17th Century. This includes a 17th Century cellar and large pits. These have been interpreted as clay-pits associated with the well-documented 17th Century brick-making industry in Worcester.

7.0 Archaeological Deposit Model (Fig. 8)
A proposed model of the deposits has been provided based on evidence gathered from the desk-based assessment, Lowesmoor Trading Estate and County Furnishings evaluations and the St Martins Gate excavation. Due to the limited area available for trial trenching the proposed model is based on a very small sample of the total development area.

For the purposes of the model the Lowesmoor Trading Estate has been divided into five areas of archaeological potential.

- (A) Area not evaluated
- (B) Deposits improbable
- (C) Deposits of alluvial silts overlain by makeup layers
- (D) Deposits likely
- (E) Deposits demonstrated
- (F) Area not evaluated (but probably consisting of alluvial silts and makeup layers)

Area A
No evaluation trenches were excavated in these areas due to the presence of the Territorial Army Centre. This area currently lies between the St Martins Gate excavations and The County Furnishings evaluation, which suggests this area has a good potential for the presence of Roman or medieval remains.

Area B
The presence of archaeological deposits is considered unlikely within much of this area due to extensive cellaring (Heaton 2001).

Area C
Although more substantial alluvial deposits may be present within other areas of the valley of the Frog brook, The sequence in Trench 10 did not appear suitable for the provision of long and well resolved palaeoenvironmental sequences. Alluvial deposits in Trench 4 showed no evidence of Prehistoric or Roman truncation and were sealed by post-medieval overburden. While the presence of waste from the overburden in Trench 10 is significant, this stratigraphy had been disturbed by modern services to a depth of 1.0m.

While the stratigraphy in Trench 14 did not provide evidence of activity predating the post-medieval period, the level of sampling in this area was particularly small. Deposits in this area may be associated with properties fronting onto Lowesmoor to the north. The County Furnishings evaluation (Trench 4a) to the west demonstrated a high level of 19th Century truncation, although further work here may demonstrate the presence of 'islands of archaeology'.

Within Trench 14 the natural subsoil (14007) was encountered at a depth of 2.6m (18.49m OD) below the modern ground surface (14000). Two alluvial deposits (14006 and 14005) were encountered depths of 2.05m (19.04m OD) and 1.6m (19.49m OD), respectively.

Area D
This area encompasses the County Furnishings evaluation area (Trenches 1a, 2a and 3a) and Trenches 2 and 12. This area lies to the west of the valley of the Frog Brook and appears to have lain beyond the area of former alluvial inundation. While this

probably made the area more suitable for settlement, it is also located closest to the foci of Roman and medieval settlement.

The potential for features cut into the natural subsoil, dating to the Roman or medieval period is considered to be high. The St. Martin's Gate excavations, to the southwest of Lowesmoor Trading Estate recorded Roman features at a depth of c1.3m from the modern ground surface. These features indicated the presence of iron smelting and smithing on, or very close to, the site. Of features of possible Roman origin (F201 and F202) recorded within Trench 2, one produced iron slag (F201). This compares well to slag recovered from Roman deposits during the St. Martins Gate excavations.

The features in Trench 2 cut the natural subsoil and were encountered at a greater depth (2.6m, 18.73m OD) below the modern ground surface than those from St Martins Gate and County Furnishings. The dark, grey- brown organic layer recorded at the St Martins Gate excavations was not encountered in Trench 2.

Trench 1a contained a clay-lined pit of probable medieval origin. This cut into the natural subsoil at a height of 20.58m OD. Trenches 1a and 2a also contained residual Roman pottery and iron slag. Several deposits containing medieval tile were identified at the northern end of Trench 2a.

Area E

The natural ground surface was not reached. Alluvial deposits were recorded at a depth of 1.5m to 2.15m (20.32m OD to 19.67m OD). Deposits in area E are typically alluvial deposits overlain by later post-medieval deposits. The alluvial deposits occupy an area to the middle of the former valley of the Frog Brook. Trench 6 contained the remains of a 19th Century pier and panel wall (F600 and F601) at a similar depth to the structures in Trench 9. This was almost certainly associated the Former Porcelain Works.

Trench 7 contained the remains of a possible floor surface (7002) of a 19th Century date. Alluvial deposits (7004 and 7005) were recorded at a depth of 1.6m to 2.4m (20.42m OD to 19.62m OD). The natural ground surface (7006) was encountered at a depth of 2.4m from the modern ground surface (19.62m OD)

Trench 9 contained a complex array of brick-built structures dating to the mid-late 19th Century. These structures relate to the former Grainger's Porcelain Works and were encountered at depths as near as c0.3m (21.58m OD) from the modern ground surface. An alluvial deposit (9013) was recorded at a depth of 1.27m (20.61m OD). The natural ground surface (9019) occurred at 2.22m (19.66m OD). 19th Century Deposits of archaeological interest were consistently recorded at a depth of c0.25m below the current ground surface in the area of Trenches 6 and 9.

Area F

No evaluation trenches were excavated in these areas. This was due to the presence of large standing buildings (such as the former Vinegar Works), the need for access and the presence of live services. While it is difficult to highlight the nature of archaeological remains due to the absence of trial trenches within this area, the stratigraphic sequence in Trenches 4, 6, 10 and 14 may imply a similar sequence

within Area F. This may consist of alluvial sequences associated with the former valley of the Frog Brook sealed by post-medieval overburden.

8.0 Discussion

The evaluation works at Lowesmoor Trading Estate, while limited in their coverage, have significantly contributed to the understanding of the nature of the archaeological remains. The area of Lowesmoor Trading Estate covers an area with diverse geological and archaeological deposits. Due to the limited amount of trenching in such a diverse area, it was understood from the onset of works that it would not be feasible to provide a full evaluation of the subsurface deposits.

Although peat deposits area absent from any of the trenches, geoarchaeological work suggests that Lowesmoor Trading Estate straddles the valley centre of the former frog brook (Jordan 2002). As such the area should contain some of the deeper Holocene sequences in the valley. The study did not, however, suggest the presence of significant accumulations of alluvium with the potential to provide a long palaeoenvironmental sequence. The presence of charcoal and other contaminants beneath uncontaminated clay does suggest the presence of more substantial pre-industrial archaeological deposits nearby.

No evidence for prehistoric activity was recorded within the development area. Romano-British remains may be limited to the eastern side of the site. It seems likely that features cutting the natural deposits in Trench 2 are of Roman origin. Slag recovered from the pit (F201) suggests localised iron manufacture characteristic of Roman deposits in Worcester. Excavations at Broad Street and Deansway have yielded iron working hearths and primary dumps of smelting slag (Dalwood *et al.* 1994, 105). This also compares well with sub-circular pits recorded at St Martin's Gate (Dingwall and Ramsey 2002, Fig. 7). These were cut into the natural subsoil (at a depth of 1.8m below the modern ground surface) and contained Romano-British pottery and tap slag. This would have derived from a bloomery furnace and attests to 1st to 3rd Century, localised iron smelting. The Roman pits at St Martins Gate are only 20m to the southwest of Trench 2 and may represent a continuation of these deposits.

While features recorded in the County Furnishings evaluation were approximately 0.70 to 1m higher than those from Trenches 2 and 12, deposits containing iron slag occurred in features cutting the natural subsoil at 18.73m OD. The development of the Roman iron working industry in Worcester has been identified as a key research objective (Dalwood et al. 1994, 111) and the ubiquitous evidence for iron working suggests it may have been a specialised industrial small town (Burnham and Wacher 1990, 232-4).

A dark earth deposit attributed to the late Roman and early post-Roman period, recorded on other sites in Worcester, was not in evidence at within Trenches 2 and 12. Further archaeological work in this area may identify this deposit due to the small size of the evaluation sample.

The evidence for medieval activity was largely present in the trenches excavated at County Furnishings. It is clearly significant that the only *in-situ* medieval feature was recorded in Trench 1a, close to Silver Street. While the eastern extent of Lowesmoor

Trading Estate may once have included the Frog Brook, it would appear that medieval activity was focused along Silver Street, along the western edge of the site. Between the Roman period and the early post-medieval period it seems likely that the area beyond the Silver Street back plots was mainly used for agricultural purposes. Industrial processes may have been a major part of back-plot activity in this area. The presence, of a large assemblage of glazed floor tile wasters suggests a tile kiln was in production at or near to Lowesmoor Trading Estate during the medieval period. A tilehouse is recorded as having stood opposite the gate in what is now Silver Street, first mentioned in 1455, and continuing in use into the seventeenth century (Hughes 1980, 285).

The medieval evidence from the 2002 evaluation at Lowesmoor Trading Estate is scant. This consists of two sherds of 12/13th Century pottery recovered from Trench 2. The paucity of medieval remains at other sites in Worcester, Loves Grove and Rea's Timber Yard, has been attributed to the fact that these areas lay outside the limits of the planned medieval suburb (Dalwood et al. 1994, 107). The absence of *in-situ* medieval remains at St Martin's Gate may suggest that beyond the back-plots of properties fronting onto Silver Street, this area was not a focus of settlement during the medieval period.

The presence of Roman remains at St Martins Gate and medieval and residual Roman remains at County Furnishings suggests a high potential for remains in the area in-between. This is currently occupied by the Territorial Army and has not been the subject of evaluation works.

The area of Lowesmoor Trading Estate appears to have been more extensively occupied from the 17th Century onwards. Evidence Trenches 1a to 4a suggests that the 17th Century saw an eastwards expansion of activity from existing properties fronting Silver Street. While some much of this was clearly structural, some activity may be related to the extraction of clay. Pottery recovered from the western half of the site (Trenches 12 and 14) suggested early to mid post-medieval activity, although no features were recorded within these trenches. Trench 12 was situated in an area that had clearly been built up by the dumping of general demolition material. The alluvial layers noted elsewhere on site were not apparent here and the level of the natural ground surface is slightly raised. Although no Roman or medieval deposits were recorded on the raised natural surface, the sondage in Trench 12 represents only a small sample of the development area.

The evaluation evidence combined with evidence from the desk-based assessment suggests that 19th Century development has had considerable impact on subsurface deposits. The desk-based assessment has suggested areas where it is considered that the survival of archaeological deposits is unlikely (Heaton 2001). The former Worcester Vinegar Works, and porcelain works dominate the site at Lowesmoor Trading Estate and both incorporate cellars and deep foundations. While Trench 3 revealed evidence of these substantial structures, this area is adjacent to St Martins Gate, and there is the possibility that islands of Romano-British activity could survive in this area, particularly since the desk-based assessment shows that this may have provided an access throughout the 19th Century.

Later post-medieval deposits in the form of dumping and levelling layers were evident in most trenches. The most important remains dating to the mid-late 19th Century were recorded in the southeastern corner of the development area. This is defined by the area of the former porcelain works. From the cartographic evidence (Fig 6) it is clear that Trench 9, and to some extent Trench 6 have identified an area of the former Grainger's Porcelain Works. Trench 9, however, provides only a very limited sample of a complex array of 19th Century brick-built structures. In the context of factory buildings in the West Midlands, the brick types employed are typical of the mid-late 19th Century, especially when bonded with cemented mortar (Steve Litherland *pers comm*). It is highly unlikely that earliest features within Trench 9 (F907 and F909) formed part of the 1801 complex that burnt down in 1809 (Heaton 2001). Both of these features are constructed from re-used materials (especially used firebricks) almost certainly recovered from an earlier kiln. That the porcelain works was subject to periodic rebuilding and improvement throughout the 19th Century until its demolition in c.1889 (Heaton 2001) is borne out by the presence of a succession of floor layers (9016, 9021 and 9022). Without the opportunity to investigate a larger area of the porcelain works it is not possible to securely date or phase the structures relating to the porcelain works with any degree of certainty.

These structures do, however, represent well-preserved remains of buildings relating to the manufacture of porcelain, and demonstrate an excellent survival of structures of several phases. These remains represent an important local industry that made Worcester porcelain world famous, and form a major part of Worcester's industrial heritage.

9.0 Acknowledgements

The fieldwork was supervised by Richard Cherrington with the assistance of Kate Bain, Emma Hancox, Phil Mann, Helen Martin, Andy Walsh and Steve Williams. John Halsted prepared the illustrations. Richard Cuttler monitored the project on behalf of BUFAU. David Jordan of Terra Nova Ltd conducted the Geoarchaeological survey. James Dinn monitored the evaluation on behalf of Worcester City Council. The archaeological consultant was Michael Heaton of ASI Consultants who commissioned the evaluation on behalf of Chelverton West Properties Ltd. We would also like to thank Don Bourton and the traders at Lowesmoor Trading Estate for their patience and co-operation during the evaluation fieldwork.

10.0 References

Brown, D.H. (1990) *'Evaluation at County Furnishings Silver Street, Worcester'.* (Archaeological Section, Hereford and Worcester County Council. Report 52)

Burnham, B. C., and Wacher, J., (1990) *The 'Small Towns' of Roman Britain.*

Dalwood, C. H., Buteux, V. A., and Darlington, L., (1994) *'Excavations at Farrier Street and Other Sites North of the City Wall, Worcester'*, Trans Worcs Arch Soc 3rd Series 14, 75 – 114.

Dingwall, L, and Ramsey, E. (2002) *'An Archaeological Excavation and Watching Brief at St Martin's Gate, Worcester'.* (BUFAU Report, Project no. 720)

Heaton, M. (2001) *Lowesmoor Trading Estate, Worcester: archaeological desk-based assessment.* (ASI Heritage Consultants, Ref: ASI 3166)

Heaton, M. (2002) *Lowesmoor Trading Estate, Worcester: Archaeological Evaluation, Written Scheme of Investigations.* (ASI Heritage Consultants, Ref: ASI 3166/2)

Institute of Field Archaeologists 2000, *Standards and Guidance: Archaeological Field Evaluation, Code of Approved Practice.* (IFA, Reading University).

Hughes, P. M., (1980) *'Houses and Property in Post-Reformation Worcester',* in M. O. H. Carver 1980.

