

6. THE EXCAVATED EVIDENCE: NEW STREET GASWORKS

6.1 Introduction

The archaeological works across the site of the former Gasworks aimed to fully record archaeological features surviving below the former New Street Bus Depot (Illus 2).

The excavations in the centre and south of the site revealed substantial remains of brick and sandstone walls and other structures, which relate to the 19th-century New Street Gasworks complex (Wilson 2008e; Illus 27). In addition, truncated pre-Gasworks buried garden soils (Phase 1) were also recorded. Three major phases of Gasworks activity (Phases 2–4) were identified through comparison of the archaeological evidence and cartographic records. These included substantial stone walls associated with the early Gasworks from around the time of its incorporation in 1818 to its redevelopment *c* 1845 (Phase 2). Features of the expanded mid-19th-century Gasworks (Phase 3) were also recorded although the majority of features were associated with the final period of the Gasworks' active life (Phase 4), between *c* 1875 and 1906. The results of these works permit the examination of the development of the Gasworks across almost a century, with the introduction of a wide range of technological innovations.

Subsequent works on the Caltongate North site comprised a series of archaeological watching briefs and an archaeological excavation, which identified further significant features associated with the Gasworks (Wilson 2008a; Illus 28). Archaeological monitoring also revealed further isolated pockets of post-medieval backland soil and sandstone walls.

6.2 The fieldwork of 2006–2008

6.2.1 Caltongate South site

The area covering the centre and south of the former New Street Bus Depot and earlier Gasworks was excavated between 2006 and 2008 using a mechanical digger with hand excavation of significant features. Excavation 'Areas' were generally defined along the boundary lines of distinct features such as long walls or drainage gullies. These Areas were labelled from A to P, with corresponding context numbers

(eg A0001, A0002, etc). Features including walls, floors and significant structures were subject to a full programme of archaeological recording aided by a programme of laser scanning.

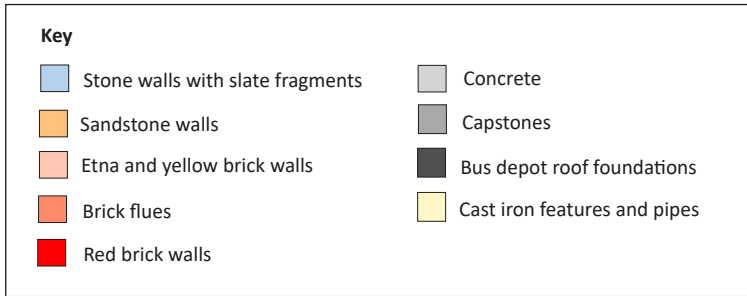
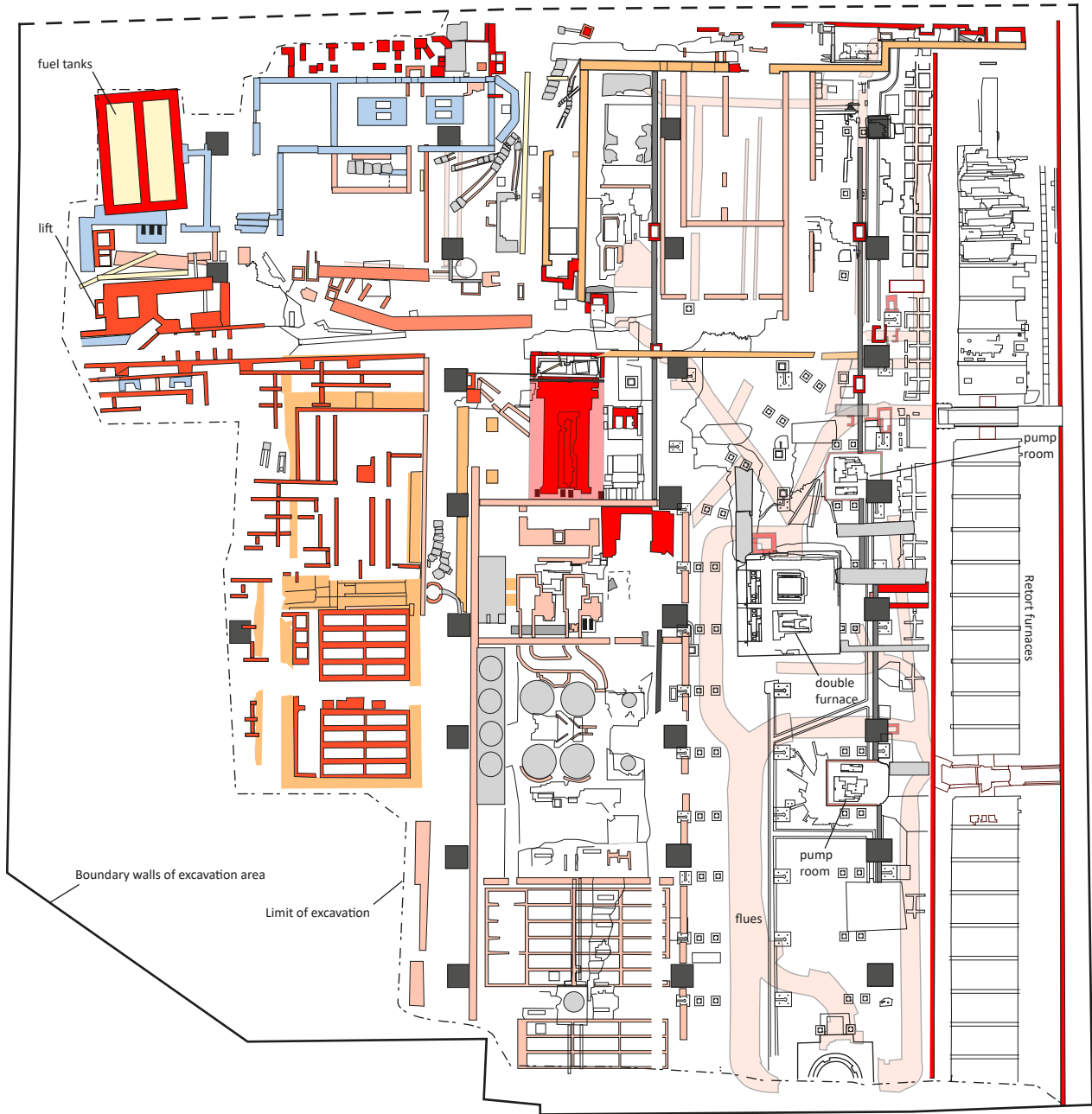
6.2.2 Caltongate North

In the area covering the north of the former Gasworks, the ground was commonly found to be contaminated, resulting in the opening of a series of test pits and monitored ground reduction works between July 2007 and May 2008 (Illus 28). This exercise identified fragments of stone walls, confirming the results of an earlier evaluation of the area (Engl & Bailey 2006). Excavation was then undertaken of any areas of in situ backland soils and associated features that would be impacted by the future development works, while all walls, floors and features associated with the New Street Gasworks were recorded.

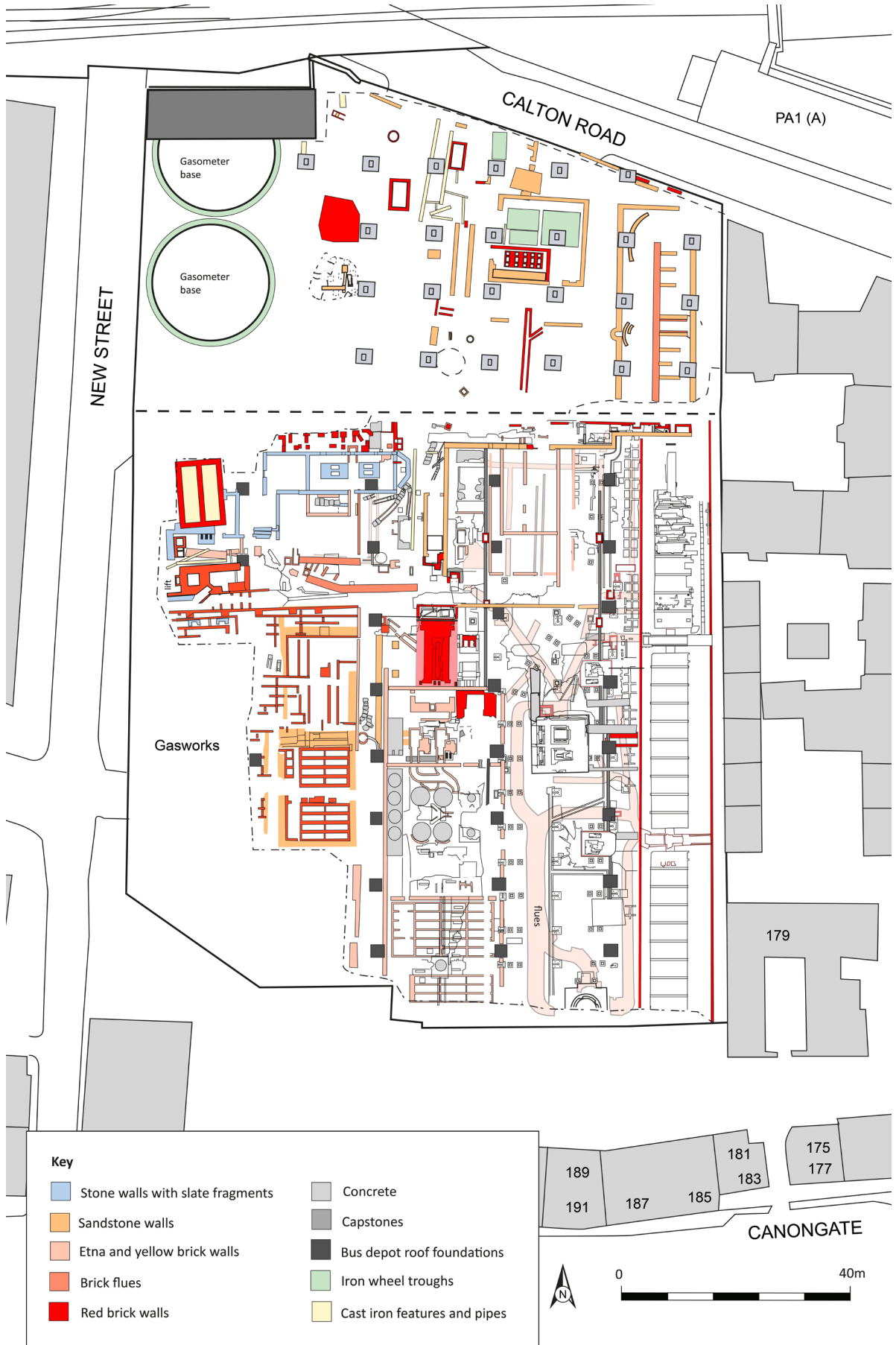
6.3 Results of the fieldwork: overview

Documentary and cartographic evidence suggest that there were six main phases (1–6) of activity in the area of the New Street Gasworks. However, due to the truncated nature of many of the excavated features and deposits, and the complexity of this largely industrial site, the assigning of many of the smaller and isolated features to a particular phase is problematic.

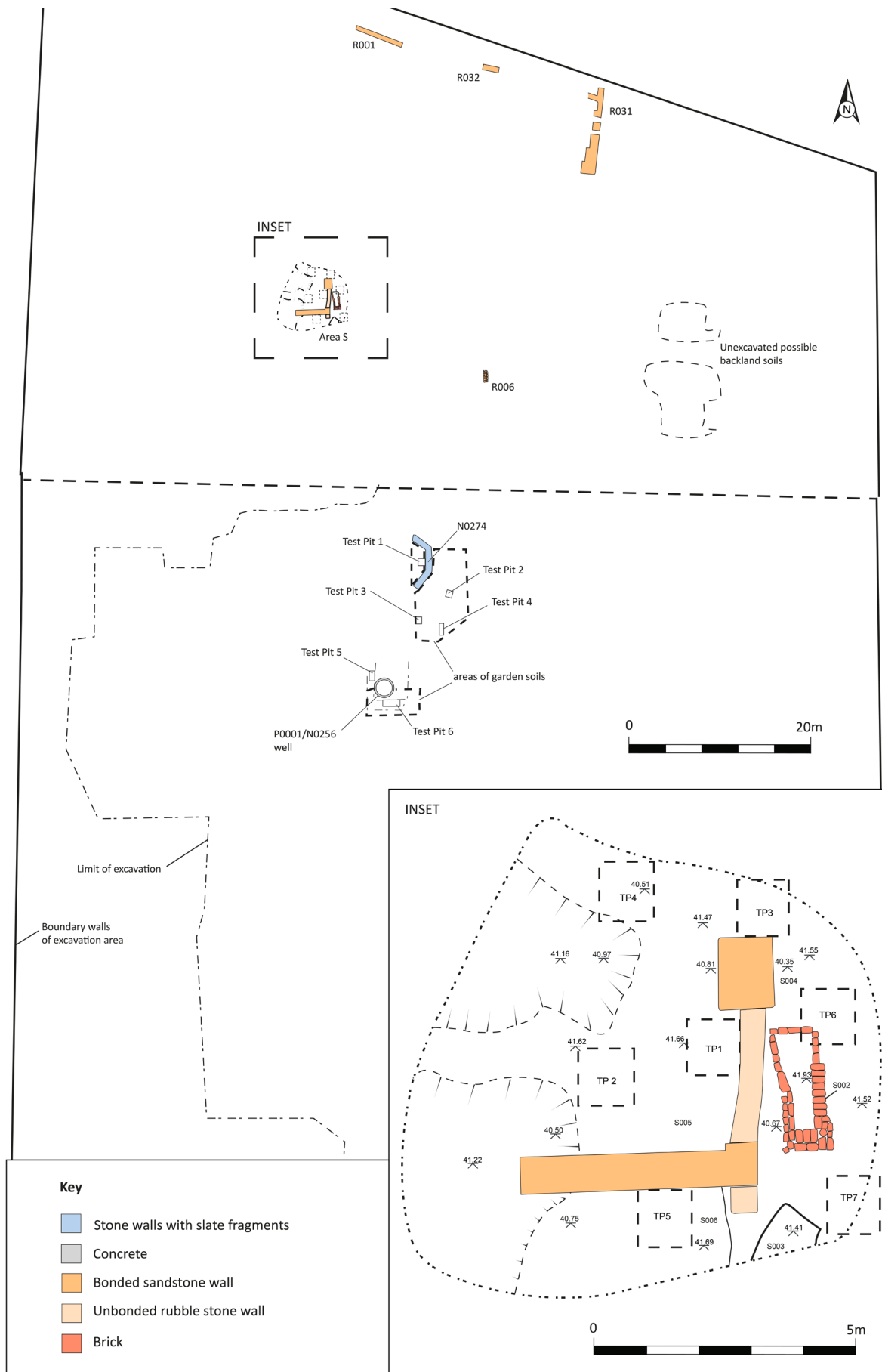
The initial phase (Phase 1) covers the period prior to the development of the New Street Gasworks in 1818. Phase 2, dating from 1818 to *c* 1845, saw the construction of the original buildings and structures of the Gasworks. Phase 3, dating from *c* 1845 to *c* 1875 was marked by the later expansion of the Gasworks, including the construction of a massive chimney and new buildings. Further expansion occurred in Phase 4, dating from *c* 1875 to 1906, including construction of a new coal shed to the east and an extension of the main Gasworks building to the south. The Gasworks closed early in the 20th century and was subsequently demolished, with part of the area used as a football pitch. This period, between 1906 and 1928, is Phase 5. The final phase (Phase 6) saw the construction of the New Street Bus Depot in 1928.