Jordan, D. (2002) *'A Geoarchaeological evaluation of deposits from the Lowesmoor Trading Estate, Worcester.* (Terra Nova Ltd)

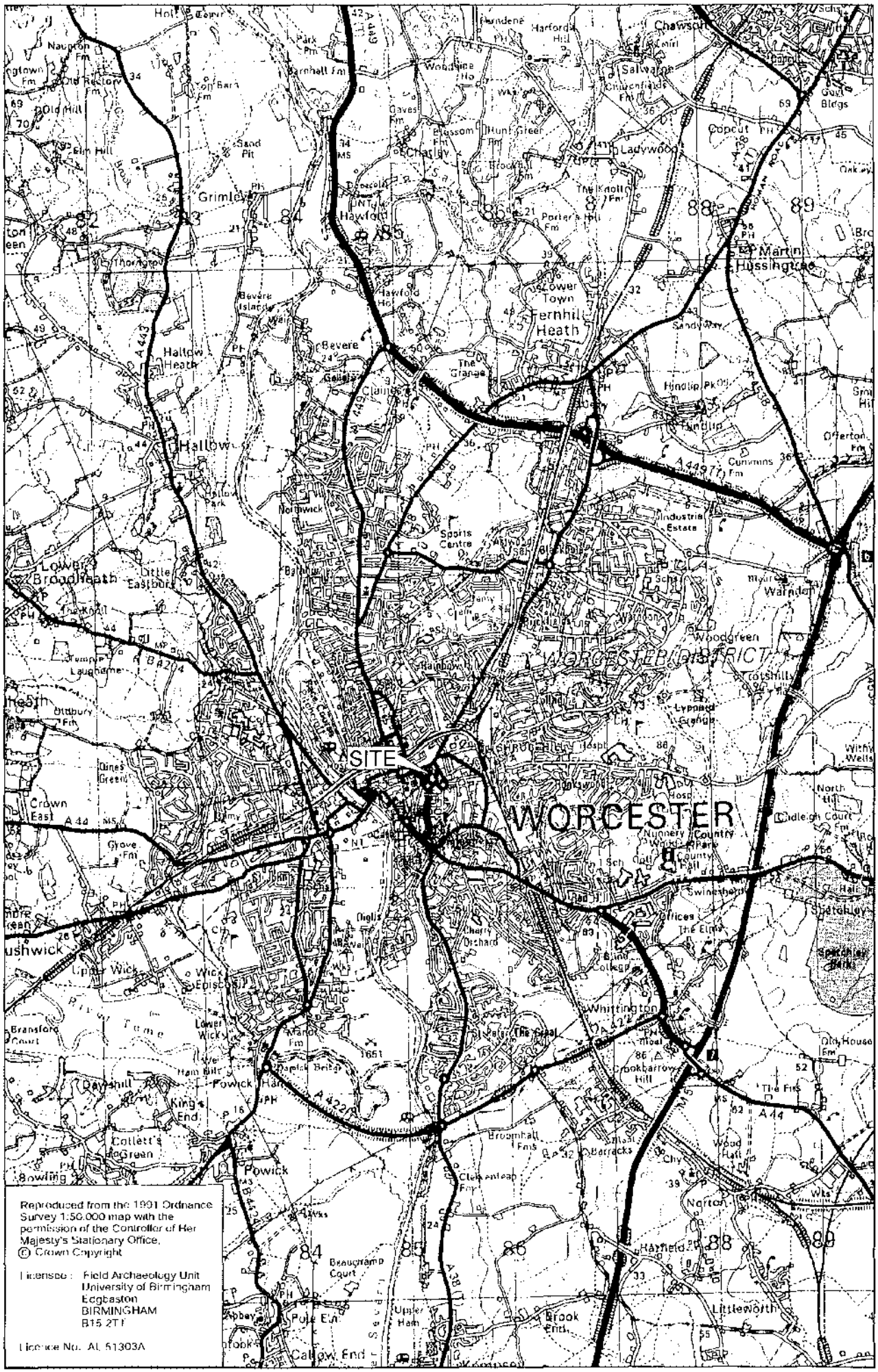

SITE
WORCESTER
WORCESTER DISTRICT
Reproduced from the 1991 Ordnance Survey 1:50,000 map with the permission of the Controller of Her Majesty's Stationary Office.
© Crown Copyright
Licensee : Field Archaeology Unit
University of Birmingham
Edgbaston
BIRMINGHAM
B15 2TT
Licence No. AL 51303A

Fig.1

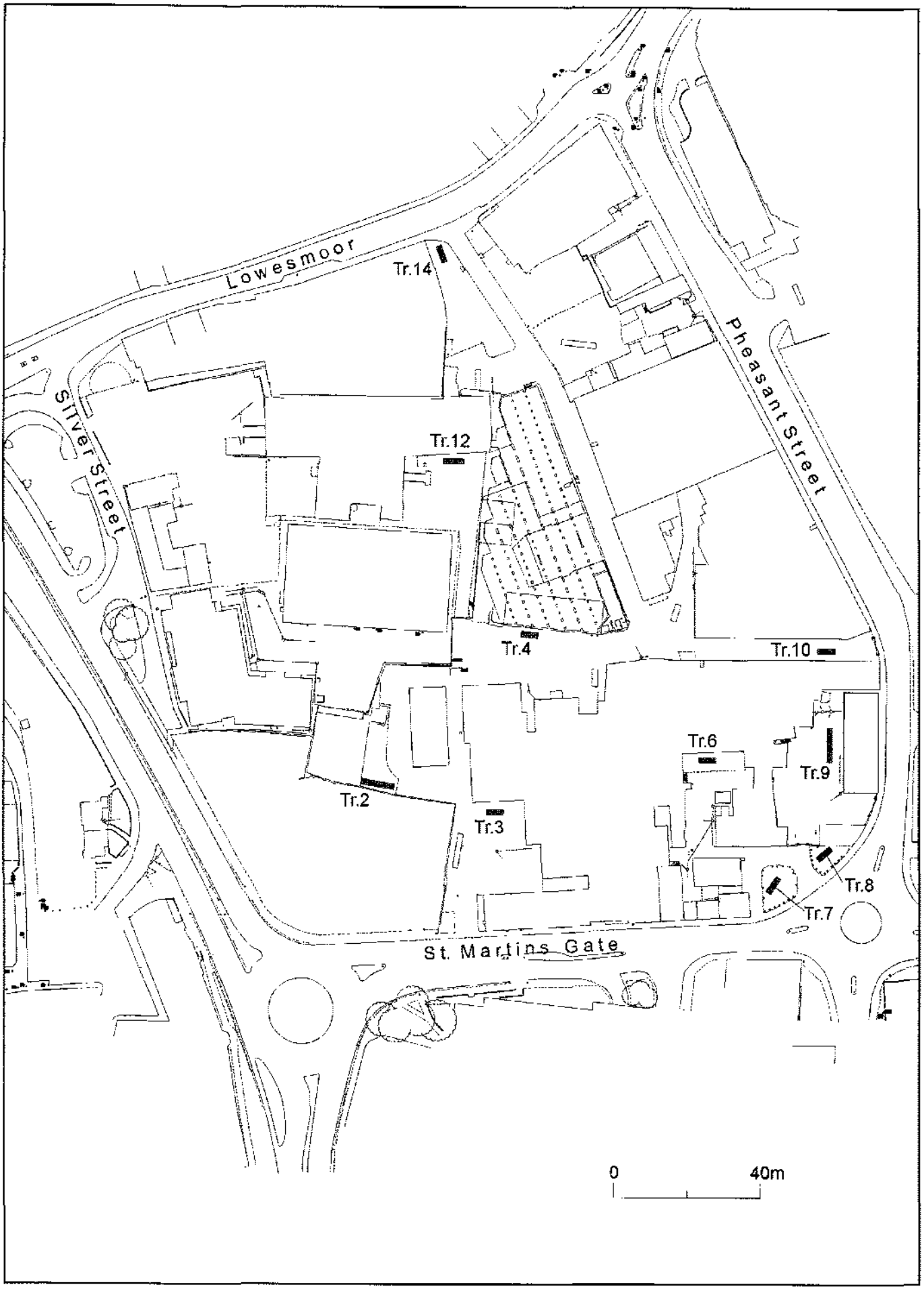

Lowesmoor
Tr.14
Pheasant Street
Silver Street
Tr.12
Tr.4
Tr.10
Tr.6
Tr.9
Tr.2
Tr.3
Tr.8
Tr.7
St. Martins Gate
0
40m

Fig.2

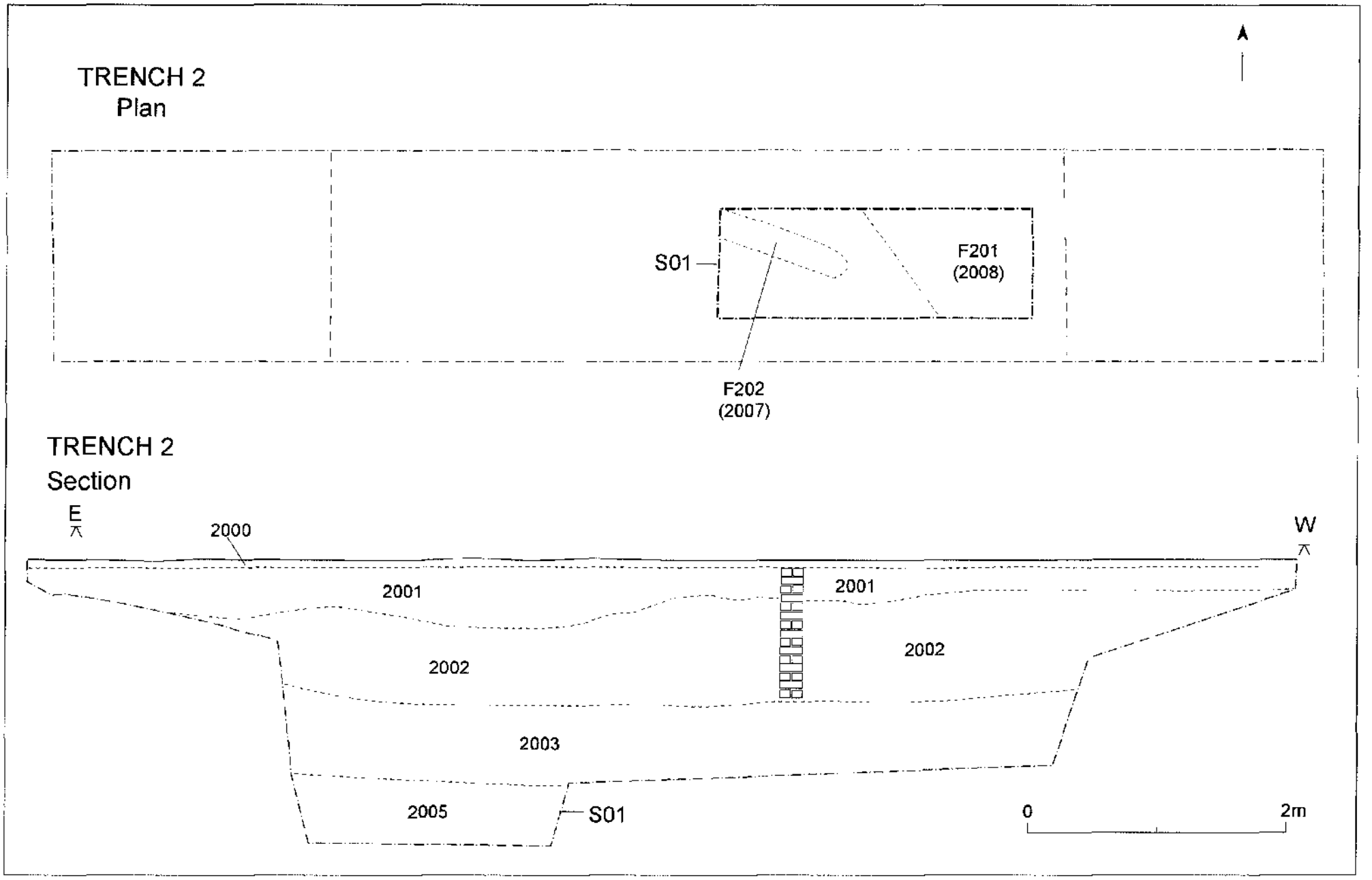

TRENCH 2
Plan
S01
F201
(2008)
F202
(2007)
TRENCH 2
Section
E
2000
W
2001
2001
2002
2002
2003
2005
S01
0
2m

Fig. 3

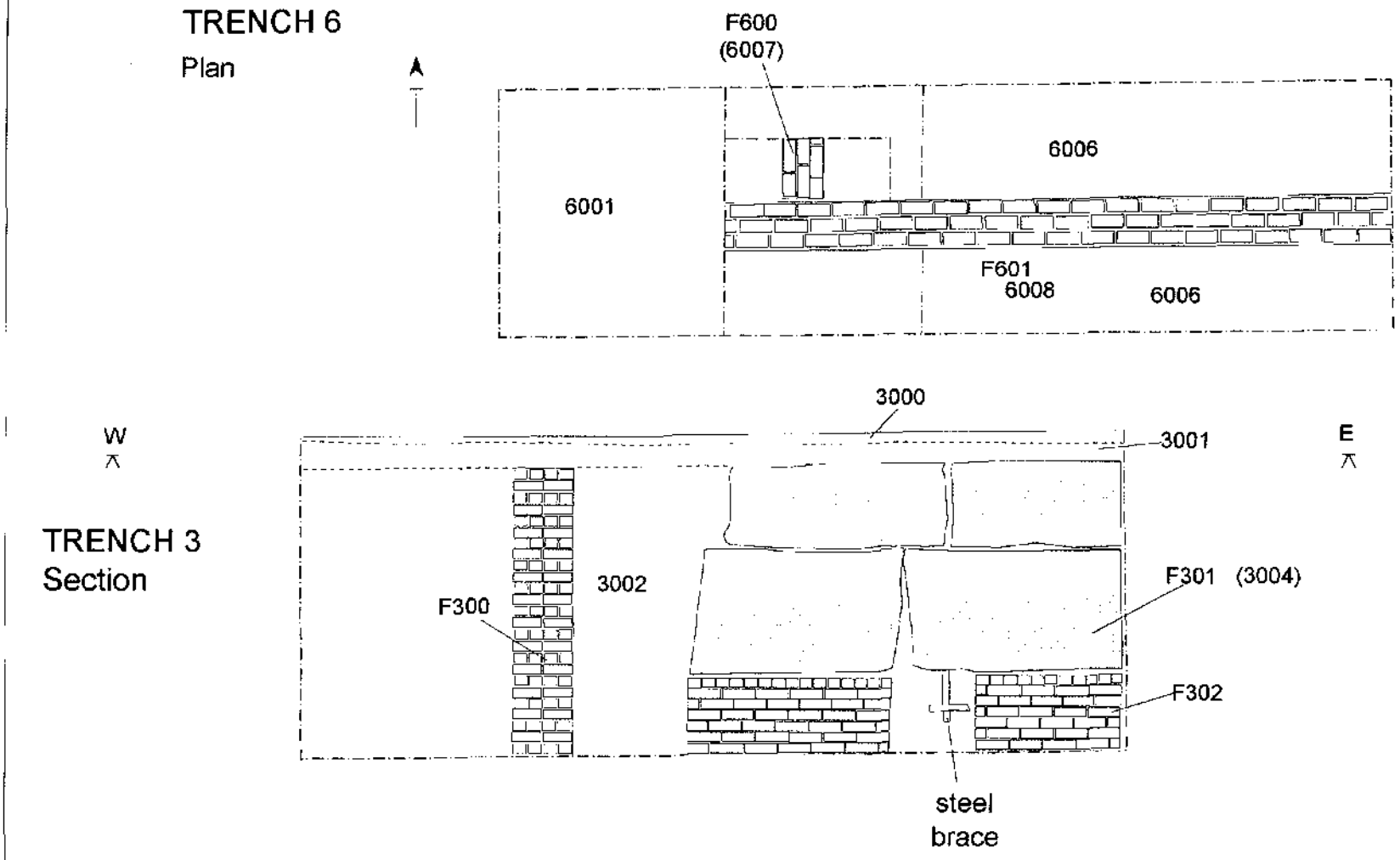

TRENCH 6
Plan
F600
(6007)
6001
6006
F601
6008
6006
3000
W
E
3001
TRENCH 3
Section
3002
F300
F301 (3004)
F302
steel
brace