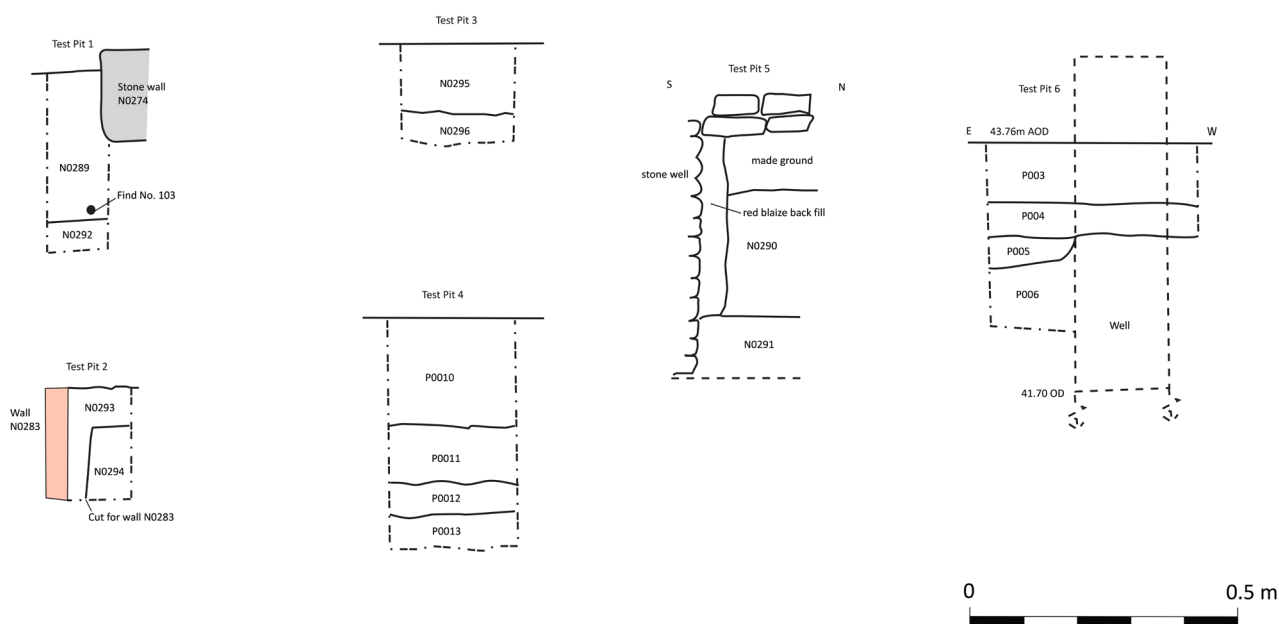
Illus 27 Plan of Caltongate South excavation



Illus 28 Plan of Gasworks excavations including Caltongate North



Illus 29 Plan of Phase 1 features



Illus 30 Sections through test pits showing Phase 1 garden soil deposits

6.4 Phase 1 (before 1818) (Illus 29 & 30)

Few features and deposits pre-dating the Gasworks survived, due to the truncation caused by its construction. This was particularly evident across the south of the former Gasworks area where this truncation had reached the natural geology. Only in small isolated pockets of the northern half of the site did any pre-Gasworks archaeology survive.

Two distinct layers of garden soil were recorded in four of the six test pits excavated in the east of the main excavation area of Caltongate North (TP1, TP2, TP3 and TP5) while three layers were visible in the other test pits (TP4 and TP6). The upper layer (N0289/N0290/N0293/N0295/P0003/P0010) was a dark brown silt, disturbed in places. Below this was a depth of between 0.10m and 0.50m of brown clayey silt (N0291/N0292/N0294/N0296/P0004/P0011) with occasional ceramic sherds. In TP4 and TP6 a layer of lighter brown clay/sand (P0005, P0012) was recorded above natural alluvial deposits. Two structures in this area were of potential Phase 1 date. A stone-lined well measuring 1.96m in diameter and 3m in depth (N0256/P0001) was cut through these deposits although its date is unclear. It could potentially be connected with attempts by the Gasworks to minimise contamination of

water flowing to the Calton Hill Brewery near the Gasworks, and therefore it may belong to a later phase (Illus 31). To the east of the well, a wall (N0274) was discovered which could also potentially pre-date the Gasworks (Illus 32). This short section of lime mortar-bonded rubble wall was cut into garden soil (N0289) and was interpreted as a possible foundation or lower element of a window bay, perhaps associated with one of the buildings known to have stood in the Canongate backlands in the post-medieval period.

Further north, one of the isolated areas of surviving backland soils, Area S, associated with the post-medieval occupation of the area was subject to intensive archaeological excavation as it would be disturbed by the development (Illus 29). Remains of structural features in this area could relate to buildings that occupied the area prior to the Gasworks.

6.4.1 Backland soils

Distinct zones of backland soils (S004)–(S006) were recorded, together with the remains of stone walls, (S001), (S007), (S008) and (S009). Finds from these deposits included fragments of pottery, clay tobacco pipe and glass. Charred cereal grain was found in low concentrations, in particular in two



Illus 31 Stone well (N0256) cut through the garden soils and alluvial deposits

test pits in this area (Test Pits 2 and 3). Animal bone (including fish bone), oyster shell and whelk, likely from domestic food refuse, were also recovered.

Deposits (S004) and (S005) were dark brown clayey silt garden soils, approximately 1m in depth. Below the backland deposits were natural alluvial deposits, generally between 40.58 and 40.97 AOD. Backland soils identified in the south of Area S, (S006), may have been redeposited. Further isolated areas of possible backland soils were present to the east (Illus 29), although these were left in situ as they would be undisturbed by the ground reduction works.

6.4.2 Structures within the post-medieval backlands

Two segments of stone wall, (S001) and (S008), (Illus 29 & 33) were cut through the backland soils in Area S. A lime mortar-bonded wall (S001) was aligned east/west (turning to the north at its east end) and survived for a length of 4.5m and to a maximum height of 1.1m. A further small section of wall (S008) was recorded 2.5m to the north, perhaps a pedestal for an arched opening. Between these two areas of wall was unbonded rubble blocking (S009). A small section of similar unbonded wall, (S007), abutted the south side of wall (S001). These



Illus 32 Remains of a stone wall (N0274) from the north

walls would have stood in the vicinity of a large building depicted on Kirkwood's map of 1817 (Illus 6) and could have formed elements of a building or boundary wall.

6.4.3 Other structural remains

Remains of several other stone structures may also represent buildings visible on historic maps of the area prior to the Gasworks. A stone wall with window bays (R001), located near Calton Road, was probably of pre-Gasworks construction. The base of wall (R001) was aligned north-west/south-east behind Calton Road. A 6m long section, up to

1.04m high, of this lime mortar-bonded rubble wall survived, with the bases of two window bays evident, 1.8m apart. Further small sections of wall base to the south-east, (R032) and (R031), could potentially have been continuations of (R001). A length of 8.7m of wall (R031) survived, aligned north/south. Although pre-Ordnance Survey maps lack detail, it appears that these walls, and the above-mentioned walls, (S001) and (S008), were not contained within the Gasworks until the expansion of *c* 1845. Buildings are depicted in the approximate location of (R001) and its related features, fronting on the North Back of the Canongate (Calton Road) on



Illus 33 View of stone walls (S001) and (S008), taken from the south-east

several 18th-century maps, most clearly on Kincaid's map of 1784 (Illus 3), where buildings also fronted the newly created New (or Young) Street. To the south, an area of cobble surface, (R006), possibly the remains of a field drain, was located 2m to the west of a stone-lined well (R002), which was likely associated with the Gasworks, though potentially also pre-dating them (see Phase 3 below).

6.5 Phase 2 (1818–c 1845) (Illus 34)

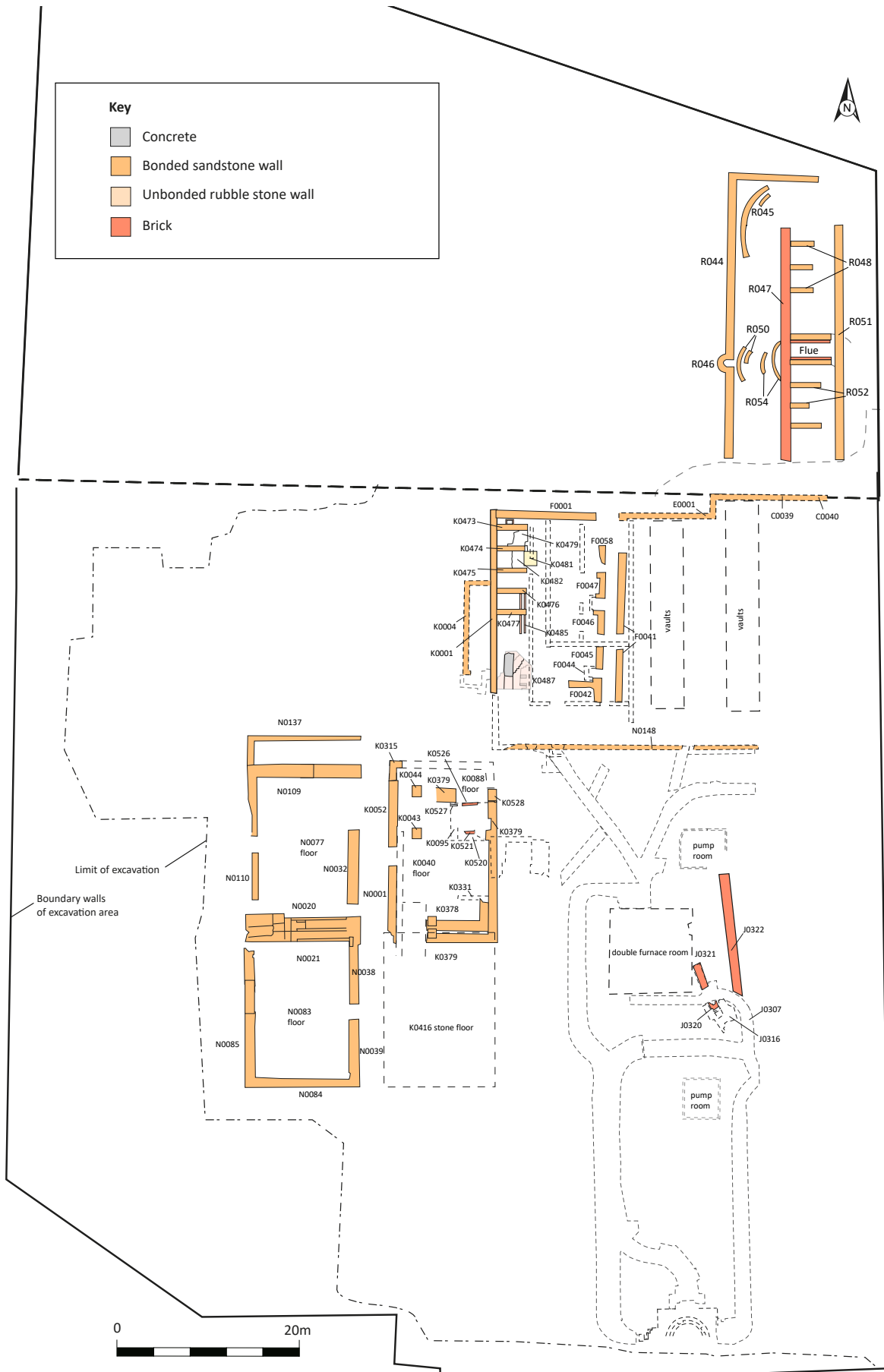
6.5.1 The parallel buildings

A series of substantial stone walls were recorded in Area K/N, together forming large stone-floored rooms, delimiting two large parallel areas, each divided into at least two main rooms (Illus 35). These parallel buildings are visible in this location on Kirkwood's map of 1821 (Illus 7) and on the Ordnance Survey map of 1852 (Illus 8); these would be occupied by 'Gas Holders', apart from the southern room of the western building, the 'Purifying House'.

To the south-west of Areas K/N, remains of lime mortar-bonded rubble walls were uncovered outlining a room, 9m in width (east/west) and 15m

long (north/south), truncated by later Gasworks construction. Wall (N0084) formed this building's southern boundary while (N0085) stood to the west, (N0039) and (N0038) to the east, and (N0021) to the north. A 1.6m wide gap separated the eastern wall segments, and a series of beam slots were visible on (N0039), which was built into the bedrock. The outer side of the wall was covered in a substantial grey clay cladding, possibly used as a sealant. These walls surrounded a substantial floor (N0083), of roughly dressed stone blocks. During Phase 4, this room was filled with a series of brick cells. The west wall, (N0085), had a maximum height of 2.77m and beam slots were visible in its south end, 2.4m above the floor, while two further beam slots were visible 1.57m above the floor to the north.

A 0.28m thick clay cladding separated wall (N0021) from parallel stone wall (N0020) to the north. This formed the southern end of the second large room of this structure, again measuring approximately 15m by 9m. In a similar fashion to the southern room, the 1.2m thick rubble walls of this room enclosed a stone floor, (N0077). The west wall, (N0110), had been truncated by later



Illus 34 Plan of Phase 2 features



Illus 35 General view of the large stone-walled room to the south-west including floor (N0083)

brick walls while the east wall, (N0032), was badly truncated by Phase 4 construction. The north wall, (N0109), however, was 2.7m high. A large recess with dressed masonry was present in the middle of this wall, 1.04m wide, 0.9m deep and 0.5m high. Another stone wall, (N0137), extending to the north from the west side of (N0109) appeared to form a northern annexe, 3m wide.

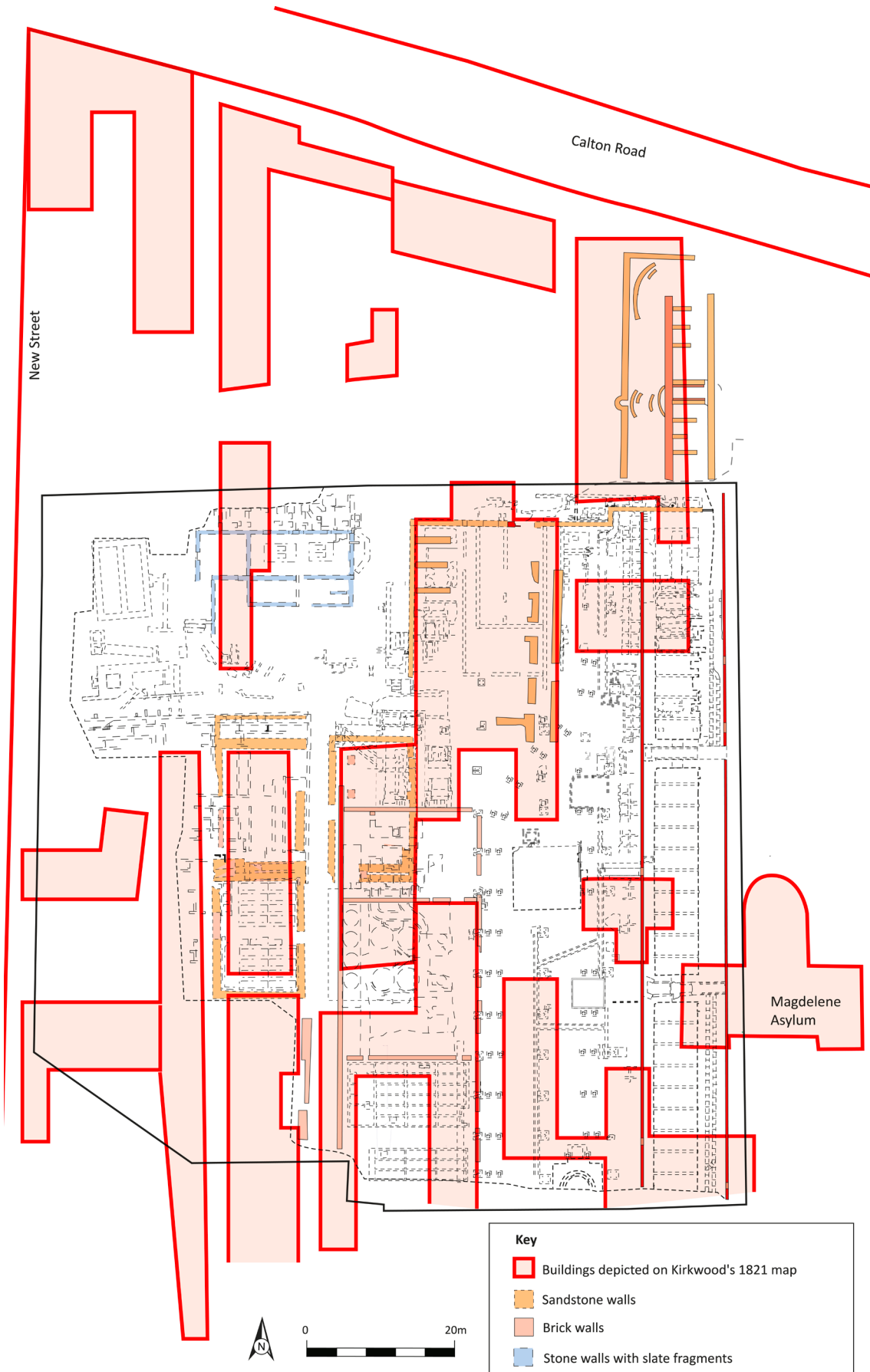
To the east of wall (N0032) was another heavily truncated stone wall, (N0001/K0052/K0055), which stood to a height of between 0.5m and 1m. This formed part of another stone-floored structure of approximately the same dimensions as the two-roomed structure to the west. Its north wall, (K0315), was largely obscured by later features. Two stone walls, (K0378) and (K0379), running parallel east/west with a clay infill between them appeared to form the south wall of the northern room of this structure, and the north wall of a second room. A stone floor, (K0416), associated with this southern room, stood approximately 1.3m higher than the stone floor to the north (K0040). At least three stone partition walls ran east/west in the north room of the structure, (K0331, K0520 and K0526) and

both (K0520) and (K0526) incorporated remains of clay-bonded brick flues, (K0521) and (K0527), aligned east/west.

These walls appear to correspond with two large parallel rectangular buildings first depicted on Kirkwood's map of 1821 (Illus 7 & 36), which continued in use within the expanded Gasworks of the mid-19th century (Phase 3), with the eastern building depicted as being used for 'Gas Holders' on the 1852 Ordnance Survey map (Illus 8), while the western building was divided, corresponding with the results of the excavation. The Ordnance Survey describes the northern half as the 'Purifying House' and the southern half as 'Gas Holders'. By Phase 4, only the western building was still depicted on Ordnance Survey mapping (Illus 20). This is substantiated by the greater truncation of the (overbuilt) eastern building.

6.5.2 The major Gasworks building

Elements of another major Gasworks building depicted on Kirkwood's 1821 map were also present in the east of the Gasworks site, to the north-east of the two parallel buildings, though clearly heavily



Illus 36 Phase 2 features overlain with features on Kirkwood's 1821 map

altered between Phase 2 and 3. By 1852, it would form part of the major building housing the 'Fire Department, Retorts, &c.' (Illus 8). The outline of this building was apparently defined by wall (F0001/E0001/C0039) to the north, likely largely of Phase 3 construction, west wall (K0001) and potentially south wall (N0148), the latter again likely a later structure. Wall (F0041) may have formed the original east wall of this building while minor wall remnant C0040 appeared to be the earliest element of the north wall.

The upstanding remains of the main west wall (K0001) were probably part of the earliest Gasworks, although truncated during later phases. It stood to a maximum height of 2.85m and was at least 19m long, comprising a sandstone wall bonded with lime mortar. The north end of the wall was keyed into north wall (F0001). The wall possibly joined east/west-aligned stone wall (N0148) at its south end.

Within the building, five stone partition walls, (K0473)–(K0477), ran off the east (interior) side of west wall (K0001); each was approximately 3.4m long and 0.6m wide, and they were set 1.6m

apart, forming four separate compartments open at the east end. Cobbled surfaces (K0479) and (K0482) were present in two compartments, the latter incorporating a cast iron cover (K0481). A stone-lined drain, (K0485), ran north/south along the east edge of the southernmost compartment and continued under and beyond wall (K0477). The function of the compartments is unknown but they were probably associated with the earliest phase of the Gasworks, and could perhaps represent storage compartments or housings for retorts. These walls appeared to be in alignment with further truncated stone walls recorded to the east (F0042), (F0045), (F0047) and (F0058). Potentially wall (F0041), to the east, could have formed an outer wall of the original Gasworks building. It comprised the truncated remains of a rubble wall, 15m long and 0.86m wide.

The east end of north wall (F0001)/(E0001)/(C0039) stood to a maximum height of 1.8m and incorporated reused stone. A section of an earlier stone wall (C0040) was recorded below the eastern end of the main wall, running for 2.8m



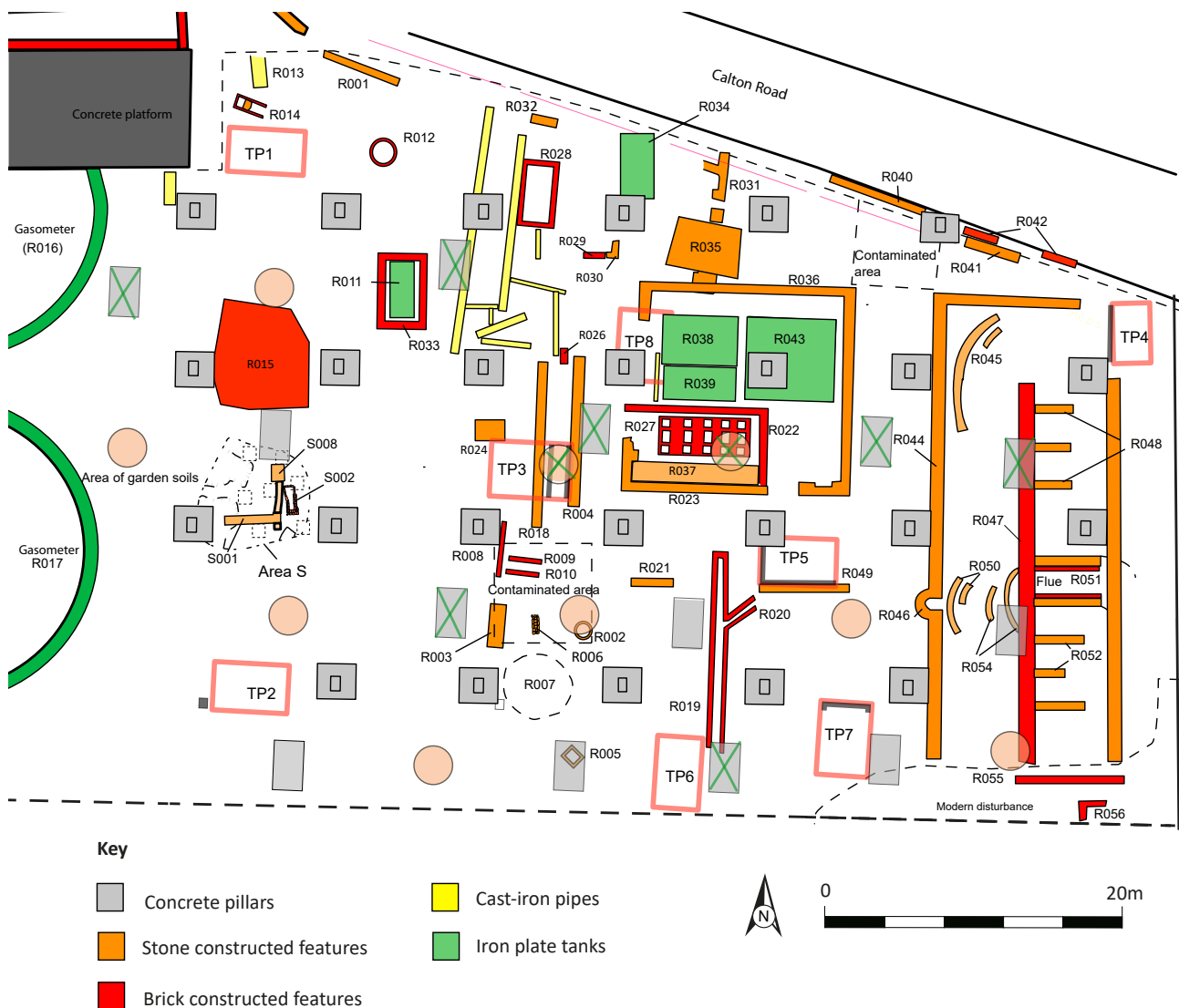
Illus 37 Flue (J0322) aligned north/south, from the east

along its base, perhaps the actual remains of the original Phase 2 north wall. This suggests that the earliest Gasworks wall had been demolished and reconstructed in Phase 3.

Only the western wall, (K0001), and sections of the eastern wall (F0041) clearly corresponded with the original major Gasworks building depicted on Kirkwood's map of 1821 (Illus 7), with the north wall of this building having seen major alterations as part of the Phase 3 redevelopment. The remains of the original southern wall of this early building were not securely identified and had clearly been truncated by later activity. Likewise, the majority of the original internal features had been lost to later disturbance.

6.5.3 Early flues

Only three of the many sections of flue identified in Caltongate South could be associated with Phase 2. Early flue (J0320) had been truncated by later features and only a length of 1.5m remained. It was on the same alignment as flue (J0321) to the north and probably formed part of the same system. They were constructed of red firebricks, one course thick, bonded with pink clay. Flue (J0321) was linked to later flues (J0307) and (J0189). Another likely Phase 2 flue, (J0322) (Illus 37), was aligned north/south to the east of J0321. This was constructed of a single course of large yellow firebricks.



Illus 38 Plan of Caltongate North showing all the features recorded

6.5.4 Gas Holders building

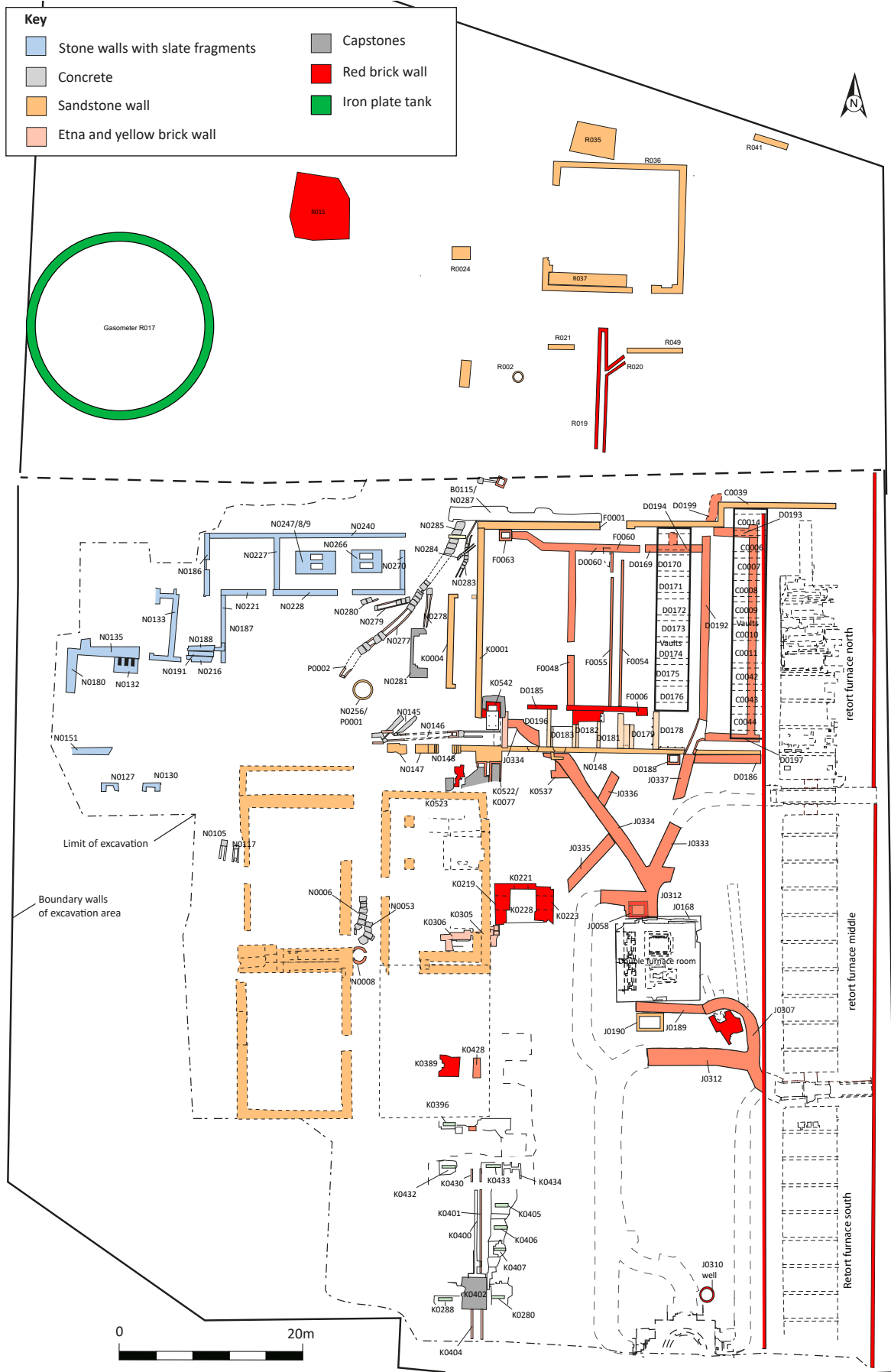
Remains in the east of the northern excavated area form elements of a structure depicted as housing ‘Gas Holders’ on the Ordnance Survey map of 1852 (Illus 8). This likely had its origins as part of the original Gasworks, as Kirkwood’s map of 1821 depicts a building in this area (Illus 7). The stone walls (R044) of this building were of solid stone construction, similar to other early Gasworks buildings recorded to the south, and it is likely that this building saw use in both Phases 2 and 3, though

it had gone by the Ordnance Survey plan of 1877 (Illus 20). Excavated features within the building included curved stone walls, perhaps to hold ‘gas holders’.