Fig.4

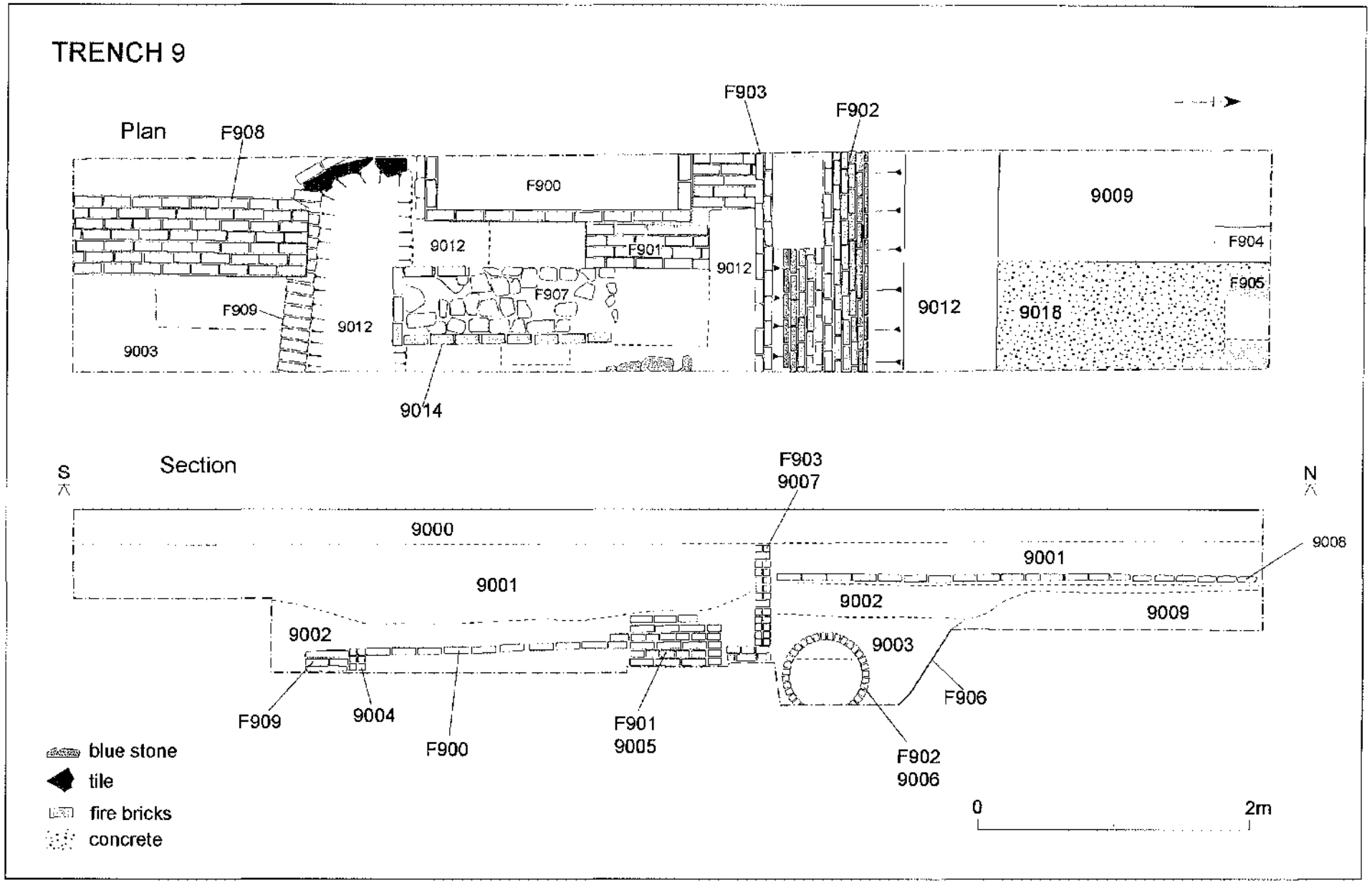

TRENCH 9
Plan
F908
F903
F902
F900
9009
9012
F901
F904
9012
F907
F905
F909
9012
9012
9018
9003
9014
Section
S
N
F903
9007
9000
9008
9001
9001
9002
9009
9002
9003
F906
F909
9004
F900
F901
9005
F902
9006
blue stone
tile
fire bricks
concrete
0
2m

Fig.5

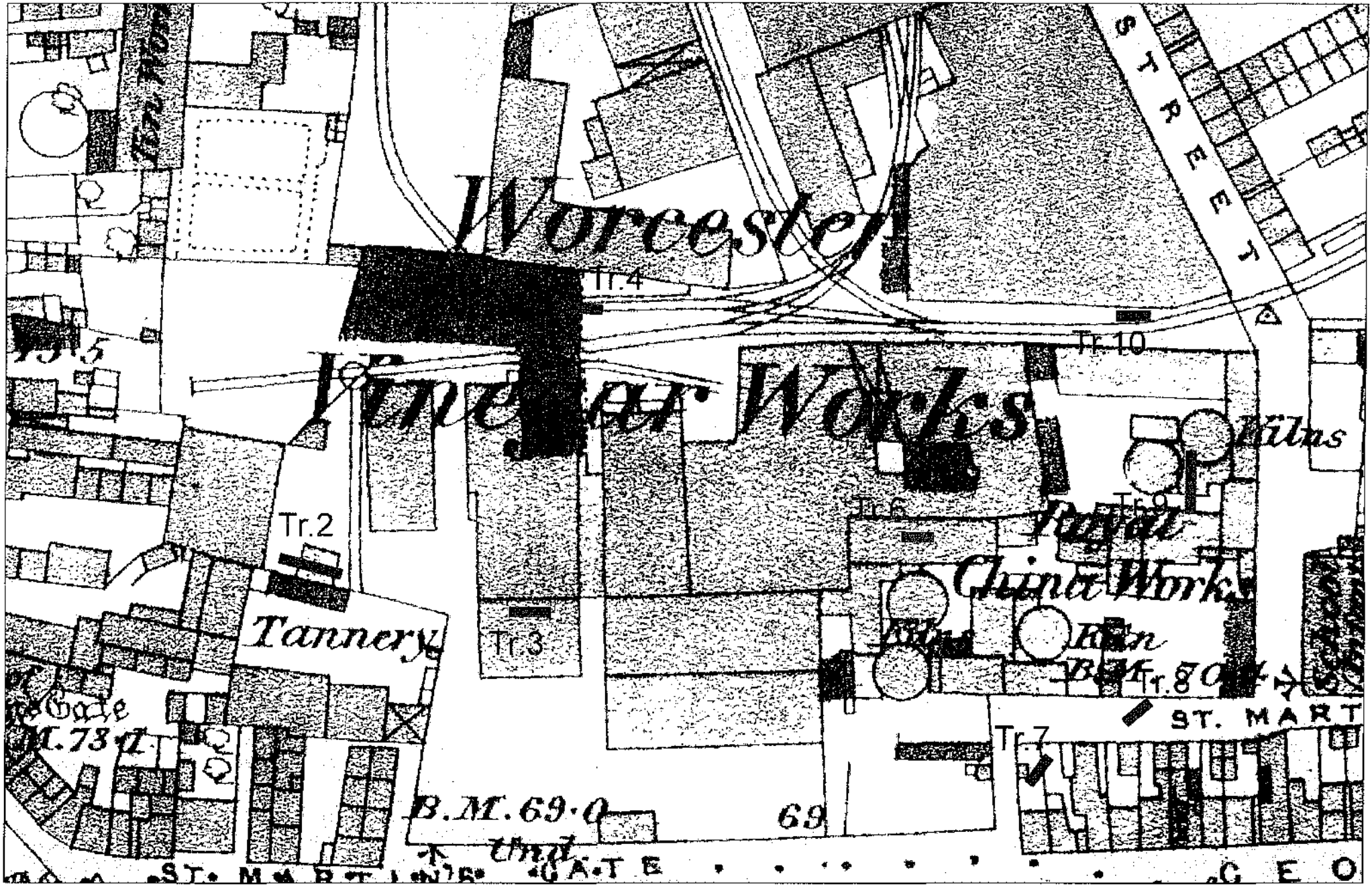

Worcester
Porcelain Works
Tr.1
Tr.2
Tr.3
Tr.4
Tr.5
Tr.6
Tr.7
Tr.8
Tr.9
Tr.10
Tannery
China Works
Kiln
Kilns
STREET
ST. MART
B.M. 69·0
69
GATE

Fig. 6

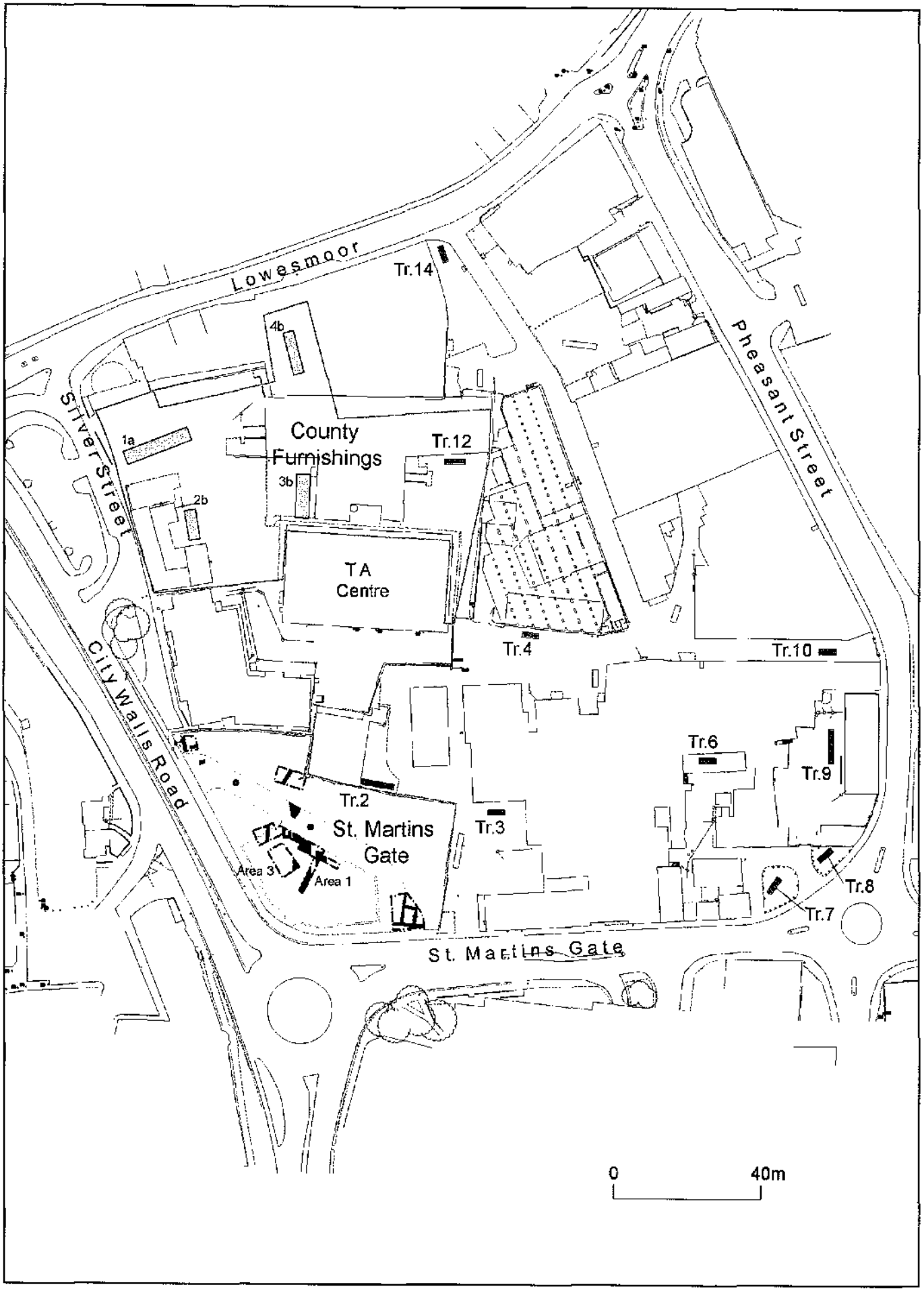

Lowesmoor
Tr.14
4b
Silver Street
1a
County
Furnishings
Tr.12
3b
2b
Pheasant Street
TA
Centre
Tr.4
Tr.10
City Walls Road
Tr.6
Tr.9
Tr.2
St. Martins
Gate
Tr.3
Area 3
Area 1
Tr.8
Tr.7
St. Martins Gate
0
40m

Fig.7

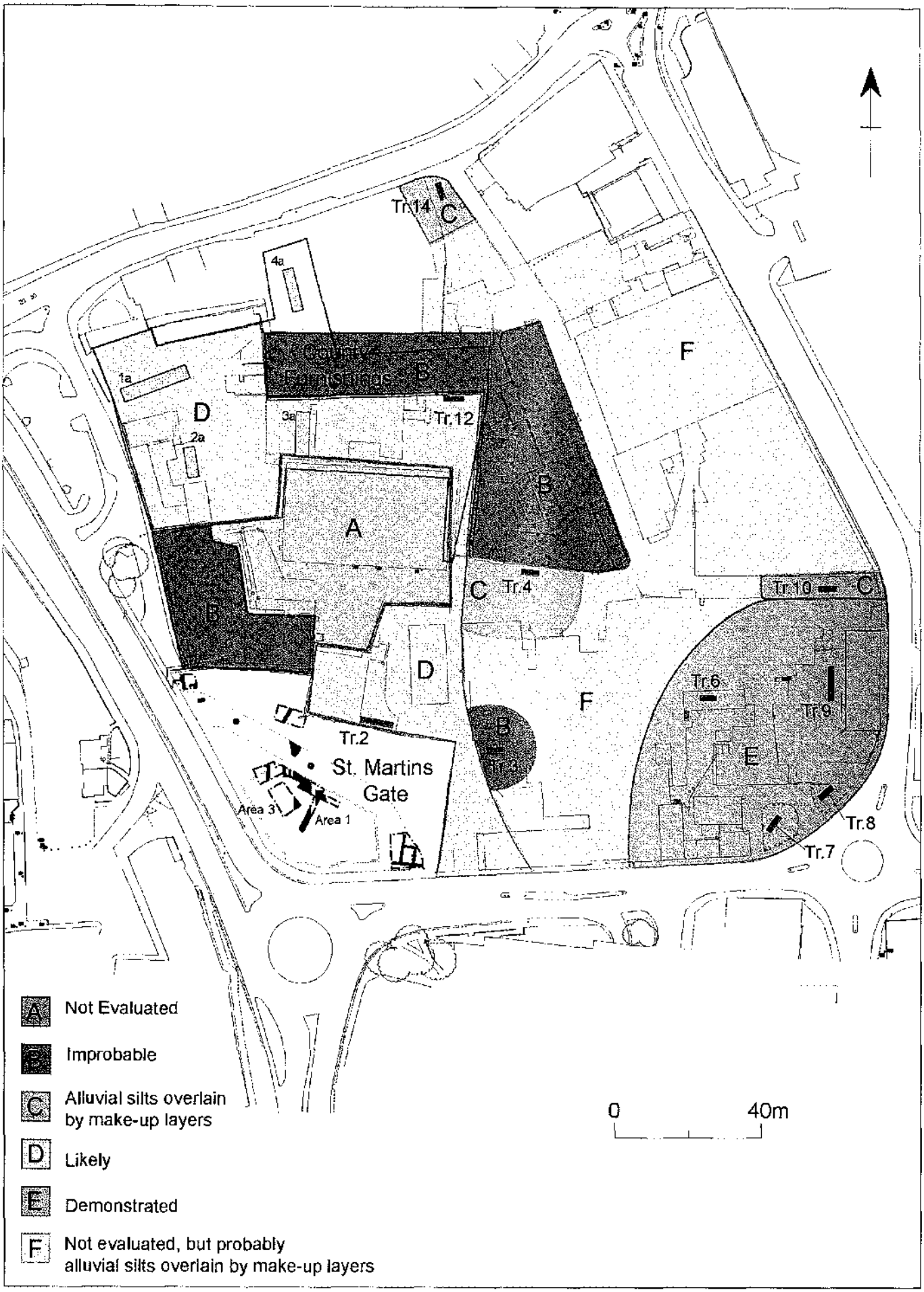

Tr.14
C
4a
County Furnishings
B
F
1a
u
D
3a
Tr.12
2a
B
A
B
C
Tr.4
Tr.10
C
D
F
Tr.6
Tr.9
B
Tr.3
E
Tr.2
St. Martins Gate
Area 3
Area 1
Tr.8
Tr.7
A Not Evaluated
B Improbable
C Alluvial silts overlain by make-up layers
D Likely
E Demonstrated
F Not evaluated, but probably alluvial silts overlain by make-up layers
0
40m