Cement-bonded rubble stone wall (R044) (Illus 38) formed three sides of a large rectangular building, aligned north/south. The remains of this wall stood to a maximum height of 3m and defined an area at least 30m north/south by 10.4m west/east. The south wall had been lost to later truncation. Towards the south of the western wall, a rounded stone buttress, (R046), projected 1.5m to the west



Illus 39 Detail of stone buttress (R046), taken from the south



Illus 40 Plan of Phase 3 features

(Illus 39), a feature clearly identifiable on the 1852 Ordnance Survey map (Illus 8) as the central of three buttresses of the 'Gas Holders' Building.

East of wall (R044) a series of curved stone wall sections, (R045), (R050) and (R054), were recorded. Curvilinear stone wall (R045) in the north-west corner of the 'Gas Holders' building stood to a height of 1.5m. A smaller section of curved wall was recorded just behind it. To the south, two further sections of curved stone wall, (R050), were recorded immediately east of buttress (R046). The outer wall of (R050) was 0.62m wide and the inner 0.70m wide with a 0.65m gap between. A third area of parallel curved walls, (R054), was recorded to the east of (R050). The inner of these curved walls stood 1m to the east of the outer, and it abutted a brick flue base, (R047). These walls were interpreted as remains of the structures that supported the earliest gasholders on the site.

The red brick flue base, (R047), which ran 24m north/south through the 'Gas Holders' building, was heavily truncated. It was 1.2m wide, stood to a maximum height of 1m, and was bonded with sandy clay. A smaller red brick flue, (R051), ran to the east from this main flue. The brick side walls of this flue were supported by stone outer walls, 0.7m wide. The internal width of the flue was 0.57m and it ran east for 3.5m before turning to the south, perhaps continuing through the building wall to the east. Two sets of east/west-aligned lime mortar-bonded stone walls, (R048) and (R052), also ran east from the main flue. Three wall segments to the north, (R048), stood 1.7m apart, while three walls located to the south, (R052), were only 1.4m apart. It is uncertain whether the flues and associated features were part of the original Gasworks, or if they were introduced as part of the expansion *c* 1845.

6.6 Phase 3 (c 1845–c 1875) (Illus 40)

6.6.1 The major Gasworks building (Fire Department and Retorts)

Large parts of the workings of the redeveloped Gasworks from the mid-1840s onwards, including the retorts, chimneys and complexes of flues, were housed in an expanded building in the east of the excavated area, described on the Ordnance Survey map of 1852 (Illus 8) as 'Fire Department, Retorts, &c.'.

The truncated remains of a stone structure, (B0115/N0287), which appeared to continue below stone wall (F0001), formed the possible foundation for the Phase 3 north wall of the rebuilt major building of the expanded Gasworks. In Phase 3 this building was bounded by wall (F0001/E0001/C0039) to the north, and (K0001) to the west. Stone foundation (B0115/N0287) was at least 15m long and projected to the north from the wall by approximately 1.5m. These formed northern elements of the major building marked on the 1852 Ordnance Survey map (Illus 8) as 'Fire Department, Retorts &c.'.

To the south was another stone wall, (N0147)/ (N0148), aligned east/west, which stretched for a significant length (Illus 41). At the west end, wall (N0147), 5.5m in length, was constructed of large stone blocks and was roughly faced on its north elevation. After a 1m wide gap, the wall continued as (N0148). A section of this wall partially enclosed two brick flue vents, (K0522) and (K0077), before the wall continued to the east. Close to the east end of the wall, a brick vent, (D0188), abutted the south face while a brick flue, (J0337), ran through the wall. At this point the wall incorporated squared stones of an earlier opening and potentially, sections of this wall may belong to Phase 2.

6.6.2 Vaults

Within this major building of the Gasworks, excavation revealed three banks of vaults, potentially for housing retorts, which belonged to the expanded Phase 3 Gasworks complex. These vaults extended 21m to the south where they were bounded by an east/west-aligned stone wall (N0148). Two north/south-aligned groups of vaults (Illus 42) were not keyed into the main walls of the building that enclosed them whereas the east/west-aligned vaults to the south were keyed into the south wall. These southern vaults were also constructed differently, suggesting that may have been part of a different sub-phase of construction. However, the southern end of the western bank of north/south-aligned vaults were keyed into the southern bank of vaults, suggesting they were constructed together. In any case, all were part of the expanded Phase 3 Gasworks, with the eastern bank being reused in Phase 4.



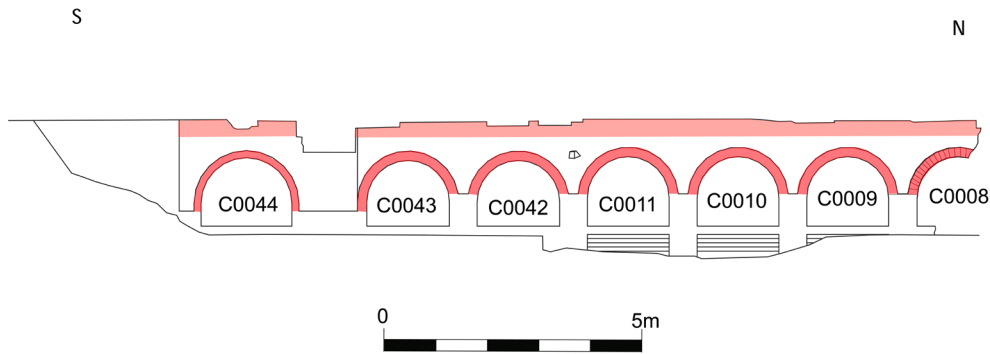
Illus 41 General view of the east end of stone wall (N0148) from the south

The bank of ten vaults to the east, (C0006)–(C0011), (C0014), (C0042), (C0043) and (C0044), with the exception of those towards the south (C0043) and (C0044) (both likely modified in Phase 4), were all 1.97m high, 1.74m wide and 2.7m deep. The brick arches were supported on stone-built pillars and the lower sections of the stone walls of the vaults were covered in a brittle burnt residue that was also recorded on the front face of the northern vaults.

The second bank of nine vaults, (D0169)–(D0176) and (D0178), stood 4.7m to the west of the first bank; all measured 1.69m high, 1.74m wide and 3.7m deep. The construction was the same as those to the east, with stone pillars supporting a brick arch. A narrow rubble-filled gap lay between the vaults and east/west-aligned stone wall (C0039)/ (E0001). The vaults were open on both the east and west elevations, as the bank of vaults to the

east would have originally been. In addition to two large beam slots above the east face of each arch, between (D0173) and (D0174) was a large square stone-lined recess (D0177).

A section of wall beyond (D0176) formed the interior, west-facing elevation of the first of a series of five further vaults: (D0179), (D0181)–(D0183) and (D0196), located along the north side of stone wall (N0148). As the west-facing wall beyond Vault (D0176) continued to the south to form the internal wall of vault (B0179), the vaults were probably part of the same construction phase. While vault (D0179) was constructed of large unfrogged bricks on a stone base, vaults (D0181)–(D0183) and (D0196) included stone vaulting instead of brick. The south walls of these vaults also formed the north elevation of the main east/west-aligned stone wall (N0148).



Illus 42 East-facing elevation of stone and brick vaults

6.6.3 Flues connected with the vaults and major Gasworks building

A complex of flues crossed the site, running in all directions, many being blocked or otherwise altered, making the phasing of these features difficult, although some of the larger flues were obviously associated with Phase 4, such as (J0306), (J0312) and (J0313), which emerged from the southern chimney (J0240) (Illus 43).

Flues that were thought to be associated with Phase 3 included (J0337) and (J0334), and were constructed of firebrick. Between the two main banks of vaults mentioned above, the floor had been badly truncated, although small areas of stone cobbles were recorded. Below the cobbles and vaults was a series of brick flues, mainly aligned north/south. Flue (J0337) ran through stone wall (N0148) before continuing north as (D0192). The flue was constructed of a single course of heat-affected bricks bonded with pink clay, standing 1.15m high and 0.07m wide. Approximately 1m from the south end of flue (D0192) a connecting flue turned off to the east, (D0197). A further 20m to the north a second connection, (D0194), turned to the west (Illus 44), while a third flue, (D0193), turned to the east near stone wall (C0039). Flue (D0194), labelled (F0060) to the west, continued west for 17m, running below the western bank of vaults, ending at a vertical vent, (F0063), bounded by stone walls (K0001) and (F0001). Further vents were recorded on various of the flues. Another flue, (F0048), turned to the south, running below Vault (D0183) and possibly joining flue (J0334) to the south of stone wall

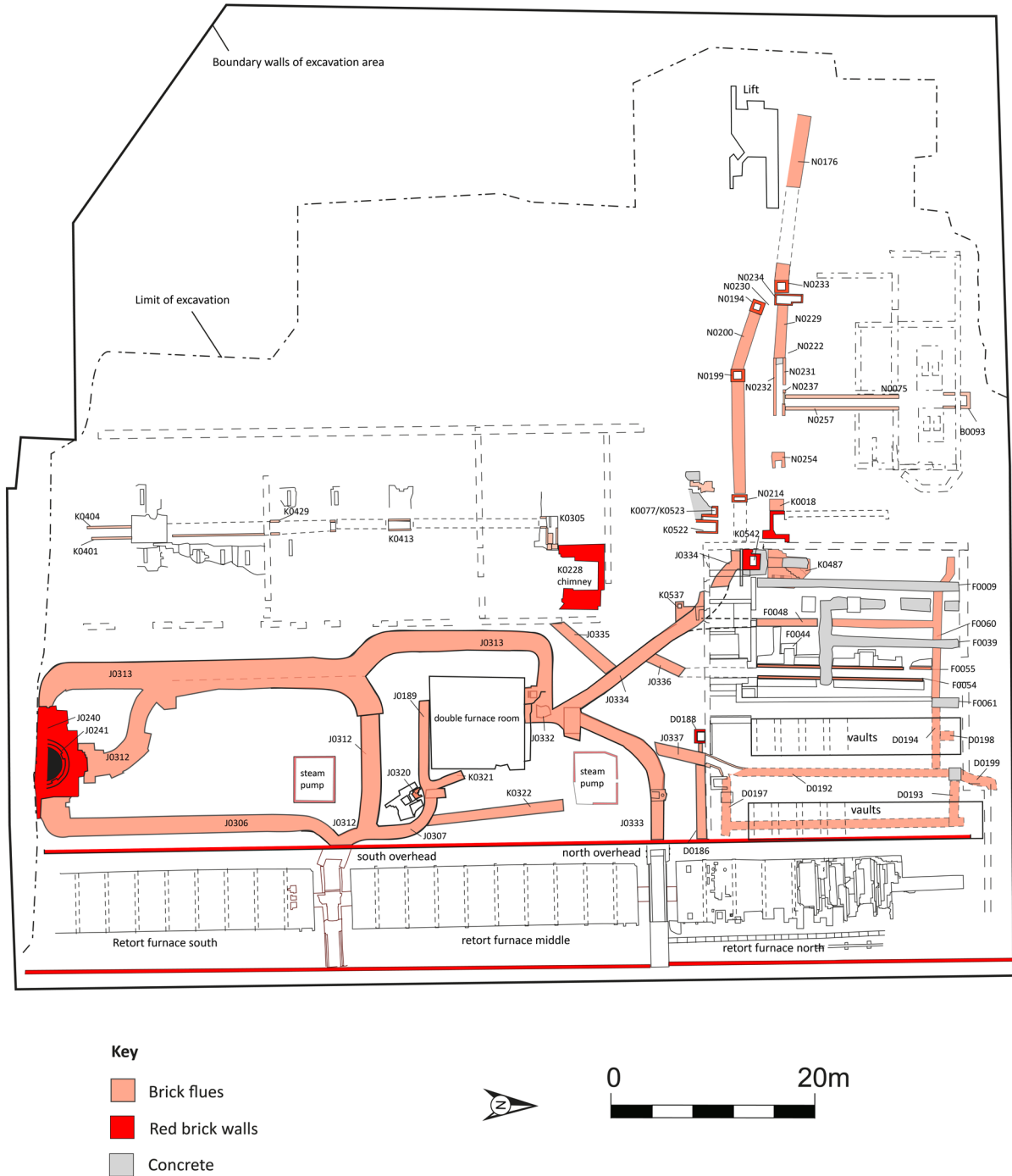
(N0148). The truncated brick footprints, (F0054) and (F0055), of a further north/south-aligned flue were identified to the east of (F0048).

It is possible that the original layout of the flues saw (J0337) continue south to a junction with (J0334) prior to connecting with (J0332), which formed a large flue opening (J0169) in the north wall of the chimney basement area (J0168) prior to it being blocked. A spur, (J0335), led off to the west from (J0334); this possibly led into minor chimney (K0228). A second spur to the east, (J0336), probably linked up with flue (F0054)/(F0055) to the north. To the north-east, flue (J0334) appeared to connect with a brick-lined damper system (K0542) (to regulate airflow), with its original chain and pulleys still in situ (Illus 45), which linked up with a second flue, (N0200), to the west beyond wall (K0001) and a truncated flue to the north, (K0487).