Fig.8

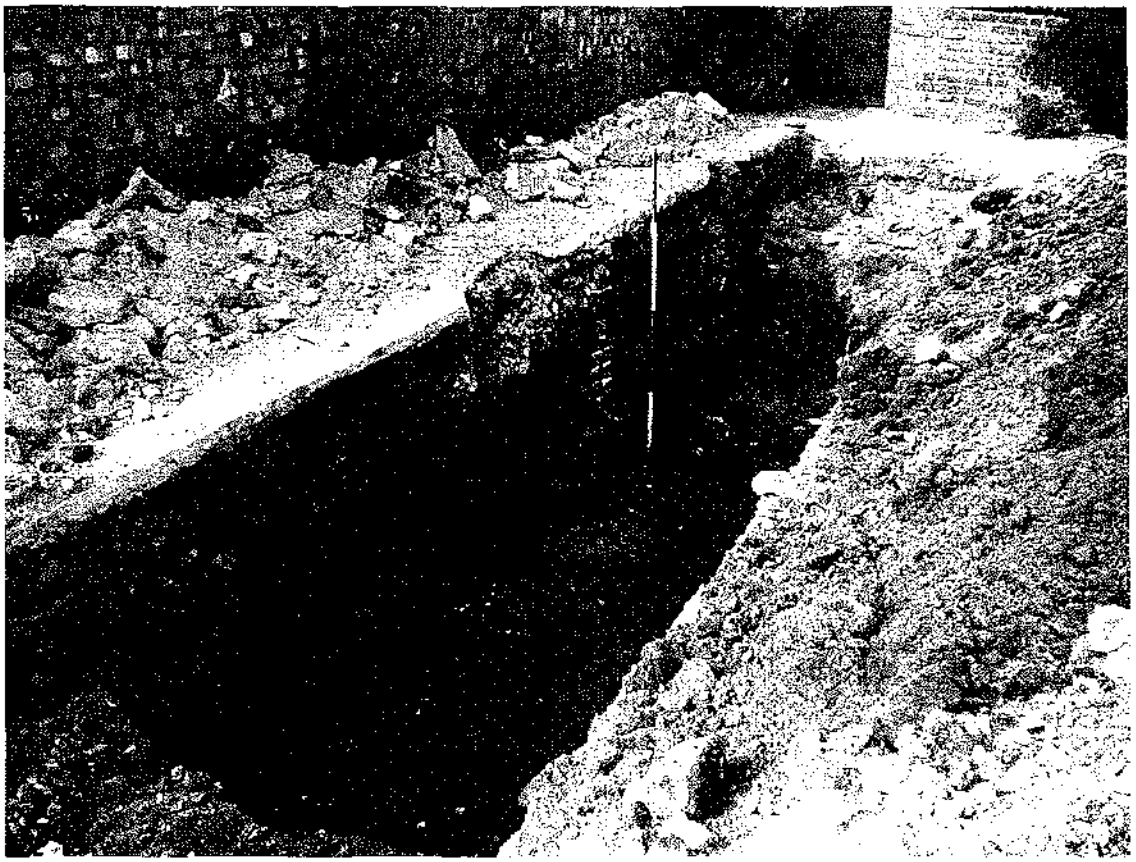


Plate 1: Trench 2, north-facing section

Plate 2: Trench 2,F201 (lcft) and F202 (right)

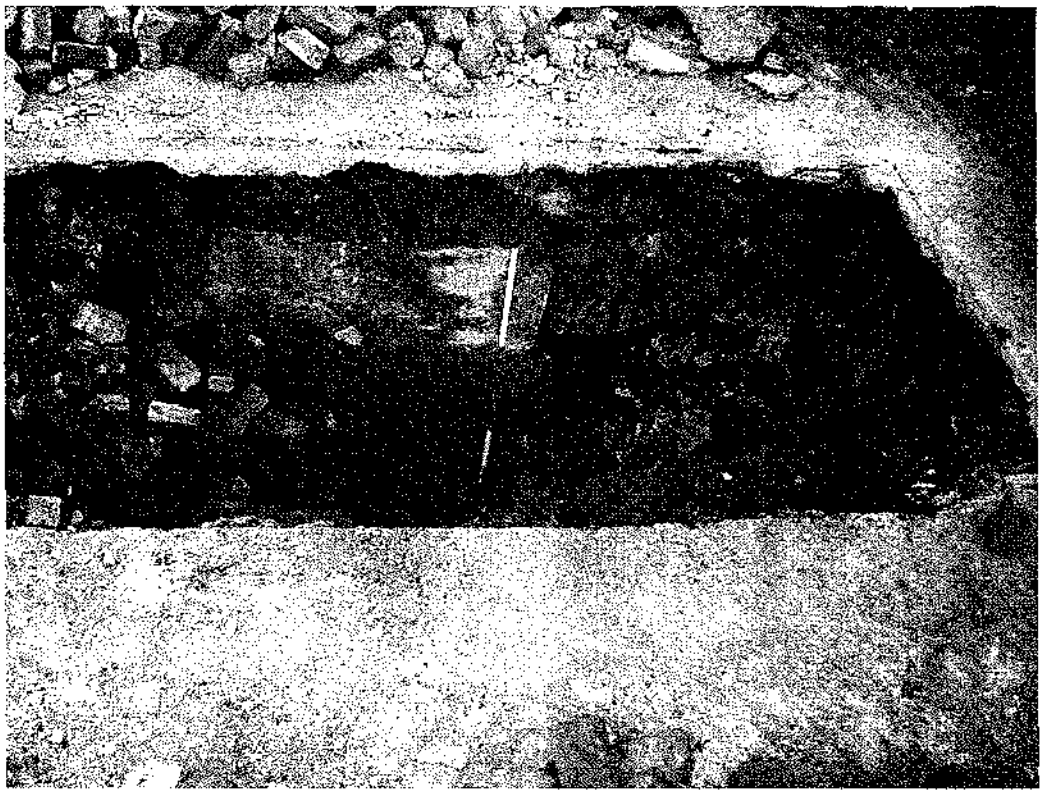


Plate 3: Trench 3, south-facing section

Plate 4: Trench 3, steel brace

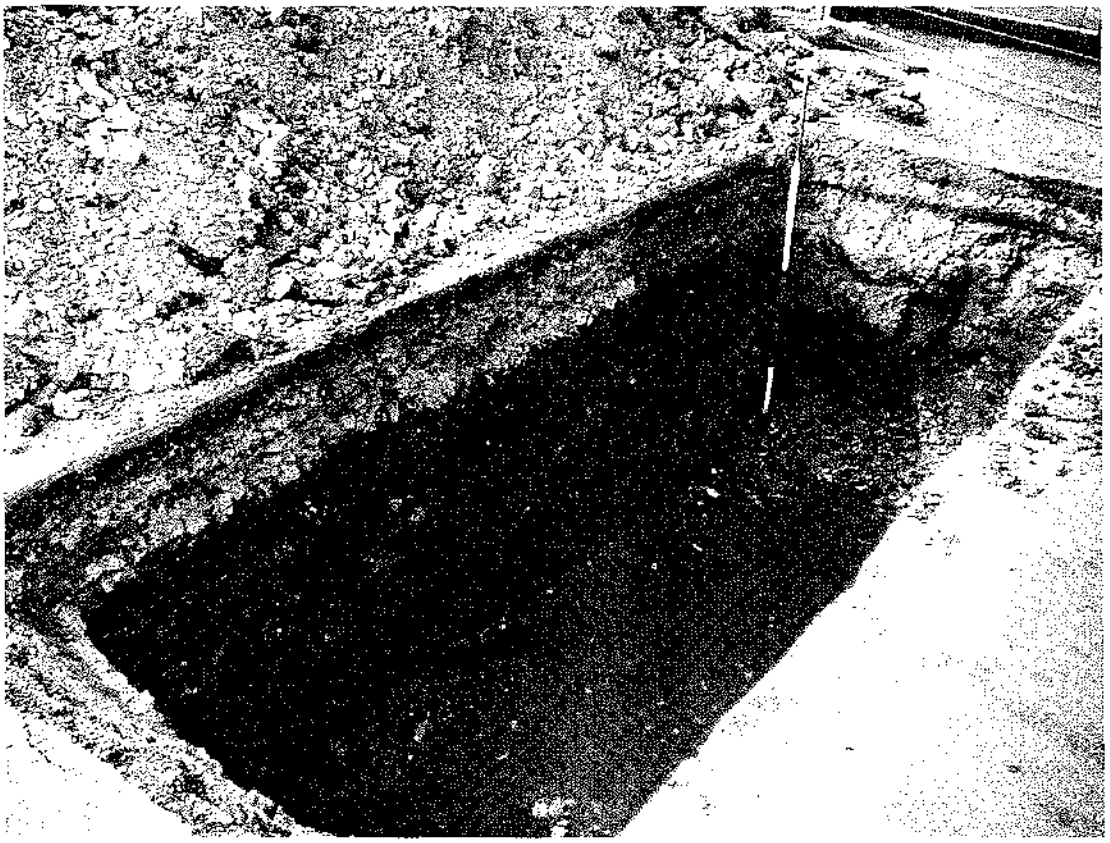


Plate 5: Trench 4, north-facing section

Plate 6: Trench 6, facing west

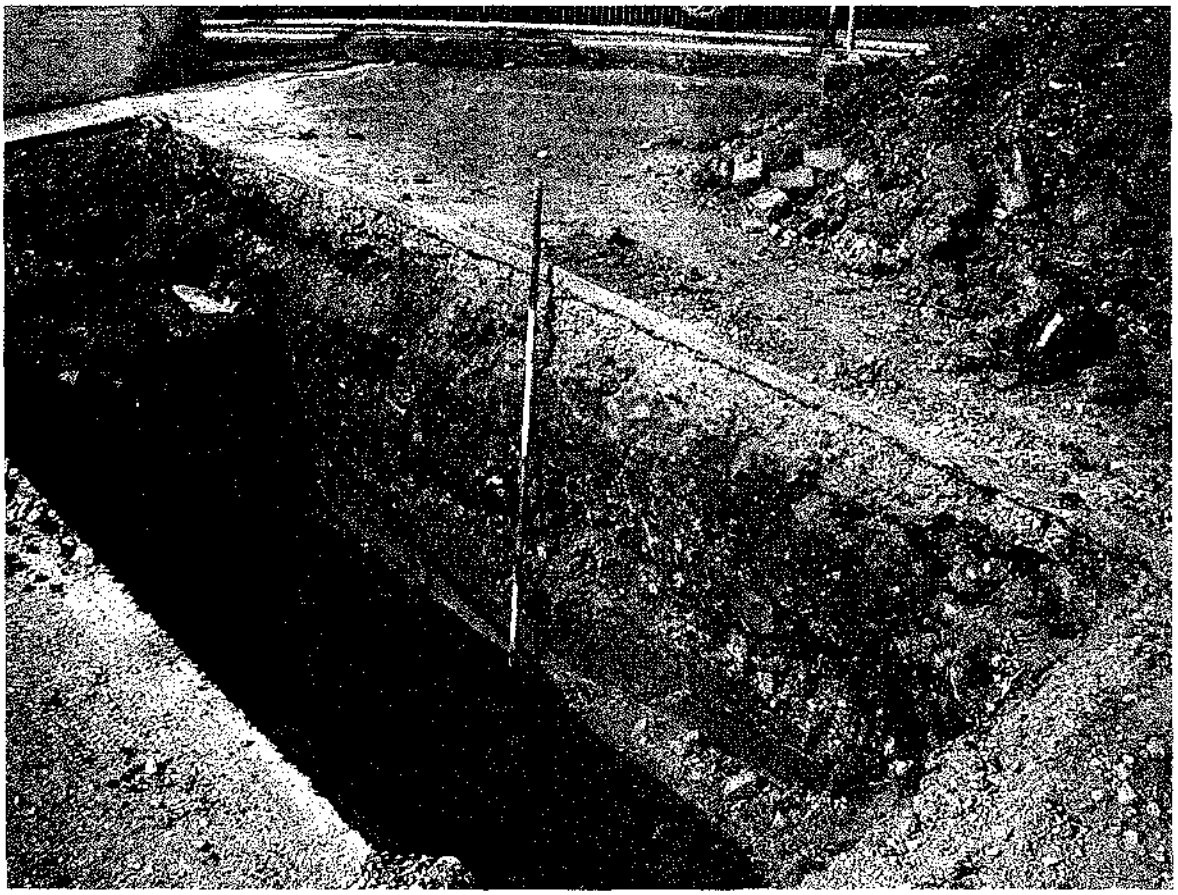


Plate 7: Trench 7, south-facing section

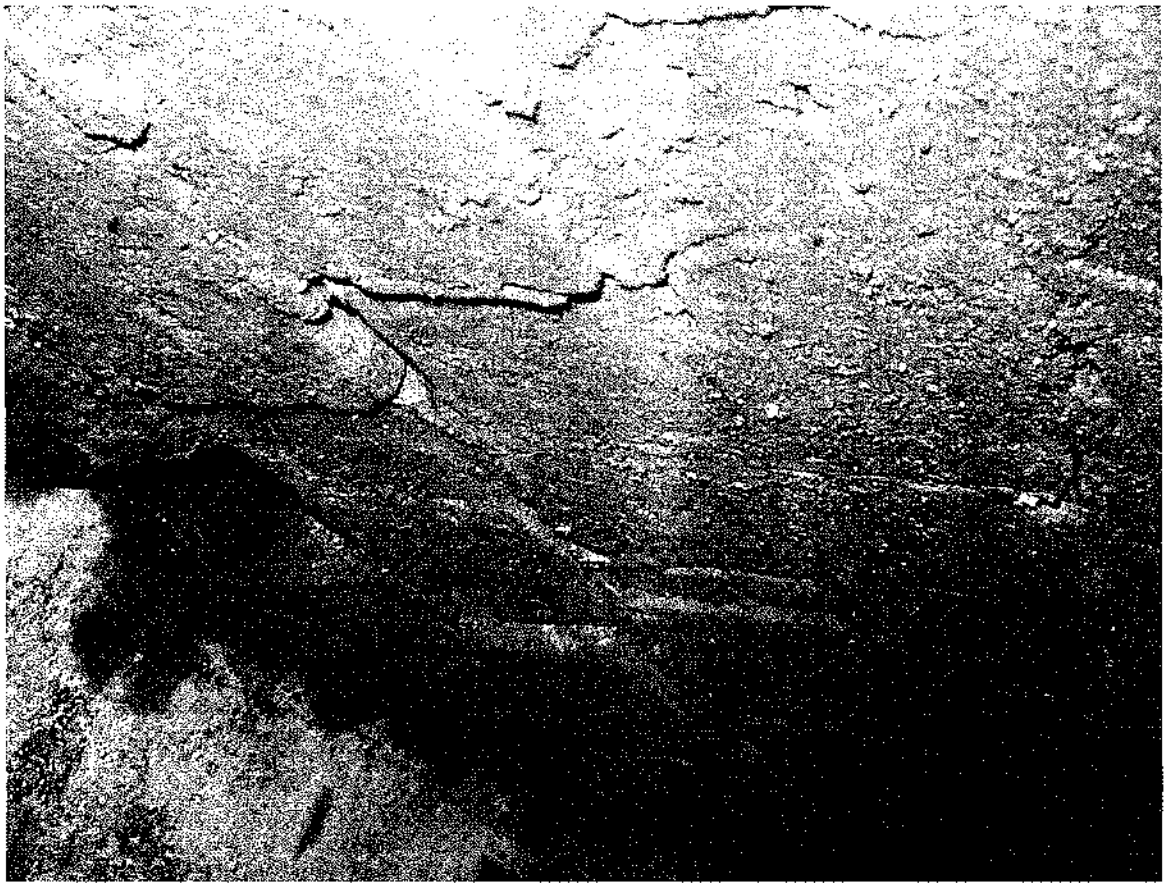


Plate 8: Trench 9, vent cut into vaulted roof (F900)