The remains of a large brick-vaulted flue, (K0547), approximately 3m high and 0.69m wide, were recorded (Illus 46). The flue, constructed of heat-affected bricks, included a brick base with vertical vents on its east side. The lining of the flue had a hard, glass-like, residue, indicating the substantial heat present when the flue was in use. Given the position of this flue within the boundary of the original stone walls (K0001) of the Gasworks, potentially this was an early (Phase 2) feature.

6.6.4 The major chimney

The expansion of the Gasworks in the 1840s saw a significant reconfiguration of the industrial complex with the addition of a large chimney. Remains of a



Illus 43 Plan of all recorded brick flues



Illus 44 Flues (D0192) and (D0194) taken from the north



Illus 45 Detail of damper system (K0542) from the north



Illus 46 Section through flue (K0547) showing the heat-affected bricks

substantial stone wall (J0168) (and other smaller sections), likely part of the base of the chimney, were recorded in the location of the chimney depicted on historic maps. This was in the north-east corner of a large basement area (Illus 47), which contained two large brick furnaces of complex multiphase origin. It was interpreted that two main phases of activity could be assigned to the basement level room associated with the chimney. The furnaces in this area appeared to form part of the final phase of Gasworks activity (Phase 4). The initial activity (Phase 3) was associated with stone walls of the Phase 3 chimney along with a large (brick-blocked) flue to the north and a smaller blocked flue to the south.

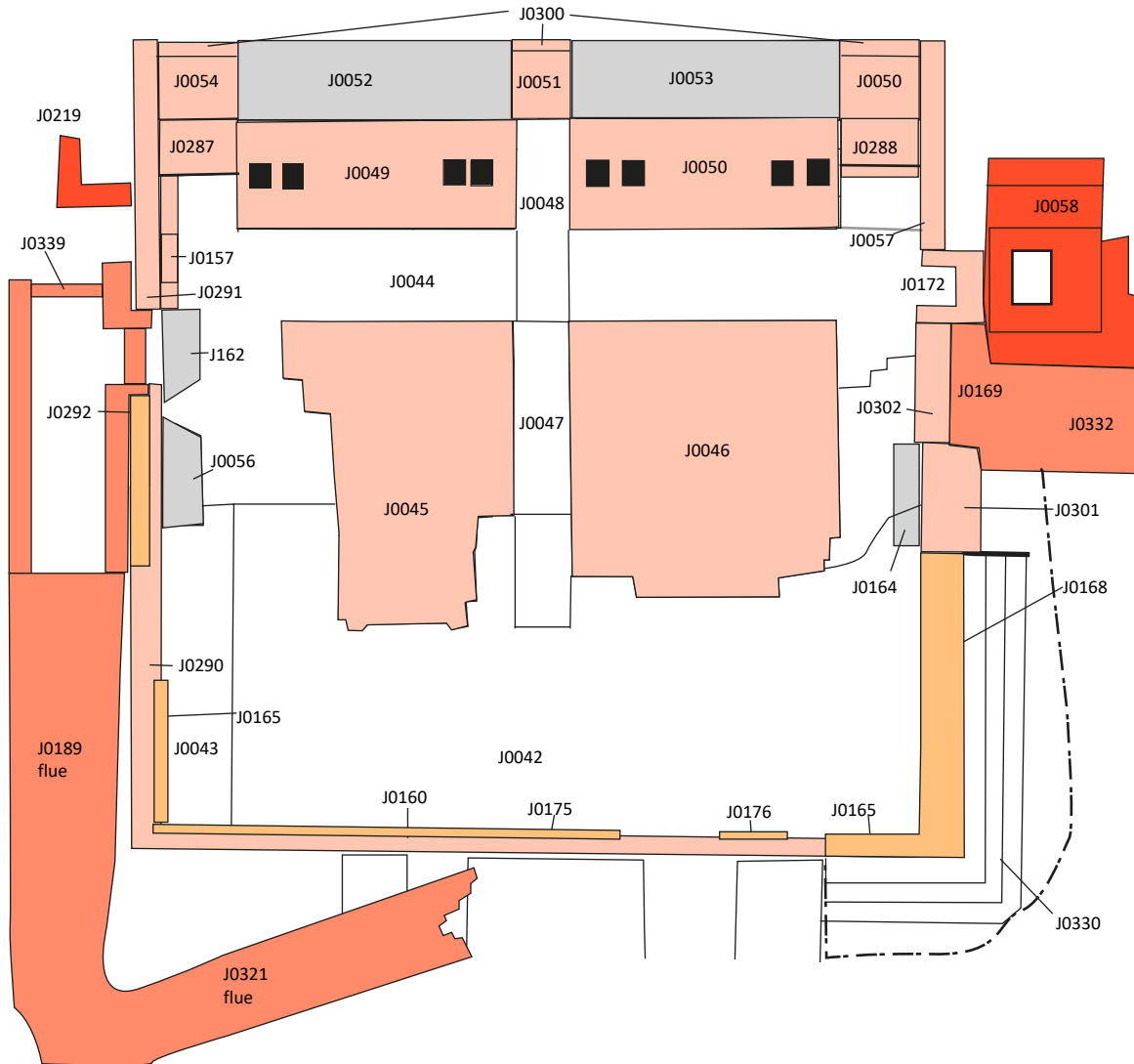
Parts of the early chimney included sections of stone wall recorded at the base of the east wall, (J0160) (Illus 48), and sections of the north and south walls. Stone-built structures on the east wall, (J0165), (J0175) and (J0176), were located intermittently along the base of the later brick wall.

To the north, a much larger 4.5m section of stone wall, (J0168), up to 2.6m in height was revealed to have an outer face that stepped out significantly. Behind later brick walls (J0290) and (J0291) on the south wall of the basement area were the truncated remains of a stone wall, (J0292), probably also part of the original basement area.

The presence of substantial stone walls, particularly on the north side of the basement area, along with early flues indicates that this feature was likely a chimney base. Overlaying the 1852 Ordnance Survey map over a plan of excavated features of Phase 3 (Illus 49) supports this as the location of the chimney of the Phase 3 Gasworks.

6.6.5 Flues associated with the main chimney

Two large flues, of which (J0169) was the larger, incorporated remains of a stone arch (J0183). This was probably associated with an early phase of the structure along with stone wall (J0168) to the east,



Key

- Brick flues
- Red brick walls
- Etna and yellow brick walls
- Stone wall
- Concrete



Illus 47 Plan of double furnace room



Illus 48 Stone wall (J0160) at the base of the east wall of furnace room

although it had been separated from the wall by a section of brick wall (J0301). The flue had originally continued to the north as flue (J0332), which in turn split into flues (J0333) and (J0334). These substantial features were likely in use prior to the insertion of the two (Phase 4) furnaces.

6.6.6 Flues in the west of the Gasworks

As noted above, an east/west-aligned flue, (N0200), extended across the west side of the Gasworks complex, with brick vents (N0194) and (N0199) to the west and east. The flue continued a further 11m where a third brick vent, (N0214), was recorded and likely continued east towards damper (K0542), linking up with flue (J0334).

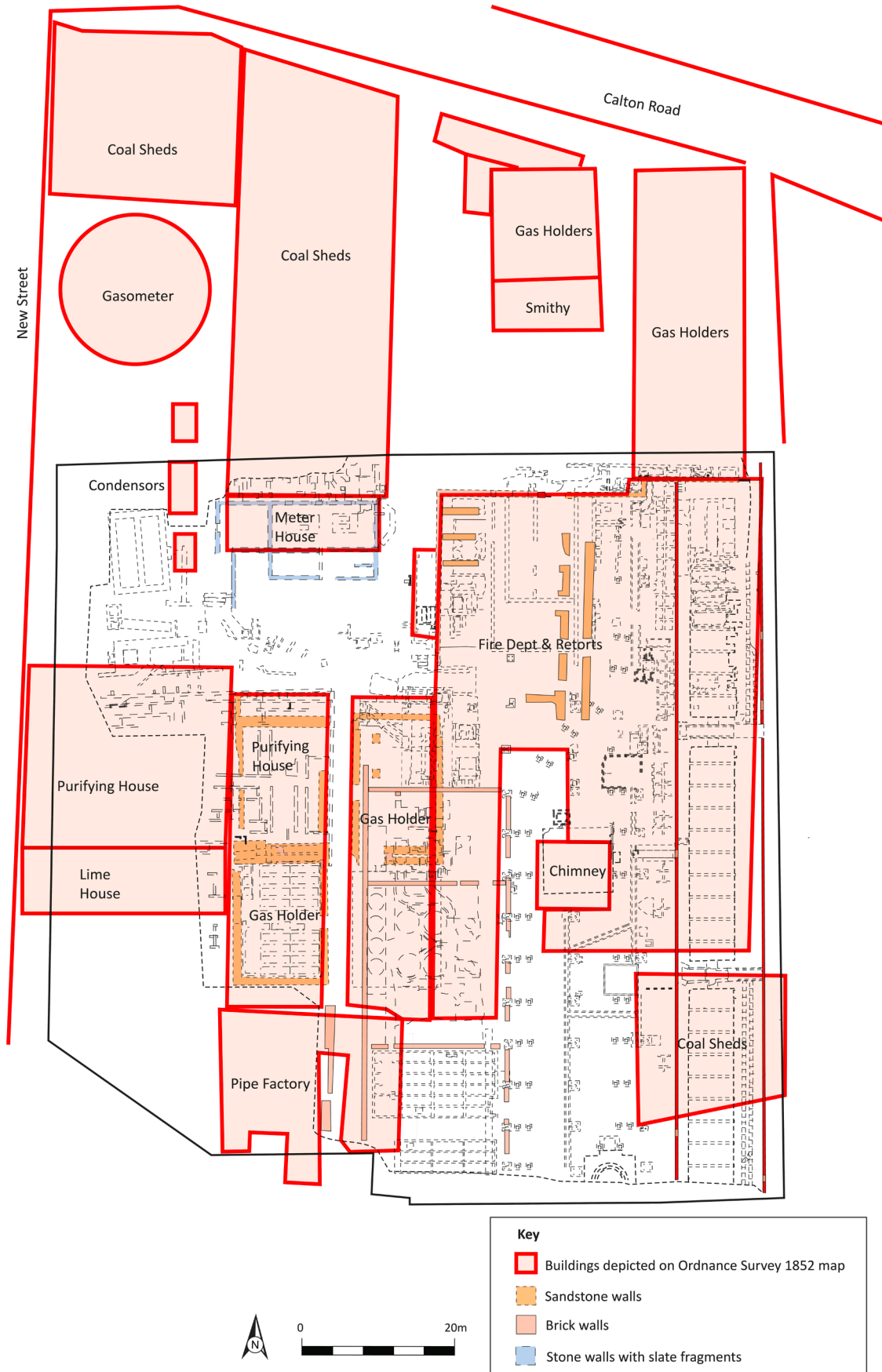
6.6.7 Retort benches

The north and middle groups of retort benches located along the eastern side of the site were likely

originally constructed during Phase 3, although the surviving structures were likely of later (Phase 4) construction (as were those to the south), perhaps remains of the 40 retorts inserted in 1888 (Cotterill 1976: 1064–5). They stood within the limits of the major Phase 3 building (Illus 49). Flues (J0307) and (J0189) linked the south end of the retort benches (possibly one long bench at this time) to the chimney area. To the south of flue (J0189) was a stone-lined vaulted chamber, (J0190), entered via a cast iron cover.

6.6.8 Minor chimney and associated flues

A possible second chimney structure of Phase 3 date was recorded, (K0228), heavily truncated by Phase 4 features (Illus 50). Brick flues appeared to lead into the area, although no clear links could be made due to heavy truncation and the walls of the putative chimney structure did not appear sufficiently substantial to support a tall structure.



Illus 49 Phase 3 features overlain with features on 1852 Ordnance Survey plan



Illus 50 General view of the chimney area (K0228)

The remains of a series of heat-affected brick surfaces were linked to remains of a brick flue system. In the south of the site, brick flue (K0401), (K0404) and (K0430), constructed of bricks bonded with lime mortar, ran for 16m northwards. On each side of the flue were truncated heat-affected red brick surfaces (K0353)–(K0358), (K0405)–(K0407), (K0432) and (K0433). These were each approximately 2.5m by 1.6m with a central cast iron trough, 1.26m by 0.28m, aligned east/west. These features may represent a series of pumps with each iron trough the location of a wheel pit.

To the east of brick floor (K0433) was a series of low brick walls, (K0434), forming small cells set into a layer of clay. Fragments of further heat-affected brick surface and flue features were identified further to the north. The northernmost of these features, flue (K0305), included the remains of a damper system. Flue (K0305) continued into the area of chimney (K0228), which comprised a brick floor surface measuring 3.97m by 3.67m with the

remains of three large vaulted flues to the east, west and north. On the south side, flue (K0230) was only visible in section. The west flue, (K0219), was constructed of red ‘Glenboig’ brick; to the north and east, flues (K0221) and (K0223) were of identical construction. The internal walls of the flues had no residues and the purpose of the area was unclear as the walls did not appear substantial enough to hold a tall chimney.

6.6.9 The annexe to the major building

Phase 3 saw the addition of an annexe on the west side of wall (K0001) of the major Gasworks building. A short section of rubble wall, (K0003), abutted this main wall and joined north/south wall (K0004), which formed an annexe, 7m in length. At the south end, the wall turned back to the east, (K0019). Within the annexe, but possibly added during Phase 4, was a small retort furnace (Illus 51) (K0006)–K0010) with a small coke oven at the base with two cylindrical clay horizontal retorts, which



Illus 51 Detail of small retort furnace (K0006)-(K0010) from the north

could have been used to test the different coals prior to use in the main furnaces. This annexe is clearly depicted on the Ordnance Survey map of 1852 (Illus 8).

6.6.10 The meter house

Further substantial stone walls, (N0216), (N0187), (N0221), (N0227), (N0240) and (N0186), to the west of the annexe likely represented the meter house (and ancillary structures) depicted on both the 1852 and 1877 Ordnance Survey maps (Illus 8 & 20). A large room recorded in the east of this building contained two large stone-built machine foundation bases (N0247)/(N0248)/(N0249) and (N0266) (Illus 52), both measuring 2.95m by 2.84m by 1.8m and containing two parallel wheel pits aligned east/west. Later elements of the Meter House included a 2.3m high rubble wall (K0494), aligned north/south, recorded as (N0228) and (N0270) at a lower level. A section of stone rubble wall (K0515) was added to the east face, forming a small room, while

brick-built wall (K0492) had been added (possibly in Phase 4) to the south end, forming another room.

Several further stone walls were likely associated with the Phase 3 expansion. To the west of the Meter House, walls (N0135) and (N0180) comprised mortar-bonded rubble walls, approximately 1.1m wide and over 3m high (Illus 53). Against the south side of wall (N0135), remains of a large brick engine mounting block (N0132), which included a small wheel pit, were recorded. The phasing of this feature is uncertain, and it could have housed later (Phase 4) pump machinery. To the north, truncated wall (N0133) was of similar construction to (N0135). Similar truncated walls were recorded to the south, (N0127) and (N0130).