Plate 9:
Trench 9, wall (F908) over drainage channel (F909), leading to cellar (900) via square vent.

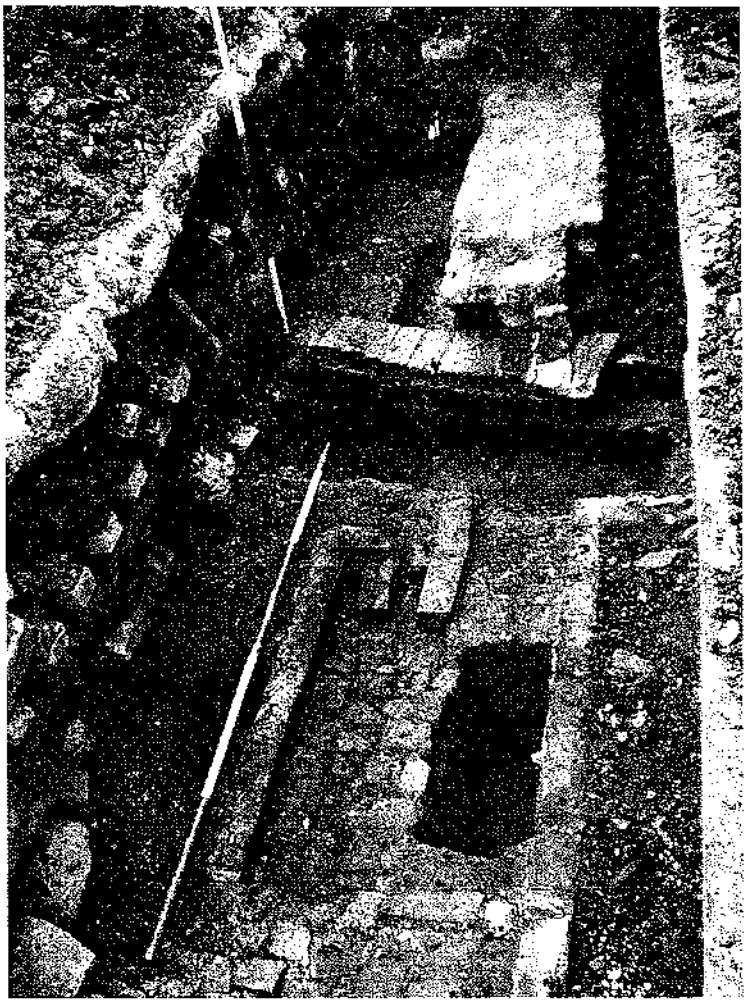


Plate 10:
Trench 9, (left) flooring layers (9016, 9021 and 9022), and (centre) brick surface (F907).

Plate 11: Trench 9, brick culvert (F902) and fill layers (9018)

Plate 12: Trench 9, wall (F904) and probable kiln remains (F905) lying over footings (9019)

Plate 13: Trench 12, north-facing section.

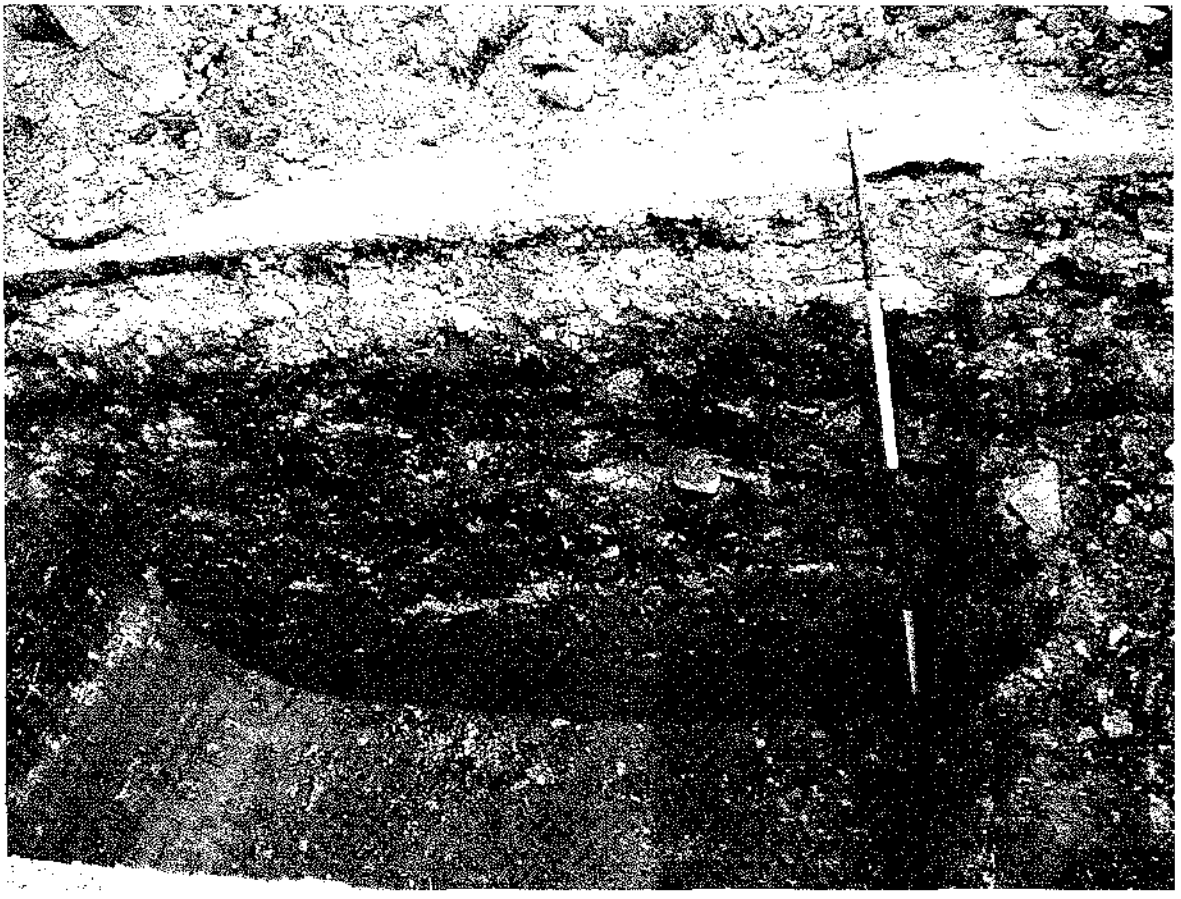


Plate 14: Trench 14, west-facing section.

Appendix 1

A Geoarchaeological evaluation of deposits from the Lowesmoor Trading Estate, Worcester

13 September 2002

Summary

Deposits, studied as disturbed auger samples, were found to represent the accumulation of clayey Holocene alluvium, much of which may be derived from the river Severn. Despite the presence of charcoal contamination within the alluvial clay the deposits sampled in these two trenches are unlikely to preserve much evidence of archaeological activity or palaeoenvironmental change.

Terra Nova Ltd

Llwynfedwen, Libanus, Brecon, LD3 8NN, Great Britain
Tel/fax 01874 636345 Mobile 0797 11 66 380
e-mail: terra@celtic.co.uk

Aims

This study aims to clarify the nature and origins of deposits examined in disturbed auger samples taken from the Lowesmoor Estate.

It addresses, in particular, questions concerning the archaeological geo-archaeological and palaeoenvironmental potential of the site.

Background and method

Worcester is underlain by the calcareous mudstones of the Eldersfield Mudstone formation within the Triassic Mercia Mudstone group. In some parts of the city this is overlain by a series of fluvial and fluvioglacial terraces of Holocene and Devensian age.

The site sits near the middle of the former valley of the Frog Brook. The geological 1:50000 map (BGS, 1993) shows alluvial deposits overlying the mudstone. The Frog Brook is thought to have developed as a Late Devensian river channel. It has been used as part of the city defences and, later, as the town ditch. The valley is known to have been prone to flooding as water from the River Severn ponded headwards during floods from pinchpoints downstream at Callow End and Cliffey Wood (Morris, 1974). This means that there is the potential for the survival of well contexted archaeological and environmental evidence in the alluvium and former ground surfaces of the Frog Brook valley, through waterlogging and accumulation.

The natural soils of nearby valleys, similar to that of the Frog Brook, are Pelo-alluvial gleys of the Compton series. These are mottled soils of moderately good drainage which are periodically waterlogged by a fluctuating ground water table (SSEW, 1986).

Observations

The site was visited on the 11 September 2002, and cores recovered, by Dutch auger, from two archaeological trenches (trenches 6 and 10). The site was photographed and auger samples taken for analysis. These were examined briefly in the laboratory to identify depositional structures and parent materials and to assess the preservation of environmental evidence. Measurements of magnetic susceptibility were made with a Bartington MS2 magnetic susceptibility meter using a type E coil. A brief introduction to magnetic susceptibility and a number of relevant publications are given below.

Trench 10

Trench 10 was excavated to 1 metre below the modern surface where a grey clay was exposed beneath layers of industrial debris. The clay was augered to a further depth of 1.25 metres, a total of 2.25 metres below the modern surface.

The clay became sandy clay by 1.65m from the surface and the proportion of sand increased further to the base of the auger hole.

Between 1.0 and 1.2m the clay was a mid grey-brown, although this was made up of a mid grey matrix separated by sharply defined red-brown mottles. These were clearly seen to form tubes which followed former fine root pores. This soil horizon became slightly more organic (darker in colour due to humified organic matter) towards the top, perhaps indicating that it includes the truncated lower part of a former soil profile. The auger samples tended to fracture along ped boundaries which were lined with a thin layer of clay.

Between 1.2 and 1.35m the clay was similar to that above but it was a mid brown-grey and contained much less mottling than the horizon above.

From 1.35 to 1.40m the clay contained a little charcoal while from 1.40 to 1.60 metres it became increasingly sandy. Microscopic examination under crossed polarised light showed that the sand was mostly quartz, with a small proportion of minerals derived from igneous material, and resembles that in the fluvioglacial deposits seen on other sites nearby (Wilson, 2000).

Below 1.60 metres the clay becomes sandy clay and is strongly coloured mid red-brown and mid yellow-grey in isolated patches. These colours are typical of the bedrock mudstones.

The deposits down to 1.6m were examined in a second auger hole so that we could determine whether the charcoal seen at 1.35 to 1.40m was representative of the deposit or the result of contamination. More charcoal was found at approximately the same depth, though less than in the first samples.

This sequence cannot be interpreted with great confidence from the disturbed samples taken from these two auger holes. Previous studies on sites nearby, however, provide many clues to the interpretation of the deposits and allow us to make a tentative interpretation.

The lowest stratum (below 1.60m) is mostly made of mudstone which, though disturbed, retains distinct patches of its original colour. This suggests that it has not moved far from its original source, although the fluvioglacial sand within it shows that it has been mixed – perhaps by periglacial frost movement. Similar parent materials have been found on a number of sites in the region, such as at Wychbold (Jordan, 2000a). The sandy clay is probably of late Devensian age and may have accumulated in the Frog Brook valley due to gradual periglacial slope movement.

The grey clay above is largely uniform and shows none of the parent material characteristics. It lacks the few fluvioglacial stones found in the lower stratum and show more evidence of sorting. It is thus more likely to be an alluvial deposit dating to the late Devensian or early Holocene. This continued to accumulate and became more clayey and less sandy as the valley was repeatedly inundated by the river Severn. Similar deposits were found on a site immediately to the east (Jordan, 2000b) where an equivalent accumulation of clay within the Frog Brook valley was ascribed to inundation from the Severn. The valley, at this time, was probably occupied by gley soils subject to periodic groundwater saturation.

The charcoal found within this deposit coincided with a significant rise in magnetic susceptibility which may indicate contamination from domestic or industrial debris. We cannot say, from these samples, whether this really represents archaeological activity – rather than contamination through an animal burrow, for example – but the presence of charcoal at the same level in both auger holes makes it less likely to be the result of contamination.

Above this level, between 1.0 and 1.35m, the presence of well sorted clay suggests that alluvial accumulation continued. The grey colours show that chemical reduction predominated, indicating long periods of waterlogging which produced anaerobic conditions. Towards the top of the sequence, however, the fine network of former root pores has been picked out by oxidation caused by the downward flow of oxygenated water from a former soil surface.

Trench 6

Trench 6 had been excavated to 1.2 metres below the modern ground surface. The base of the trench was crossed by the lower parts of former brick walls and filled with other industrial debris. A small area of debris-contaminated clay was exposed on the southern side of the trench base and this was augered to a further depth of 1.65metres, 2.85 metres from the surface.

The sequence which we recovered is similar to that from trench 10 but is much more uniform towards the surface. It lacks the fine root mottling but show more evidence for the downward mixing of contaminants from the surface which existed when the site was converted to industrial use. The lack of mottles and the surface mixing might indicate that the ground was exposed and biological activity continued here whereas the surface at trench 10 was built upon, biological activity ceased and thus the profile was fossilised when the site was first developed.

From 1.20 to 1.55 the deposit consists of a mid brown sandy clay with occasional artefacts and charcoal, which becomes rare by 1.50m. The deposit shows slight evidence of a former granular structure although this is very unclear.

Between 1.55 and 1.85m the deposit is a mid brown-grey sandy clay with a few mid brown mottles. There were slightly more artefact and charcoal fragments between 1.55 and 1.60 metres which might indicate a similar kind of contamination to that between 1.35 and 1.40m in trench 10.

Below 1.85m the deposit becomes an increasingly sandy clay with patches of red-brown and yellow-grey, very similar to the trench 10 sequence. It contains a few well-rounded stones which are probably derived from fluvioglacial deposits nearby.

The lower part of the magnetic susceptibility profile is similar to that in trench 10 but values rise considerably towards the surface. This probably indicates that domestic or industrial debris has been mixed into the soil profile. This may also explain the difference between the colours of the upper horizons of the two profiles since such mixing would have destroyed any root pore mottles and added their brown colour to that of the whole horizon.

Discussion

The presence of charcoal and other contaminants beneath uncontaminated clay in both profiles suggests that there may be more substantial, pre-industrial, archaeological deposits nearby. Our study has not, however, located significant accumulations of alluvium within which may be preserved long and well resolved palaeoenvironmental sequences. Nor does it appear that there are significant archaeological deposits below the surface on which industrial development took place close to these two auger holes. It seems likely that at most 70cm or so of alluvium accumulated during the Holocene and, since biological mixing descends to at least 50cm, any palaeoenvironmental evidence may be contaminated.

It is possible that more substantial archaeological deposits and sources of palaeoenvironmental evidence may be present within the valley of the Frog Brook. A study immediately to the east located small amounts of peat which are absent here. The form of valley, however, suggests that the Lowesmoor Estate site straddles the valley centre. From this we might infer that it is likely to contain some of the deepest Holocene sequences in the valley – and that other areas nearby might be even less promising sources of evidence.

Bibliography

Avery, B. W. (1980) *Soil classification for England and Wales.* Soil Survey Technical Monograph no. 14, Harpenden, pp.67.

Bridges, E. M. (1980) *World Soils.* Cambridge, Cambridge University Press, pp. 170.

British Geological Survey, 1993 *Worcester, England and Wales Sheet 199, , solid and drift geology. 1:50000* Keyworth, Nottingham, British Geological Survey

Fitzpatrick, E. A. (1999) *Interactive Soils* Aberdeen. CD-ROM version 1.0.

Jones, A. P, Tucker, M. E., and Hart, J. K. (1999) *The description and analysis of Quaternary stratigraphic field sections.* Quaternary Research Association, technical guide no. 7, London, pp. 293.

Jordan, D W, 2000a *Excavations at Wychbold. The Soils* Unpublished report to BUFAU

Jordan, D W, 2000b *Tallow Hill, Worcester, Evaluation Excavations, The Soils* Unpublished report to Worcestershire County Council Archaeological Service

Macphail, R. I. (1983) The micromorphology of dark earth from Gloucester, London and Norwich: an analysis of urban anthropogenic deposits from the late Roman to early Medieval periods in England. In, (eds. Bullock, P. and Murphy, C. P.) *Soil micromorphology 2: soil genesis.* Berkhamsted: A B Academic Publishers, pp. 245-252.

Morris, I., 1974 The site of Worcester: its geology and geomorphology. In (ed. Adhlam, B. H.) *Worcester and its region: field studies in the former county of Worcestershire.* Worcester Branch of the Geographical Association, Worcester: pp.25-34.

Wilson, C A, 2000 *Geoarchaeological analysis of the soils and sediments from Conder Building, Worcester* Unpublished report to Archenfield Archaeology

A note on the identification of environmental evidence.

This report is the result of a geoarchaeological study of the mineral and organic deposits and soils. In the course of examining the deposits pollen, diatoms, and other forms of environmental evidence are occasionally found and recorded. However, the samples have not been prepared specifically for the recovery of these materials and no attempt at species identification has been made. This report is not intended to be, and should not be used as, a substitute for full pollen, diatom and other environmental assessments made by suitably qualified specialists. The aim of this report is rather to comment on the nature of the deposits themselves and as contexts for the survival of archaeological and environmental information, to provide relevant information to the other specialists.

Magnetic Susceptibility Measurements

Sample Depth	Trench 6	Trench 10/1	Trench 10/2
0	25	4	6
5	17	4	4
10	16	4	4
15	17	6	4
20	6	5	5
25	9	5	5
30	6	5	4
35	7	7	12
40	6	5	7
45	7	5	5
50	5	5	5
55	4	3	4
60	7	4	5
65	6		4
70	6		4
75	3		3
80	4		4
85	4		4
90	4		3
95	4		3
100	3		4
105	5		3
110	6		3
115	5		3
120	5		
125	6		
130	5		
135	4		
140	5		
145	5		
150	4		
155	5		
160	4		
165	4		

These measurements are given as SI values of susceptibility by volume

Magnetic susceptibility (χ) is a measure of the degree to which a material will become magnetised in the presence of an external magnetic field. Burnt soil material, domestic debris and ceramics typically have high magnetic susceptibilities. Ferrous metals have susceptibilities which are even higher. The degree to which an archaeological or natural deposit is contaminated with these materials can be determined by measuring its susceptibility, either in the field, using a small, portable detector, or under more controlled conditions in the laboratory. Laboratory instruments also allow us to calculate the frequency dependence (fd) of the susceptibility. This is a measure of the percentage difference between the susceptibility of a sample to magnetic fields which are alternated at two different frequencies, 0.465 and 4.65 KHz – known as low frequency (lf) and high frequency (hf), respectively. Samples containing magnetic minerals of different types show different χ_{fd} values - although the interpretation of these differences is, as yet, a matter of debate.

The use of magnetic susceptibility measurements is discussed in Walden et al (1999)

Walden, J., Oldfield, F., and Smith, J. (1999) *Environmental magnetism: a practical guide.* Quaternary Research Association, technical guide no. 6, London, pp.243.

Glossary

Allochthonous - Deposits formed in-situ - for example peat.

Alluvium – Sediment transported and deposited by rivers.

Apedal – Soil or sediment without structure.

Argillic – Soil horizon significantly enriched in clay translocated down profile from overlying horizons.

Autochthonous - Clastic deposits that have been transported by some agency (water, wind, man etc.) from elsewhere.

Bioturbation – Mixing of the soil by the biota including earthworms.,

Birefringence – The numerical difference between the highest and lowest refractive index of a mineral.

Burial gleization – Post-burial gleying (reduction – removal of oxygen - due to waterlogging) of a sediment or soil in response to rising ground water or the development of standing water tables at textural discontinuities.

Buried soil – An old soil profile that has developed upon a former land surface and that has subsequently been buried by a depth of sediment or other deposit.

Chamber – Relatively large spherical or ovoid pore with an outlet void.

Channel – Tubular shaped void, usually produced by soil fauna or plant roots.

Channel migration – The movement over time of a river channel bed across its floodplain.

Chronosequence – Sequence of buried soils of different ages, together taken to represent the development of the local soils over time.

Clay – Particle size class <2μm in diameter. Also describes a class of silicate minerals.

Clay cutan (coating) – Thin layer of clay (and occasionally silt and fine organic matter) that has moved down profile in suspension in the soil water and been deposited upon ped faces and round channels elsewhere in the profile. This clay is known as illuvial, i.e. has been transported in the soil water.

Clay translocation – The process by which clay is mobilised in one horizon, suspended in the soil water, and carried to another horizon where it is deposited as clay coatings. The process may occur naturally during soil development, but may also be initiated/exacerbated by disturbance of the soil surface; including cultivation.

Colluvium – Accumulation of soil material at base of slope through the actions of slope wash.

Cross polarised light – Plane polarised light after transmission through the sample is passed through an analyser (a second polariser turned at 90° to the first) so that the analyser will adsorb all light transmitted through the first polariser.

Cryoturbation – Mixing of the soil / deposit by periglacial freeze-thaw processes.

Dark earth - Urban anthropogenic deposit of the late Roman to Early Medieval periods. The deposit is dark grey in colour and composed of a variety of occupation debris mixed with soil.

Diagenesis – Post-depositional processes affecting a sediment, may include short term changes such as soil formation and rapid changes in response to burial, but also includes longer term changes in response to burial that result in lithification of sediment.

Eluviation – Removal of material from a soil horizon in solution or suspension in the soil water.

Fabric – The pattern of soil constituents.

Fabric unit – A part of the soil material homogeneous at the scale of observation.

Flood couplets – Very fine laminae of alternating coarse and fine material. Each couplet consists of silt and sand fining upwards into clay; each couplet relates to a single flood event

Gley – Waterlogged soil type dominated by the effects of poor drainage and anaerobic conditions.

Gleying - Is a reduction-oxidation (redox) process that occurs in waterlogged soils and sediments. Waterlogging results in anaerobic conditions and the reduction of iron from its oxidised ferric form (Fe^{3+}) to its reduced and more mobile ferrous form (Fe^{2+}) giving the soil a grey appearance. Where reducing and oxidising conditions alternate, mottling occurs.

Gravel – Particles of rock that have a diameter of between 2mm and 10mm.

Head walling – The uphill extension of a stream or river by the erosion of the upstream side (headwall) of its spring.

Horizons – Are horizontal zones within the soil profile that possess soil (pedological) properties. The A horizon is a mineral horizon formed at or near the surface characterised by the incorporation of humified organic matter and the loss of fine and dissolved matter to the horizons beneath. The B horizon is a subsurface mineral horizon that results from the *in-situ* alteration of materials or from the inwashing of material from overlying horizons. The C horizon retains evidence of rock (or parent material) structure. Numerous sub-divisions of each exist. Including Ah – A horizon characterised by the accumulation of humus, and Bg - a B-horizon with gleyic properties resulting from waterlogging.

Humification – The process of decomposition of organic matter leading to the formation of humus.

Humus – The dark and relatively stable product of aerobic organic matter decomposition and microbial synthesis; it is chemically very complex.

Hydromorphism, redoxymorphism – Alteration of soil characteristics by long term waterlogging and water movement within the soil profile. This often shows itself as mottling and staining caused by the accumulation of iron and manganese oxihydroxides.

Hyphae – Filamentous fungal organs.

Ice wedge casts– Near vertical wedge shaped periglacial features formed by repeated opening of cracks caused by thermal contraction during winter and the infilling of these cracks with sediment.

Illuviation – Movement from one horizon and deposition in another horizon of soil materials.

Indurated - An increase in hardness and density of a material as a result of freeze-thaw processes.

Involution – Distortions resulting from the mass displacement of soil. Often periglacial in origin, they may form as a result of high porewater pressures as sediments freeze or by the liquefaction of sediments as frozen ground thaws.

Lag deposits – Coarse deposits found in the bed of a river channel.

Laminae – Layers of sediment less than 1cm thick.

Leaching – Removal of soluble base cations from the soil in the soil water, particularly affects the upper soil horizons..

Le Borgne effect – the increase in magnetic susceptibility of soil towards the surface. his is a natural effect present in many soils and apparently caused by the increasing availability of oxygen which causes susceptible ferrous oxides to form.

Levee – raised river bank caused by overbank flood sediment accumulation.

Limpid - Pure clay, without significant quantities of silt or particulate organic matter.

Lithification – Processes of physical and chemical alteration that turn a sediment into a sedimentary or metamorphic rock.

Loam – Soil which contains approximately equal proportions of sand, silt and clay.

Mafic - Rocks containing ferro-magnesian minerals (micas, pyroxenes, amphiboles and olivines), they tend to be dark in colour and relatively dense.

Magnetic susceptibility – The degree to which a substance becomes magnetised in an applied field. Measurements are usually made at 0.46kHz (low frequency), but by taking a second measurement at a higher frequency (4.6kHz) the presence of ultra-fine (<0.03μm) magnetic particles can be determined.

Massive – Fine-grained soil horizon or sediment lacking structure.

Matrix – The fine material <2mm within which coarser components are set.

Meander – river bend

Micromorphology – the microscopic examination of soil structure in a soil thin section.

Moder - Organic matter in advanced but incomplete state of decomposition.

Mor – Accumulation of acidic organic matter at soil surface.

Mull – Type of organic matter produced by humification that is intimately mixed with the mineral soil component.

Mycorrhizae – Fungal hyphae living in close symbiosis with plants, may form a net around plant roots, or live within the cells of the root.

Oblique incident light – Light from above, reflected off the surface of the mineral and passed through the objective.

Ombrogeneous peat – Peat formed above level of groundwater, initiated and maintained by rainfall. Tend to be nutrient poor as all nutrients come from rainwater (ombrotrophic) and may form raised bogs.

Outwash deposits – deposits of fluvioglacial origin which have usually been eroded from upstream till surfaces and redeposited as sand and gravel beds on valley bottoms.

Overbank deposits – fine grained deposits which have been deposited from river floodwaters which extend beyond the normal river banks.

Oxbow lake – An abandoned river meander containing standing water.

Packing voids – Irregular voids between aggregates (compound packing voids), sand grains (simple packing voids) or both (complex packing voids).

Palaeochannel – Abandoned former channel of a river.

Palaeosol – An old soil horizon, can include buried soils, exhumed soils (buried and then uncovered) or relict soils (surface soils that retain relict characteristics of their development in a previously different environment). The definition implies a time limit to differentiate them modern buried and unburied soils. Quaternary scientists and geologists usually take this as 10,000yrs, however, it is a term frequently employed in archaeology for much younger buried soils.

Parent materials – The parent material of a soil is the material little affected by the present weathering cycle from which the soil has developed. The parent materials of sediments and archaeological deposits are more complex and may include rock, soil, other sediments and anthropogenic debris.

Peat – An accumulation of surface organic matter. A soil must have a surface accumulation of organic matter in excess of 30cm deep to be classed as a peat soil.

Ped – Soil aggregates with specific shapes, including granular (non-porous), crumb (porous), blocky, prismatic, and platy, that define the soil structure.

Pedofeature - Discrete fabric units present in soil materials, recognisable from an adjacent material by a difference in concentration in one or more components.

Pedogenesis – soil development

Pedoturbation – Mixing of a soil / deposit by certain processes of soil formation.

Pelo-/Pelosol – Slowly permeable clayey soil that have formed from argillaceous sedimentary rocks and fine textured Pleistocene deposits such as chalky Boulder Clay.

Periglacial – Is a zone peripheral to glacial ice and subject to intense cold. Many of the processes operating in this environment are the result of repeated freezing and thawing.

pH – The concentration of hydrogen ions measured upon a logarithmic scale. Affects the preservation of organic and inorganic materials, and affects the nature of soil development.

Planar void – Crack, has parallel edges and tends to form in clay rich soils.

Podzol – Acid soil formed by the process of podzolisation.

Podzolisation – soil forming process characterised by the downward movement of sesquioxides to form a red-brown spodic B horizon and the formation of acid surface and eluviated Ea horizons.

Polarised light – Light with a single vibration plane as opposed to natural light in which vibration is in many planes.

Redox potential - Oxidation-reduction potential; is measured in millivolts as the potential difference in the soil solution between a working electrode and the standard hydrogen electrode. Affects the mobility of many soil minerals.

Regolith – the layer of weathered rock found above many bedrock surfaces.

Sand – A particle size class between 60 and 2000μm in diameter. Individual grains can be felt if rolled in the hand and are visible to the naked eye.