6.6.11 Drainage

A complex of brick-lined drains with stone caps were recorded in Area N towards the centre of the Gasworks, near the annexe to the major building. To the north, drain (N0280) was truncated by



Illus 52 Machine mounting bases (N0248)

stone wall (N0228) of the Meter House, indicating that the drains were earlier than this structure. Two further drains on a broadly similar alignment, (N0277) and (N0279), joined at their east ends where they connected with a brick-lined vent. Drain (N0278), aligned north/south, extended from the vent to a stone-lined sump (N0281). The three drains united as drain (N0285) to continue to the north-east. Sump (N0281) was 3.7m long and at least 2m wide and its walls were covered in a white residue.

Four wells were located during the excavations that, though difficult to date, may be associated with this phase. Well (J0310) (Illus 54) was located close to the later chimney base (J0240). It was constructed of yellow firebricks bonded with grey cement and was 1.1m in diameter and at least 2.1m deep. To the north-west, between the parallel rectangular buildings of the Gasworks, a second brick well, (N0008), was recorded. This well, which appeared to post-date Phase 2, was 1.22m in diameter and

was recorded to a depth of 2.15m. A stone-lined well, (R002), to the north could potentially be of pre-Gasworks origin, although it was interpreted as more likely to belong to Phase 2 or 3. This was cut into an area of dark (backland) soil and had a depth of at least 2m. A fourth well, (N0256)/(P001), constructed of stone blocks, was possibly of an earlier date and is discussed in Phase 1 above.

6.6.12 Coal shed

The expansion of the Gasworks in the middle of the 19th century saw the introduction of large coal sheds in the north-west of the development, towards Calton Road. However, little evidence was found for the Phase 3 coal sheds during the archaeological works. Two short sections of stone wall, (R003) and (R024), may have formed elements of the eastern wall of the large Phase 3 coal shed, visible on the 1852 map (Illus 8). In addition, a section of brick floor, covering an area 5m by 3m, (R015), could have belonged to this building.



Illus 53 Wall (N0135) from the south-east



Illus 54 Brick well (J0310) from the north

6.6.13 Western gasholder

The possible remains of large circular gasholder, also visible on the 1852 map, were recorded to the west. The 16m diameter base of a cast iron tank, (R017), was constructed with large plates of iron, riveted together, with a series of brick buttresses around its circumference.

6.6.14 The smaller 'Gas Holders' building

A series of stone wall bases further to the east appeared to be located on the footprints of buildings depicted on the 1852 Ordnance Survey map (Illus 8). Together, rubble walls (R036) and (R023) formed a large square building. Its south-west corner was formed by (R023), which extended 9m east/west before turning to the north for 3.5m. An area of stone floor, (R037), lay north and east of this wall. Rubble wall (R036) was a more extensive feature, forming both the 13.5m long north wall of the building and its east wall. The location of these walls corresponded with the smaller 'Gas Holders' building depicted on the 1852 map.

6.6.15 Smithy

The 1852 Ordnance Survey map labels an annexe to the south of the smaller 'Gas Holders' building as a 'Smithy'. Small sections of stone wall base, (R021) and (R049), may be remains of the southern wall of this annexe. Both were constructed of lime mortar-bonded rubble. Wall (R021) was 2.5m in length while wall (R049), to the east, was over 4m in length. Separating these segments of wall was a 12m long brick-lined drain, aligned north/south, (R019). A second drain, (R020), aligned south-west/north-east, extended from its west side. This drain was either associated with the smithy or was a later feature.

6.6.16 Northern building

To the north of wall (R036), large square stone blocks formed a floor surface, measuring 5.1m by 3.1m, (R035). This floor appeared to be part of a building of unknown purpose depicted on the 1852 map, fronting on an area of rail tracks at the north of the Gasworks.

6.7 Phase 4 (c 1875–1906) (Illus 55)

The design of the Phase 4 Gasworks aimed to speed up the processes involved, from the introduction of the coal onto the site to the distribution of gas through the city. For example, the coal sheds were moved to the east, closer to the retort benches. From there the gas produced was sent through a series of purification processes, removing waste by-products. The gas was then passed through the meter house before entering the gasholders.

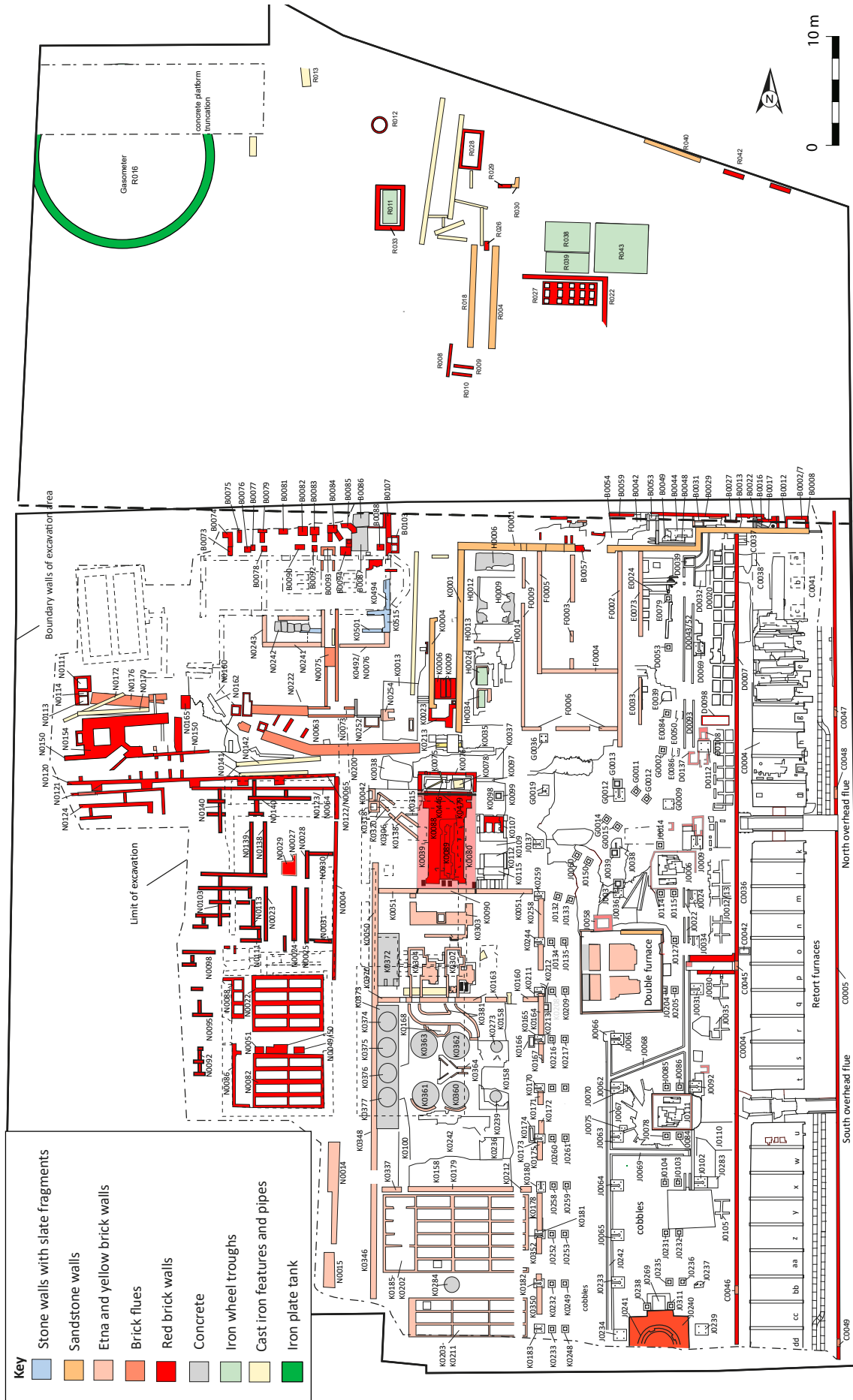
As the cartographic evidence demonstrates (Illus 8 & 20), a major expansion of the Gasworks facilities took place between 1852 and 1877; these also show the development of railway access for the provision of raw materials and the exporting of by-products. At the time of the Ordnance Survey map of 1877 (Illus 20) the Gasworks was in transition, with the expansion of coal sheds to the east and the reconfiguration of much of the rest of the Gasworks. By the time the Gasworks closed in the early 1900s, a multiplicity of processes took place on what had become a crowded site without space for expansion. The detailed plan of 1915, when overlaid over excavated remains (Illus 56) represents the full extent of the developed Gasworks. Many of the depicted features correspond with the excavated remains. Commonly, Phase 4 features were of a similar yellow brick construction.

6.7.1 The central chimney (Illus 47)

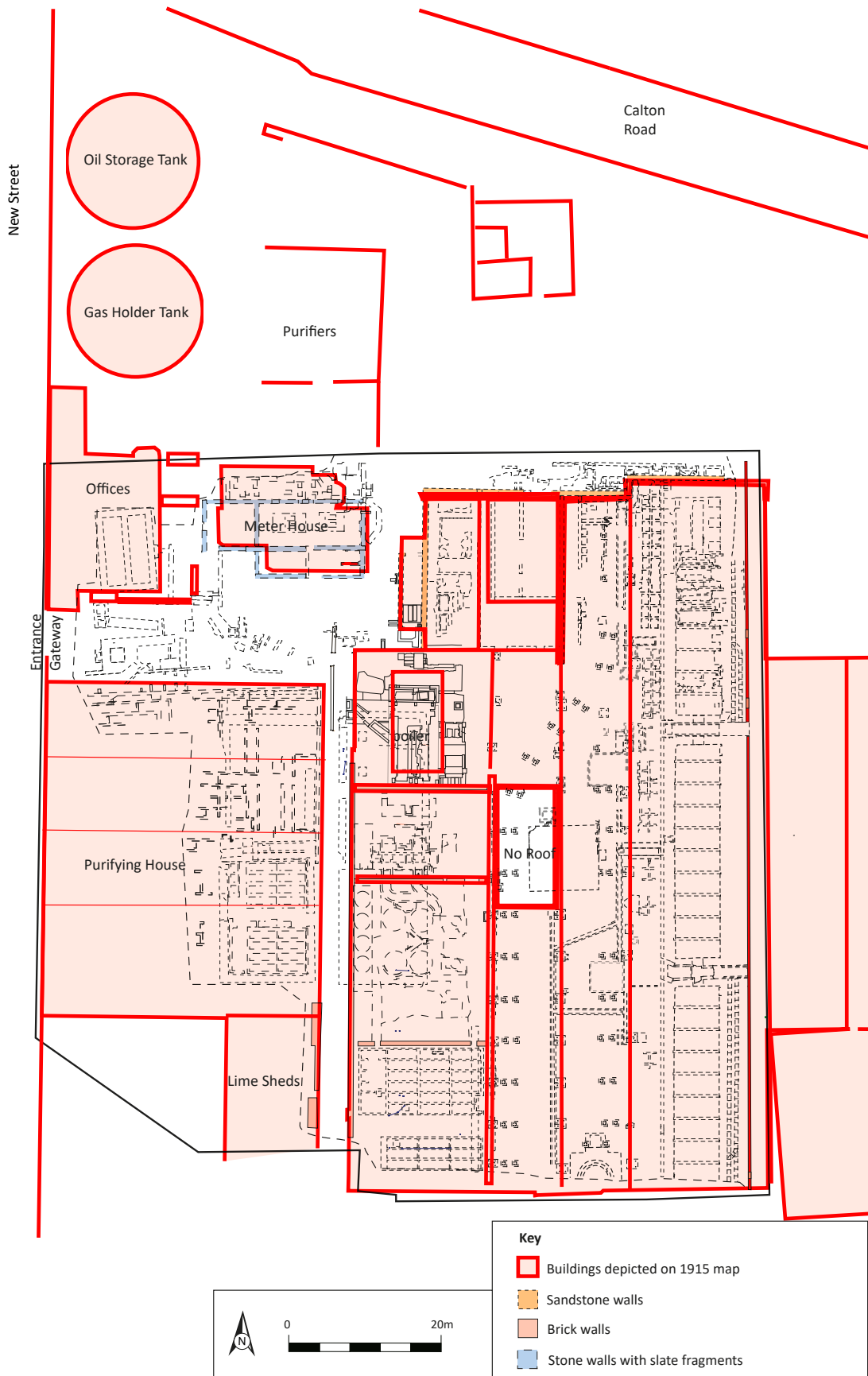
During Phase 4, the south wall of the major chimney depicted in the centre of the 'Fire Department, Retorts, &c.' building on the Ordnance Survey map of 1877 (Illus 20) incorporated brick walls (J0290), (J0291) and (J0158) with a small flue (J0157), which mirrored one on the north wall (J0172). Flue (J0157), together with the large vents to the rear of the furnaces, would have facilitated airflow. The various Phase 4 flues connected to the chimney and its double furnaces were used to channel air through the retort benches to regulate heat.