Sclerotia - Fungal fruiting bodies

Sediment – A material that has been transported and then deposited, transport may involve, water, air, man etc. The particle size distribution of the sediment reflects the energy conditions and distance of transport, and particle shape may be altered during transport.

Sesquioxide – the oxides of aluminium, iron and manganese, often found to determine many fundamental properties of soils.

Silt – A particle size class of between 60μm and 2μm. The individual particles can not be felt by hand, but can be felt if ground between the teeth. A silty soil/sediment has a smooth silky feel.

Single grain structure – Coarse-grained soil or sediment lacking structure / peds.

Slaking – the breakdown of weak soil structure, usually under raindrop impact, to form a slurry and, ultimately, a surface crust.

Soil – Sequence of 'horizons' formed in-situ at the interface between the lithosphere and the atmosphere by pedogenic (soil forming) processes that is capable of supporting plant life.

Solifluction – A slow, down slope mass movement usually in a moist periglacial environment.

Spherulite – Small spheres of calcite, between 10 and 100μm in diameter that may form in the gut of herbivorous animals that are grazed on calcareous pasture. Alternatively, they may also be formed by earthworms and slugs, calcite dissolution and recrystallisation or be inherited from shell or calcareous geologies.

Strata – Layers of sediment that form depositional units, which may be differentiated by their parent materials and/or mode of deposition.

Stress cutan – A shiny clayey coating around voids or on ped faces (slickensides) caused by pressure in fine-grained, clay rich soils and sediments. They are very similar in appearance to illuvial clay coatings.

Thalweg – The line of maximum flow in a river; is the deepest part of the channel and will usually have the coarsest bed load.

Thin section – Glass mounted, transluscent soil sample used in micromorphology. Soil samples are dried, consolidated with resin, sliced and bonded to glass slide, then ground down to thickness of 30μm.

Topogeneous peat – A peat developed in a depression etc. and influenced by groundwater.

Topography – the form of the ground surface

Toposequence – a sequence of soils which is determined by the topography of the landscape. For example an acid podzol may form on a hilltop due to good drainage and may grade through a brown earth to a gley on the valley bottom where drainage is restricted.

Topsoil – The A horizon of a soil, see horizon.

Tufa – Calcareous deposit caused by evaporation and transpiration in base-rich standing water.

Turbation – mixing.

Unconformity – a boundary between two strata which represents a hiatus in sedimentary deposition.

Vesicle – Spherical or near spherical void often found in periglacial deposits, tend to form in response to pressure.

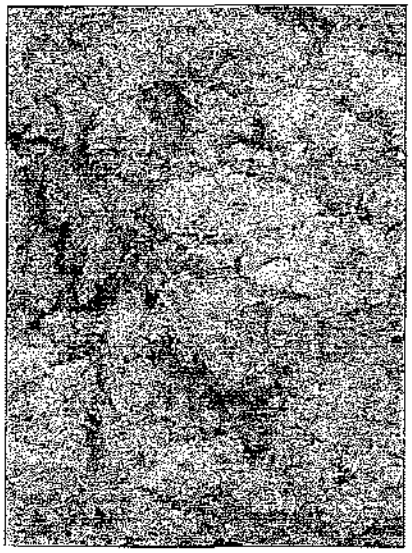
Vugh – Irregular void neither a packing void, channel, planar void, nor vesicle.

Water table – the level to which soil pores are filled with water.

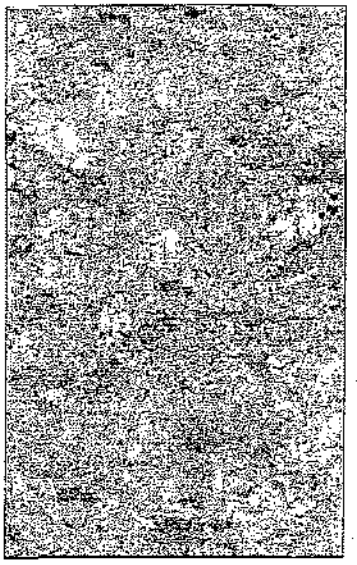
Welding - The chemical and physical mixing through the processes of soil development of a buried soil profile with a later soil profile forming at the ground surface. The buried soil takes on the characteristics of a sub-soil horizon although certain relict features of its original topsoil properties may be preserved.

Geoarchaeology requires quite specific definitions of certain terms, the glossary has been built from our own experience, but relies heavily on the writings of earlier workers; these have been adapted where necessary. The following sources have been particularly useful: Avery (1980), Bridges (1980), Fitzpatrick (1999), Jones *et al.* (1999), and Walden *et al.* (1999).

Figures

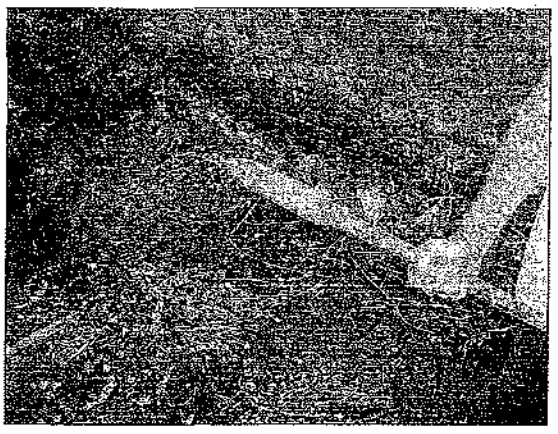


Mottles in former root pores in Trench 10



Patches of coloured mudstone parent material in trench 10

Coring in Trench 6



A sample in the auger chamber

Appendix 2

Lowesmoor Trading Estate, Worcester

Tabulated results of preliminary manual auger survey, machine excavation and Terra Nova Ltd survey

NGR's of auger samples by trench centered on each trench

Trench	NGR
2	385251 255014
4	385294 255059
6	385349 255025
7	385367 254987
9	385385 255027
10	385381 255057
12	385270 255108
14	385269 255167

Trench 2

Context	Deposit	AOD
2000	modern surface	21.33m
2004	natural subsoil (Sands and gravels)	18.73m

Trench 4

Context	Deposit	AOD
4000	Modern surface	21.23m
4006	Brown clay	19.73
4005	Light brown clay	19.43m

Trench 6 (Terra Nova Ltd)

Context	Deposit	AOD
6000	Modern surface	21.82m
6009	Mid brown sandy clay	20.62m
6010	Mid brown-grey sandy clay	20.27m
6011	Mixed red-brown and yellow-grey sandy clay	19.97m

Trench 7

Context	Deposit	AOD
7000	Modern surface	22.02m
7005	Green clay	20.12m
7006	Sand and gravel	19.52m

Trench 9

Context	Deposit	AOD
9000	Modern surface	21.88m
9013	Green-brown clay with charcoal flecking	20.62m
9019	Red sand and gravel	19.67m

Trench 10 (Terra Nova Ltd)

Context	Deposit	AOD
10000	Modern surface	21.05m
10002	Mid grey-brown clay	20.05m
10003	Mid brown-grey clay	19.85m
10004	Mid brown-grey clay and charcoal	19.70m
10005	Mid brown-grey clay and sand	19.65m
10006	Mid red-brown and mid yellow-grey sandy clay	19.45m

Trench 12

Context	Deposit	AOD
12000	Modern surface	22.05m
12005	Orange and brown clay and sand with gravel	18.95m

Trench 14

Context	Deposit	AOD
14000	Modern surface	21.09
14006	Green and brown clay	19.29m
14007	Red sand and gravel	18.79m

Appendix 3

Appendix 3
Evaluation narrative

Trench 1

This trench was not excavated due to health and safety risks posed by the presence of extensive live services and the need to preserve constant vehicle access.

Trench 2 (Figs.2 & 3, Plates 1 & 2)

Trench 2 (Plate 1) was excavated on an east-west alignment and measured 10m x 1.6m. The natural subsoil (2004) was encountered at approximately 2.6m below the modern ground surface. The natural subsoil comprised a mixed layer of orange, reddish-brown and greenish mixed clays and sands with occasional pebbles. Two features (F201 and F202) cutting the natural subsoil were recorded within a sondage (SO1) measuring 0.9m x 2.5m (Plate 2). Due to health and safety concerns, these features were recorded by observation only. F201 comprised elements of a possible pit or linear feature measuring approximately 0.9m x 1.3m. F201 was filled by a medium to dark brown earthy deposit (2008) of uncertain depth with frequent inclusions of iron slag, pebbles and charcoal flecks.

Immediately to the west of F201 was a northwest-southeast aligned linear feature (F202) measuring approximately 0.2m x 1.2m. A medium brown earthy deposit (2007) of shallow, but uncertain depth filled F202 and contained small pebbles, charcoal flecks and tile. Immediately above F201 and F202 was a medium brown clayey silted layer (2005) containing post-medieval pottery, fired clay/daub, mortar, iron slag and one sherd of medieval pottery 0.8m in depth. This was overlain by a dark brown to black clayey earth deposit (2003) 0.3m in depth containing inclusions of red brick and tile fragments, charcoal and pebbles. Surviving elements of a brick wall 1m in height (F200) lay above layer 2003. The brickwork (2006) comprised two skins of machine-cut red bricks, bonded with cemented mortar and laid in stretcher courses. An analysis of the brickwork would suggest a late 19th, or 20th century date of construction. Above F200 was a dark grey to black clayey earth deposit (2002) 0.6m in depth containing one sherd of 12th / 13th century pottery, fragments of red brick and tile, and pebbles. A layer of sandy earth (2001) containing general building debris that included brick, stone and tile overlay this. The modern ground surface (2000) comprised a layer of concrete 0.08m in depth.

Trench 3 (Figs. 2 & 4, Plates 3 & 4)

Trench 3 was excavated on an east-west alignment and measured 5m x 1.6m. Due to health and safety risks posed by the unstable nature of the overburden, and the proximity of standing buildings, this trench was not excavated to the level of the natural subsoil.

The earliest features were the remains of a brick built cellar (F300) and brick footings (F302) for a masonry structure (F301). F300 comprised the surviving elements of a brick built cellar in the form of a springer wall 3.6m in length and 1.7m in height, and

a returning end wall 0.35m in length and 1.7m in height. A small bricked-in aperture was visible in the end wall. The brickwork (3003) consisted of red machine-cut bricks, bonded with cemented mortar, laid in English garden wall bond.

F302 comprised elements of brick-built footings 2m long and 0.65m high, to receive a masonry structure (F301). The brickwork (3004) consisted of red machine-cut bricks, bonded with cemented mortar, laid in an English garden wall bond. F301 comprised elements of a large masonry structure approximately 2.7m long and 1m high. The masonry (3005) consisted of two courses of very large regularly cut blocks of stone. The stone blocks measured between 0.6 x 1.3m and 0.4 x 0.8m and were probably cut from Oolitic Limestone, sometimes called 'Bathstone'. The masonry had been pointed in places with cemented mortar. A steel support propped the central portion of the masonry.

The cavity formed by the surrounding brick and masonry features (F300, F301 and F302) had been backfilled with general demolition debris (3002) that consisted of red machine-cut bricks, Staffordshire blue engineering and bull-nosed bricks, roofing slate and fragments of cemented mortar to a depth of 2m. Immediately above this was a layer of modern concrete (3001) 0.2m in depth. A layer of asphalt up to 0.1m in depth formed the modern ground surface.

Trench 4 (Fig. 2, Plate 5)
This trench was rotated by 90° and moved to the east of its intended position in order to mitigate vehicle access problems. Due to the close proximity to standing buildings, and the unstable nature of the overburden, it was not possible to fully excavate this trench to level of the natural subsoil. Further sampling below the lowest machine level was undertaken using a hand auger.

Trench 4 was excavated on an east-west alignment and measured 5m x 1.6m. This trench was machine excavated and hand augured to a combined depth of 2.8m. Hand auguring ceased within a layer of light brown clay (4006) 1m in depth. This was overlain by a layer of clean medium brown clay (4005) 0.3m in depth. Immediately above lay a dark brown clayey silted deposit (4004) with inclusions of red brick fragments and coke 0.45m in depth. Above this was a medium brown earthy deposit of general demolition debris (4003) containing red brick and tile fragments, and mortar 0.3m in depth. Immediately above was a black and grey earthy deposit (4002) 0.3m in depth, this contained ash, coke, red brick and tile fragments, and mortar. This was sealed by a layer of hardcore (4001) 0.35m in depth. A layer of black asphalt (4000) 0.12m in depth formed the modern surface.

Trench 5

This trench was not excavated due to health and safety risks posed by the presence of extensive live services and the need to preserve constant vehicle access.

Trench 6 (Figs 2 & 3, Plate 6)

This trench was moved to the east of its intended position due its close proximity to standing buildings. Due to the close proximity to standing buildings, and the unstable nature of the overburden, it was not possible to fully excavate this trench to level of the natural subsoil. Further sampling below the lowest machine level was undertaken using a hand auger.

Trench 6 was excavated on an east-west alignment and measured 5m x 1.6m. Hand auguring recorded a layer of mixed red-brown and yellow-grey sandy clay (6011) at a depth of 1.85m. This was overlain by a deposit of mid brown-grey sandy clay (6010) 0.3m in depth. Above this was a layer of mid brown sandy clay (6009) 0.35m in depth. Immediately above this was a deposit of silted brown clay with charcoal inclusions (6006) 0.45m in depth. F600 and F601 cut a layer of silted earth, red brick and mortar fragments and coke (6005) up to 0.5m in depth. Layer 6006 was cut by a truncated linear brick wall (F601) measuring 4m in length and 0.35m in width. The brickwork (6008) comprised machine-cut red bricks bonded with limed mortar and laid in header and stretcher courses. F601 was butted by a block of brickwork (F600) measuring 0.36m x 0.25m. The brickwork (6007) comprised machine-cut red bricks bonded with limed mortar and laid in stretcher courses. Above this was deposit of ash and coke (6004) 0.1m in depth. In the western half of the trench this was sealed by a layer of dry-laid red bricks (6003) 0.07m in depth. Layer 6003 was covered by a narrow band of grey-blue clay mixed with ash (6002) 0.08m in depth. Immediately above lay a deposit of general modern demolition debris (6001) containing red brick and tile fragments, kiln furniture, post-medieval pottery, mortar, burnt material and coke 0.7m in depth. The modern ground surface (6000) was formed by a layer of perished concrete 0.05m in depth.

Trench 7 (Fig 2, Plate 7)

This trench was excavated on a northeast-southwest alignment and measured 5m x 1.6m. Due to the unstable nature of the overburden, it was not possible to fully excavate this trench to level of the natural subsoil. Further sampling below the lowest machine level was undertaken using a hand auger.

Hand auguring ceased on top of a layer of sand and gravel (7006) 2.5m below the modern ground surface. Above this was a green clay deposit (7005) 0.6m in depth. This was overlain by a layer of brown silted clay (7004) with stone inclusions and one tile fragment 0.2m in depth. Above this was a deposit of black earth mixed with ash (7003) and red brick and tile fragments 0.85m in depth. This was overlain by a layer of dry-laid red bricks surrounded by black earth and ash (7002) 0.15m in depth, but with a central lens 0.6m in depth. Above this was a layer of white hardcore (7001) 0.2m in depth. The modern ground surface comprised a layer of black asphalt (7000) 0.1m in depth.

Trench 8 (Fig 2)

This trench was excavated to a depth of 0.3m. Machine excavation halted due to the presence of live services. A deposit of topsoil (8001) was encountered to a depth of 0.3m. A turf layer formed the modern ground surface.

Trench 9 (Figs. 2 & 5, Plates 7, 8, 9, 10 & 11)

Trench 9 was excavated on a north-south alignment and measured 10m x 1.6m. The trench was situated in an area known to have formed part of the Porcelain Works. Excavation in Trench 9 revealed the remains of a complex system of brick-built industrial features relating to porcelain manufacture. The brick-built structures within this trench were all dateable to the late 19th century or early 20th century. Therefore, stratigraphic relationships within this brief time-scale are not fully discussed here.

The natural ground surface (9019) comprised a deposit of red sand and gravel, and was encountered at c2.2m from the modern ground surface. This was sealed by a layer of green-brown clay (9013) with charcoal flecking 0.95m in depth. Features within this trench truncated this layer (9013).

F900 comprised the truncated and backfilled remains of a north-south aligned vaulted cellar measuring 2m x 2.6m. The depth of the cellar could not be ascertained due to the backfill. The brickwork (9004) comprised machine-cut red bricks laid in header and stretcher courses and bonded with a cemented mortar. The interior walls had been rendered with a cemented mortar. A small square vent in the brickwork connected the cellar to a brick-built flue or channel arrangement (F909). Another small square vent was visible in the vaulted roof interior (Plate 7).

F908 overlay a brick-built curvilinear drainage arrangement (F909) connected to the vaulted cellar (F900). The brickwork (9017) comprised red and blue bricks, mixed with yellow firebricks. Some of the bricks had a glazed vitrified appearance. The bricks had been arranged to form a covered drainage channel (Plate 8) and were bonded with a perished limed mortar. The base was formed by a single course of red floor tiles. The fill of F909 comprised a deposit of mixed green, white and grey silted clay layers (9020).

F908 (Plate 8) consisted of the truncated remains of a north-south aligned brick-built wall measuring1.5m in length, 0.6m in width and 0.3m in height. The brickwork (9015) comprised machine-cut red bricks laid in stretcher courses and bonded with cemented mortar.

Immediately to the east of F900 was a brick surface with a single brick course around the edge (F907) (Plate 9). The surface measured 2.3m x 0.6m. The brickwork (9014) comprised a single layer of assorted dry-laid bricks. The bricks were mostly broken and were laid on-bed. A single course of yellow firebricks formed an edge around the surface. To the east of F907 were a series of floor surfaces only visible in the eastern section (Plate 9). The earliest floor surface (9016) comprised a single layer of irregular dry-laid blue stones up to 0.1m in depth. Immediately above was a layer of

mixed common bricks (9021) up to 0.3m in depth. This was sealed by a layer of blue engineering bricks (9022) up to 0.1m in depth.

F900 was abutted to the north by two substantial adjoined blocks of brickwork (F901) measuring 0.5 and 1m in length. The brickwork (9005) comprised two skins of red brick bonded with cemented mortar. The surviving elements of an east-west aligned wall (F903) abutted F901 to the north. The brickwork (9007) consisted of red bricks bonded with cemented mortar.

An east-west aligned brick-built culvert (F902, Plate 10) ran across the trench. The diameter of the culvert was 0.6m. The brickwork (9006) comprised a single skin of apparently dry-laid red clamped bricks. The culvert was filled by layers of ash and grey, green and white silted clays (9018). F902 had been constructed within a trench (F906) approximately1m in width and 1m in depth. F906 had been backfilled with crushed coke and ash (9018).

At the northern end of the trench were the remains of two brick-built structures (F904 and F905). F904 comprised elements of a north-south aligned brick wall surviving to a height of 1m. The brickwork (9010) consisted of three skins of red bricks bonded with a cemented mortar. F905 comprised elements of a north-south aligned brick wall, also surviving to a height of 1m. Further disturbed brickwork mixed with deposits of ash and coke was visible in the eastern section of the trench. The brickwork (9011) consisted of two skins of yellow firebricks bonded with cemented mortar.

Layer 9002 was a mixed deposit of general demolition and industrial debris including brick and tile fragments, mortar, ash and coke. Amongst this material were fragments of pottery and kiln furniture. In the northern half of the trench this layer was sealed by a former floor surface (9008). This floor surface comprised a single layer of dry-laid red and blue bricks. Below the modern ground surface was a layer of general demolition debris (9001) 0.6m in depth. The modern ground surface (9000) comprised a layer of modern concrete 0.25m in depth.

Trench 10 (Fig 2)

This trench was only partially excavated due to the presence of extensive live services. A sondage (SO3) was excavated around the services to facilitate hand augering. The earliest deposit comprised a layer of mid red-brown and mid yellow-grey sandy clay (10006) at a depth of 1.6m from the modern ground surface. This was overlain by a layer of mid brown-grey clay and sand (10005) 0.2m in depth. Above this was a deposit of mid brown-grey clay and charcoal (10004) 0.05m in depth. This was overlain by a layer of mid brown-grey clay (10003) 0.15m in depth. Above this was a deposit of mid grey-brown clay (10002) 0.2m in depth. These deposits were overlain by a dark brown earthy deposit (10001) containing 19th Century pottery and saggars 1.0m in depth. Layer 1001 had been disturbed by the laying of modern services. The modern ground surface (10000) was formed by a thin layer of compacted earth.

Trench 11

This trench was not excavated due to the need to preserve constant vehicle access to the surrounding trading units.

Trench 12 (Fig 2)

This trench was moved to the northeast of its intended position due to the resence of a static trailer. Trench 12 was excavated on an east-west alignment and measured 7m x 1.6m. Due to the unstable nature of the overburden it was not possible to machine excavate all of the trench to the level of the natural subsoil. The natural subsoil was recorded within a sondage (SO2) measuring 1.5m x 0.9m. The natural subsoil (12005) comprised a mixed layer of orange and brown clays and sands with occasional pebbles. This was overlain by a loose deposit of light to medium brown earth (12004) with Post-medieval inclusions such as red brick fragments, slate and tile 1.7m in depth. Immediately above this was a loose layer of medium brown earth and ash (12003) with inclusions of general modern demolition debris 0.2m in depth. Above this was a dark brown to black silted ash layer (12002) containing general modern demolition debris up to 0.1m in depth. The modern ground surface (12000) was formed by a levelling layer of random red bricks receiving a layer of hardcore 0.3m in depth.

Trench 13

This trench could not be excavated due to the presence of live services and the need for unrestricted access.

Trench 14 (Fig. 2)

This trench was excavated on an east-west alignment and measured 5m x 1.6m. Due to the unstable nature of the overburden, and close proximity to standing buildings, it was not possible to fully excavate this trench to level of the natural subsoil. Further sampling below the lowest machine level was undertaken using a hand auger. Hand auguring ceased when further sampling by hand auger was not physically possible.

Hand auguring ceased at 2.4m below the modern ground surface within a layer of red sand and gravel (14007) 0.1m in depth. This was overlain by a deposit of green and brown clay (14006) 0.55m in depth. Above this was a deposit of reddish brown silted clay (14005) up to 0.45m in depth. This was overlain by a layer of reddish brown sandy clay (14004) with red brick and tile inclusions up to 0.4m in depth. Immediately above this was a deposit of brown earth and ash (14003) with red brick and tile fragments 0.4m in depth. This was overlain by a levelling layer (14002) of general modern demolition debris and ash 0.3m in depth. This layer included numerous cylindrical cores of a white marble material 0.12m in height. Above this was a deposit of hardcore (14001) 0.3m in depth. The modern ground surface (14000) was formed by a layer of black asphalt 0.05m in depth.

Trench 15

This trench could not be excavated, as it was not possible to gain access to the trial-trenching area.

Trench 16

This trench could not be excavated, as it was not possible to gain access to the trial-trenching area.

Trench 17

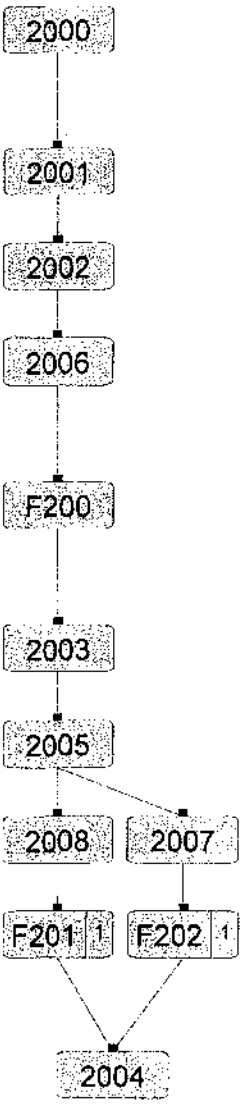
This trench could not be excavated, as it was not possible to gain access to the trial-trenching area.

Trench 18

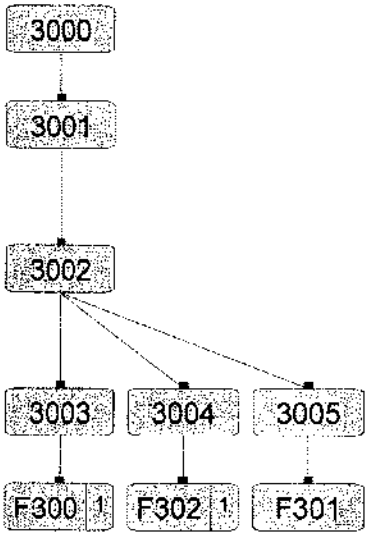
This trench could not be excavated, as it was not possible to gain access to the trial-trenching area.

Appendix 4

File trench 2

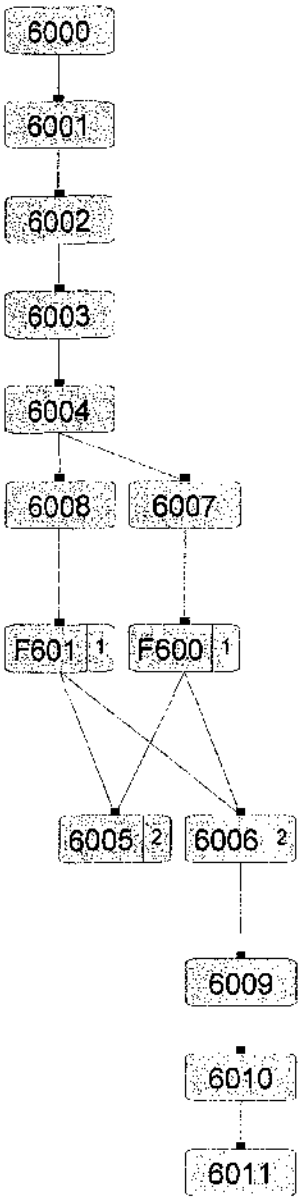


File trench 3



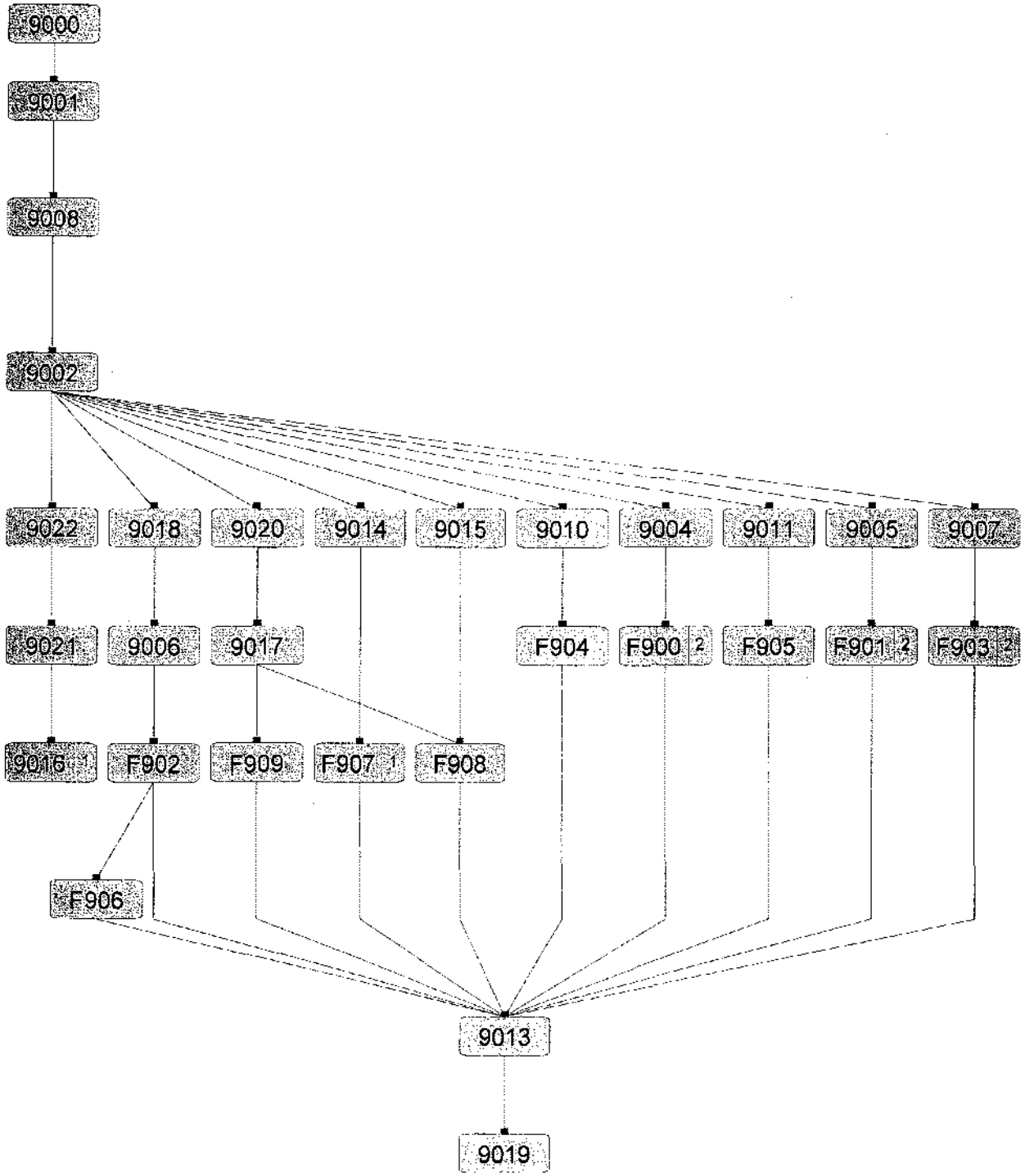
File trench 4

File trench 6

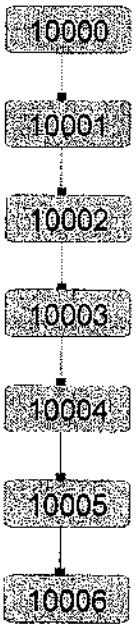


File trench 7

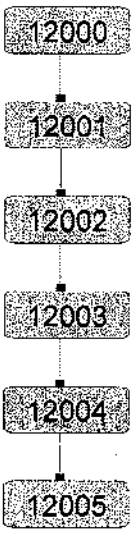
File trench 9



File trench 10



File trench 12



File trench 14