6.7.2 The double furnaces

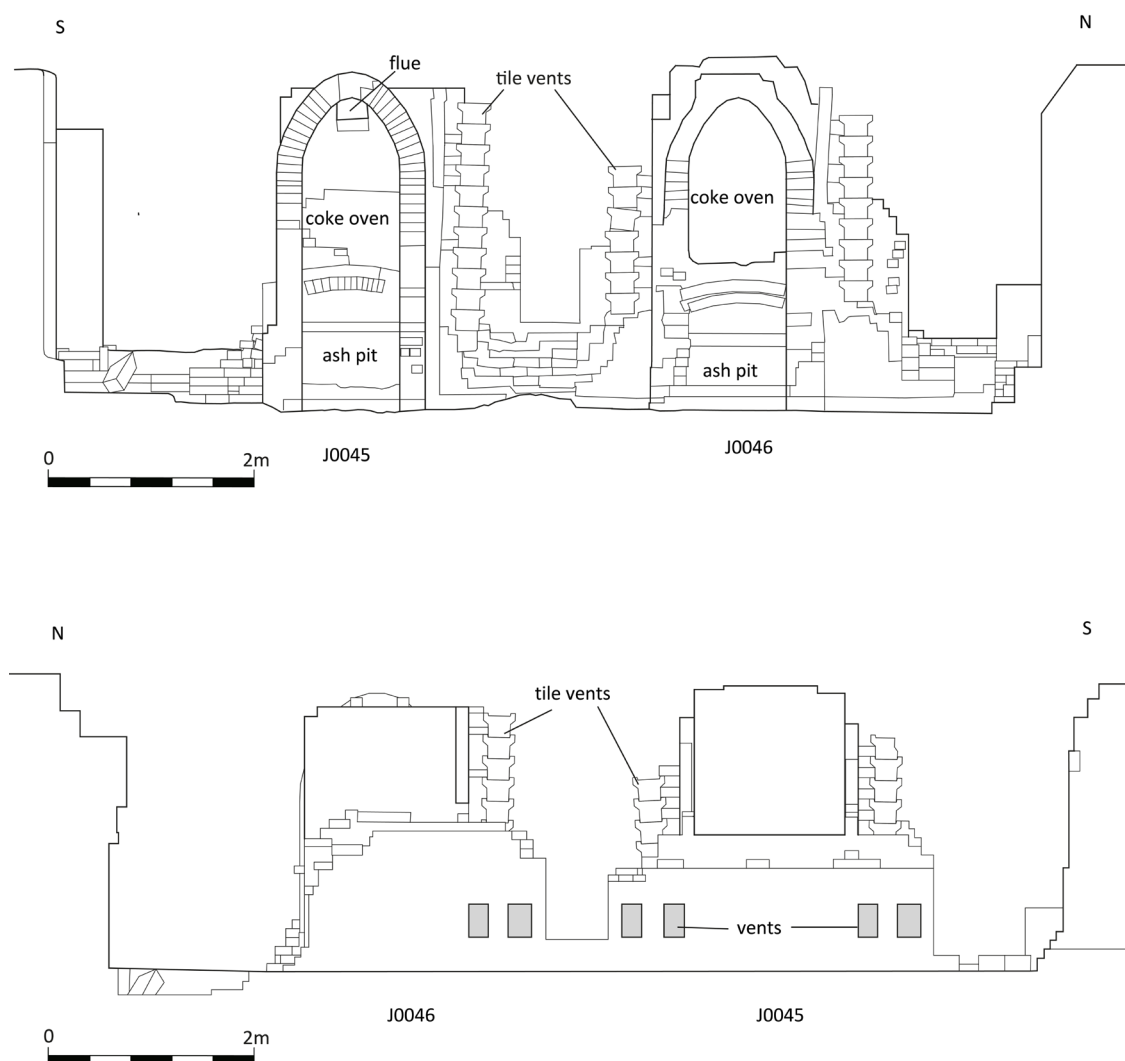
The large basement area associated with the main chimney (Illus 47 & 57), approximately 9m by 10m in plan and 2.6m deep, contained two large brick-built furnaces, (J0045) and (J0046), both aligned



Illus 55 Plan of Phase 4 features



Illus 56 Phase 4 features overlain with features of detailed 1915 plan



Illus 57 Elevations of double furnace room

east/west (Illus 57 & 58), interpreted as Phase 4 features. The furnaces varied in shape and scale. The furnace to the south (J0045), 3.5m by 2.3m in plan and 3m high, was slightly longer and narrower than (J0046), with dimensions of 2.9m by 2.75m by 3.26m. Both were constructed of unfroged red firebrick. On each side of both furnaces were structures of fired clay square tiles forming vertical flues. The front (east-facing) elevation of furnace (J0045) comprised two openings, the lower half being the ash pit, the upper being the furnace oven. The lower portion included a sloping brick base above which were two iron beams, which would have held a grate above the floor to separate the spent coke and ash. On each side of the east elevation of the furnace, close to the base, was a

small section of brick wall that included two small vents with iron covers that could be raised or lowered to alter the airflow through the furnace, regulating the heat of the furnaces. The main chamber above the ash pit was 1.9m high, 1.5m deep and 0.94m wide with an arched head and a corbelled rear wall that included a small flue opening at the base and a second flue at the top. This formed the main coke oven that would have heated structures above. Gas may have been reheated to extract impurities. The second furnace, (J0046), to the north, which was in a better condition, was of similar design.

Two firebrick platforms, (J0049) and (J0050), were separated from the furnaces by a narrow gap. Each platform measured 3.04m north/south by 1.29m east/west with a height of 1.20m and had two

sets of double vents that ran from the east elevation, where they mirrored vents on the furnaces (Illus 59). Immediately to the rear (west) of these platforms were two large concrete covers, (J0052) and (J0053), which abutted a yellow brick wall (J0300) that formed the western limit of the basement.

6.7.3 Flues associated with the Phase 4 chimney and double furnaces (Illus 43)

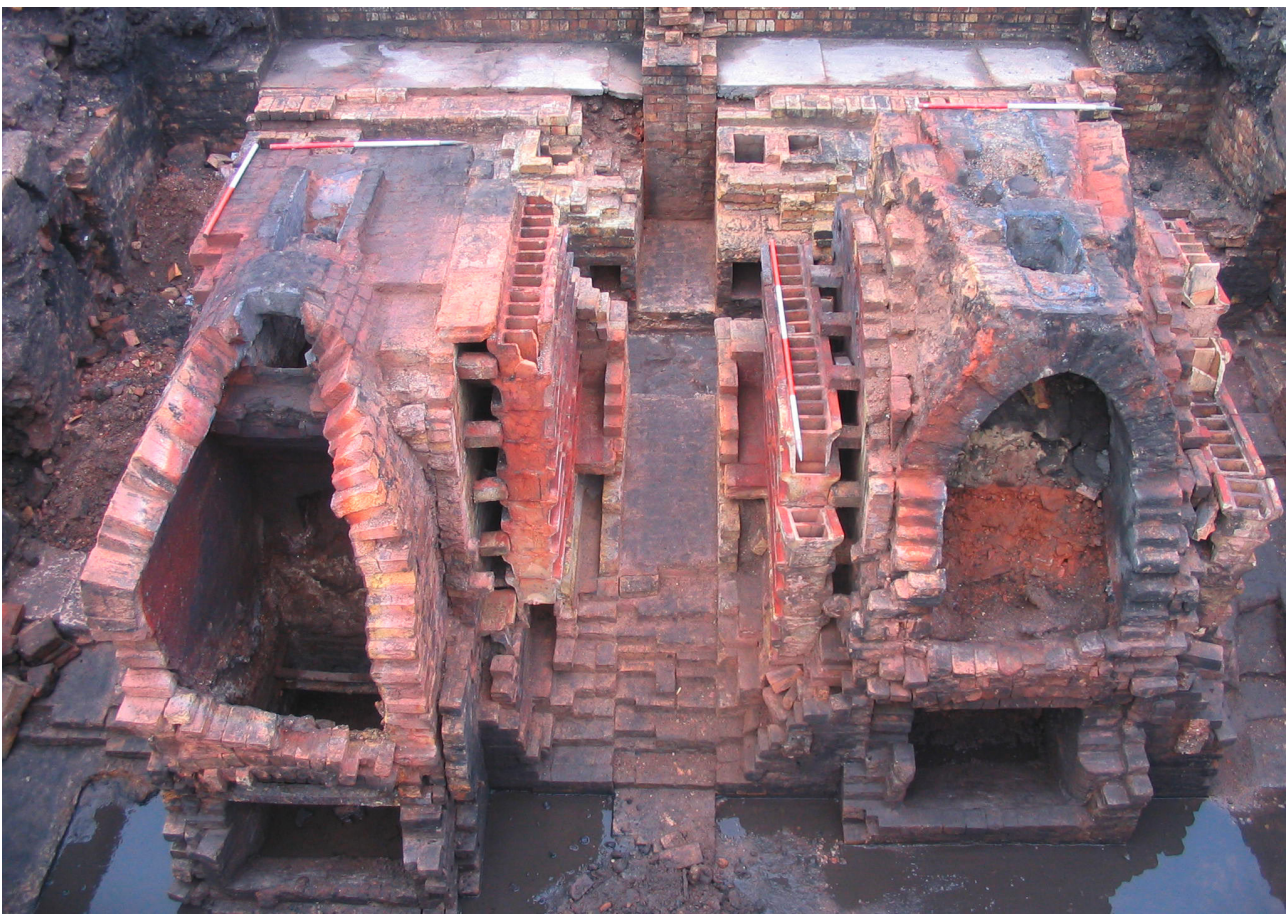
To the north of the furnaces, brick-lined flue (J0172) had a door/shutter constructed of four large blocks of concrete encased in an iron frame. This formed part of a damper system that was operated from above the flue. The flue continued to the north where it connected with the main flue (J0313). To the south, behind the basement area, was a flue opening, 0.85m high and 0.74m wide, which led into an east/west-aligned flue, (J0189), which led towards the retort benches. Possibly of Phase 3 origin, the opening had been blocked with ‘ETNA’ firebricks.

6.7.4 Retort benches

Three banks of retort bench furnaces, (C0006), were recorded in the east of the excavation area (Illus 60, 61 & 62). It is likely that these 30 retorts were part of the 40 retorts constructed in 1888 (Cotterill 1976: 1064–5). Phase 4 saw the apparent expansion of the furnaces to the south, with new flues placed between each set of ten furnaces to regulate airflow. These flues connected with chimney (J0240) at the south of the Gasworks and to the major 1840s chimney.

A series of 30 furnaces (a–dd) were set in groups of ten, bounded to the east by a 2.42m high brick wall, (C0005), likely also the west wall of the Phase 4 coal sheds. On the west side of the furnaces was another significant brick wall, (D0007). In general, the retort benches at the north end (a–j) were in worse condition than those to the south, with the lower sections of the second and third groups of benches mostly intact.

Each retort bench was constructed of firebricks bonded with sandy clay. The major surviving



Illus 58 East elevation of two furnaces (J0045) and (J0046)



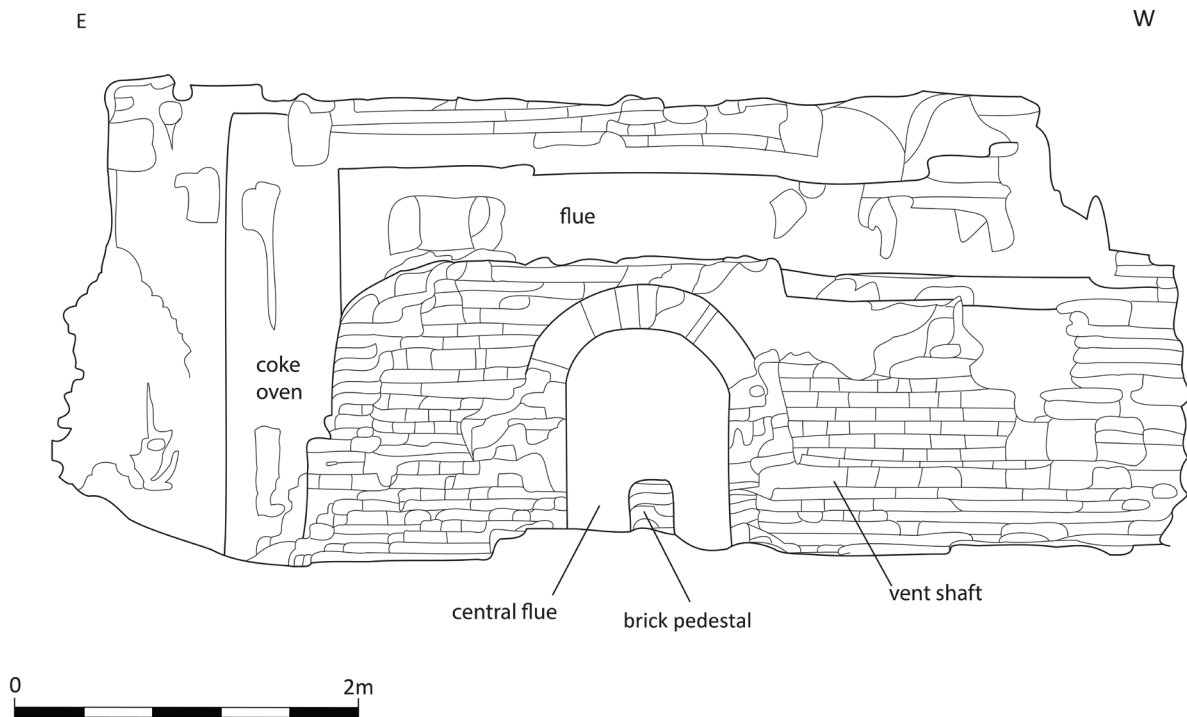
Illus 59 General view of brick base (J0050) from the south

features of each bench were ten coke ovens on the west side. These were 2m high, 1.05m wide and 1.6m deep (Illus 63). None retained the cast iron door that would originally have been attached to their front. The base of each oven (the ash pit) had an angled front and rear wall with the front of the pit extending 0.8m beyond the front wall of the oven. A shelf on the rear wall was set above the ash pit, over which a grate would have been positioned. At the top of the oven on the rear wall was a vent leading into the structure. Further corbelled vents were present at the top of the side walls of the oven leading to vents on the top of the bench. A

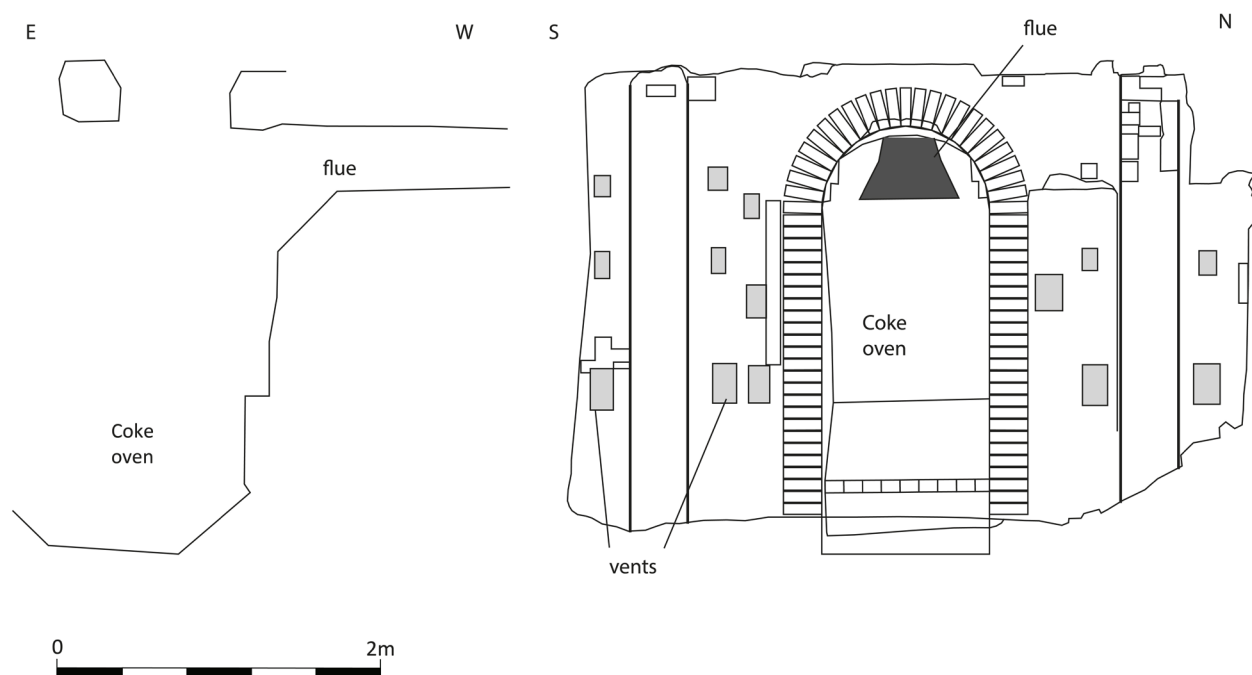
series of six vents was located on each side of the oven, which ran through the structure and could be left open or closed in order to regulate the flow of air. Below each of these, a small brick arch with a flue ran through the structure leading to the central flue. Each furnace was separated from the next by a brick wall that was not keyed into the main structure. At the base of each of these walls were square pits, which contained the remains of a cast iron support beam. These beams may have supported a frame for the oven doors and carried the weight of the heavy clay retorts above the coke ovens.



Illus 60 General view of retort benches from the south



Illus 61 Section through retort furnace



Illus 62 Front elevation of retort furnace

The rear elevations of the benches were consistent with two groups of seven small vents on each side of each furnace block and three small brick arched flues at the base. Again, a pit in the concrete floor at the base would have held a support pillar. The upper sections of the retort benches contained groups of east/west-aligned vents (Illus 64). The vents on top of the retort benches would have transferred heat from the coke ovens to the individual clay retorts above, only one of which (Illus 65) was recovered.

6.7.5 Retort flues

Running beneath the floor of the centre of the entire retort bench area was a north/south-aligned flue, 0.93m wide and 1.48m high. A low brick wall ran down the centre of the flue (Illus 66). Two gaps between the retort bench banks contained large east/west-aligned overhead flues, (C0026) and (C0030), between the coal shed wall (C0005) and wall (D0007) to its west (Illus 67). Flues (C0026) and (C0030) were constructed of firebrick encased in an iron plate sleeve and were internally

1.2m wide and 0.67m high. The northern flue, (C0026), was supported on a brick structure, (C0027) (Illus 68), with a large arched opening below the flue. Flue (C0027) ended between two side walls, (C0028), that continued beyond the furnaces, abutting the main north/south brick wall (D0007). At this point, a large vaulted flue, (J0333), continued through the wall – this may have been part of the Phase 3 complex as the Phase 4 flue system may be a modification of the Phase 3 system.

The overhead flue to the south, (C0030), was more heavily truncated, revealing its lower elements. The central flue through the retort benches was seen to form a junction with a flue leading off to the east and a more substantial flue to the west. The walls of the flue to the west, (C0034), abutted brick walls, (C0032), which projected from wall (D0007) and led to flues (J0306) and (J0307). Flue (J0306) stretched to the south towards Phase 4 chimney base (J0240), while flue (J0307) continued to the north, with a third flue, (J0189), stretching off to the west side towards the double furnace room. Several of these flues likely originated in Phase 3.



Illus 63 Detail of one of the furnace ovens showing the sloped base

6.7.6 Trolley line

Between the retort benches and east wall (C0005), the concrete floor incorporated a narrow trolley line, (C0002). At the north end it was a single track, 0.40m wide with iron plate sleepers. A second track turned off from the first to form two parallel tracks along most of the length of the retort benches. The tracks rejoined close to the south end of the retort bench area (Illus 69). These tracks aided the conveyance of coke to the ovens and the removal of residues.

6.7.7 The purifiers

Wall (C0005) to the east of the retort benches extended approximately 100m north/south and incorporated openings (C0013), (C0017), (C0047) and (C0049), which led to the coal sheds. To the west, north/south-aligned wall (D0007) again continued the full length of the retort benches. Immediately to the west of wall (D0007) was a complex of interconnecting rectangular brick features that were interpreted as potentially part of the purifying complex, though this could not be confirmed by the cartographic evidence. These



Illus 64 Detail of the top of one of the furnaces from the west



Illus 65 Detail of a clay retort



Illus 66 View through the central flue running through the retort benches

chambers ran parallel to the retort benches and were delimited by three north/south-aligned brick walls, (D0001), (D0010) and (D0007), 0.91m apart, and by east/west-aligned walls, (D0005), every 1.23m. The chambers were one or two courses high and filled with coke residue and burnt material. A 0.75m wide brick-lined drainage channel, (D0030)/(D0042)/(D0052)/(D0093), ran parallel and west of the chambers, with a branch at its north end running to the west, (E0024) and (E0091).

Nearby, stone mountings (D0053), (E0039), (E0079), (E0084) and (E0086) each comprised a large stone block (1.16m by 1.22m by 0.32m high) with four iron pins inserted. They may have supported pipes or an overhead rail system.

6.7.8 Possible workshops

In the north of the major 'Fire Department' building, a complex of brick walls formed three basement rooms with packed earth floors, possibly workshops. The northern wall of this block comprised earlier stone wall (F0001). The brick walls to the south

formed two rectangular rooms aligned north/south to the north, FA1 and FA2, with a third room, FA3, aligned east/west to the south. Wall (F0002) was the east wall of this complex, with (F0006) the south wall of room FA3. East/west-aligned wall (F0004), with an arched opening, formed the division between room FA3 and rooms FA1 and FA2, while wall (F0003) separated room FA1 from FA2. This wall included the remains of two brick arches, while the west wall of FA2 (F0005) included three brick arched openings.

6.7.9 Features to the west of the workshops

To the west of the workshop rooms were further Phase 4 features. In the north of this area was a concrete floor, (H0006), with the remains, (H0009), (H0011) and (H0012), of a large concrete block. The whole structure would have measured 4.3m by 3.6m in plan and included two east/west channels. Another feature in this area was a 0.11m-deep iron basin, (H0034), 2.04m long and 0.74m wide, of unknown purpose.



Illus 67 View of north overhead flue (C0026) from the west

6.7.10 Steam engine basements near retorts

There were two large steam engine basements, (J0006) and (J0111), in the east of the site, approximately 25m apart. The northern basement, (J0006), measured 5.5m east/west by 4m north/south and was 2.48m deep. Its walls were mortar-bonded yellow brick and its brick floor incorporated two brick engine supports (Illus 70). The larger of these, (J0007), measuring 2.3m by 2.23m in plan, was a U-shaped structure. Iron mounting bolts projected from the top of the structure, which would have held machinery in place above. To the south,

the smaller mounting, (J0008), measured 1.9m by 0.67m and had an iron pin at each corner. The southern machine basement (J0111) was identical to (J0006).

6.7.11 The southern chimney and its flues

In the south of the Gasworks was the base of a brick-built chimney, (J0240)/(J0241) (Illus 71), which was probably constructed during Phase 4. Measuring at least 6.8m long and 6m wide, this was a substantial feature. Its floor was constructed of concentric rings of bricks (one stamped 'GLENBOIG'). The chimney



Illus 68 View of the lower flue and support (C0027) from the north-east

interior was 3.3m in diameter and flues entered the base of the chimney from the east (J0306), west (J0313) and north (J0312). On each excavated side of the chimney were brick-lined shafts that formed part of a damper system to regulate airflow. The largest of these, shaft (J0269) to the north, measured 1m by 1.1m in plan and was flanked by two stone mountings, (J0238) and (J0311).

The three substantial flues (Illus 43) that emerged from the southern chimney, (J0306), (J0312) and (J0313), headed north to join the retort bench area and the major chimney in the centre of the Gasworks

(Illus 72). The eastern flue, (J0306), constructed of firebricks stamped with 'ETNA' and 'HURLL GLASGOW', eventually curved to the east through wall (D0007) where it formed part of the flue system running into the retort bench area, where it appeared to be built over flue (J0307), which extended to the north, joining a complex of further flues. Flue (J0306) was a substantial structure, its wall being 0.62m thick with a vaulted roof five brick courses thick.

Flue (J0312), which curved to the west to run alongside (J0313), though of a similar brick build,



Illus 69 View of the rail tracks to the east of the retort benches

was in places more substantial than (J0306), being up to 2.26m high with walls 0.75m thick. A white fibrous material acted as insulation within this structure. Where the structures of flues (J0312) and (J0313) joined, an internal wall separated the two flues (Illus 73) before dividing again. Flue (J0313) continued to the north and flue (J0312) turned east to join an earlier section of flue that continued into (J0307), where it linked with the southern overhead flue of the retort benches. It is possible that the northern section of (J0312) may represent the reuse of an earlier flue. Flue (J0313) continued

north beyond the double furnace room to join flues (J0332), (J0333) and (J0334). It was connected via damper structure (J0058) and flue (J0172) with the double furnace structure, (J0045) and (J0046). Flue (J0333), likely of Phase 3 origin, then joined the northern overhead flue in wall (D0007) to link into the retort bench area.

6.7.12 Boiler house

In the west of the major Gasworks building, a brick surface, (K0088), measuring 10m by 4m in plan, was defined by raised brick wall bases (K0039),



Illus 70 Engine mounting (J0007) from the west



Illus 71 Cobbles (J0248) and (J0249) abutting chimney base (J0240)



Illus 72 General view of the main flues at south end of Gasworks



Illus 73 Section through flues (J0312) and (J0313) as they join from the north

(K0080), (K0090) and (K0079). A north/south-aligned brick plinth, (K0089), stood in the centre of this area, measuring 8m by 1.92m in plan, and 0.65m high (Illus 74). The south wall, (K0090), included vents and a raised area of heat-affected brick, (K0093). This room appears to have held large horizontal tanks of a boiler house, marked on the 1915 plan of the Gasworks (Illus 9 & 56). Small brick enclosures, (K0107), with sloping brick edges on three sides were located to the east.

6.7.13 Structures south of the boiler house

In Area K, the southern wall, (K0090), of the boiler house continued as (K0051). It formed the north wall of a group of rooms defined to west and east by north/south-aligned brick walls. The north of the east wall of this building south of the boiler house was wall (K0258), a yellow brick wall base; it continued in truncated segments to the southern limit of excavation until wall segment (K0350). The wall segments were divided every 4m by stone mountings, (K0244), (K0259), etc, which had

shallow channels running from the centre to the west and projecting iron bolts. To the west, the wall of this building also extended to the south towards the end of the excavated area as (K0050), (K0348) and (K0346).

East/west-aligned yellow brick walls (K0160)/(K0163) and (K0212)/(K0179)/(K0337) formed partitions of this building (Illus 75). Wall (K0160)/(K0163) included a 0.70m wide gap for a cast iron pipe, where originally a small arch had existed. Another wider brick arch was recorded 5m to the west. The southern of the two partition walls, (K0212)/(K0179)/(K0337), also included two arches.

These brick walls formed three distinct areas or rooms. The southernmost room contained a complex of brick-walled cells, (K0185)–(K0211) (Illus 76). Two sets of 24 cells would originally have been present, formed by low brick walls; each cell measured 3.9m east/west by 1.1m north/south in plan. The gap between the two groups of cells contained a circular concrete platform, (K0284), 1.84m diameter. At the east and west ends of the northern group of



Illus 74 Brick base (K0089) from the north



Illus 75 General view of Area K from the south-west

cells, gaps occurred in the cell walls in line with the arched openings in brick partition wall (K0212)/(K0179)/(K0337) to the north. These respected the routes of pipe trenches which ran through the wall. The cells could potentially have formed a foundation support for a floor.

In the central walled area, to the north of the cells, against the north side of partition wall (K0179)/(K0337), were remnants of a granite sett floor, (K0158)/(K0336), laid over a concrete base, (K0242), with an intervening layer of latticed timber flooring (K0236) at its eastern end. The floor had been cut by two north/south-aligned pipe trenches, (K0100) and (K0162), aligned with the arched areas in the wall to the south.

In the west of this room was a rectangular north/south-aligned concrete platform, (K0373), set against wall (K0050) and partition wall (K0370). This platform, standing 1.09m high and measuring 18.2m by 2.7m in plan, supported four circular cement-covered brick bases, (K0374)–(K0377), which were each 2.43m in diameter. A white fibrous

material was recorded on these bases, suggesting that they had been insulated, although their use is unknown – they may have held cylindrical tanks.

To the east of this platform stood four large circular cement-covered brick bases (K0360)–(K0363) (Illus 77), which were each 2.9m in diameter. In the middle of the four bases was an associated Y-shaped brick channel (K0364). At the eastern edge of the concrete floor on which the tanks stood was a channel leading to the north, defined to the east by a low brick surrounding wall, (K0240), for two cement-rendered brick bowls, (K0273) and (K0239). These bowls were 1.44m in diameter, with concave bases, again perhaps for supporting tanks.

North of the area containing the circular platforms, brick wall (K0381) associated with a lined channel (K0424), extended to the north before curving to the west where it split into two separate channels that ran north through the partition wall (Illus 78).

These two channels led into the northern room of the building to the south of the boiler house. Against the western wall of this room, (K0050), was



Illus 76 Brick cells at south end of Area K

a large rectangular concrete platform (K0372), 6.1m by 2.75m in plan and parallel with and similarly constructed and aligned to platform (K0373) to its south. It had five sets of projecting iron pins and stood over walls of the eastern of the parallel rectangular Phase 2 buildings. To the east, two large concrete blocks with irregular brick surrounds, (K0302) and (K0304), formed the bases of machine mountings, with projecting iron pins. The walls surrounding these blocks were continuations of the brick channels located to the south. To the east of each of these mountings were concave recesses, interpreted as wheel pits.

To the north of the engine mounting blocks was another large brick platform, (K0303), set on a thick concrete plinth. Two L-shaped structures formed a large U-shaped platform, 7m east/west by 2.5m north/south and 1.15m high. The platform incorporated a series of projecting iron bolts, suggesting it was another machine mounting. A narrow wall formed a 1m wide channel along the south side of this platform.

6.7.14 The 'Purifying House'

In Area N, to the west of brick wall (K0050)/ (K0348), and in the location of the Phase 2 western rectangular 'Gas Holders' and 'Purifying House' building, a former southern room contained truncated remains of two groups, originally of eight brick-lined cells though reduced by truncation to six in one instance, (N0022 a–h) and (N0082 a–f). This has been interpreted as belonging to Phase 4. Each cell measured 3.46m by 1.11m in plan and was 1.57m in height with three large brick pillars (N0049)–(N0051) standing between the cell groups. Another set of smaller brick cells, (N0088), was recorded in the north-west corner of this room. The cells were interpreted as supports for a floor or other structures. On excavation, a very strong ammonia smell was apparent in this area, and the 1915 plan indicates that this formed an element of the extensive purifying house (Illus 56).

Beyond the east/west-aligned stone walls, (N0020) and (N0021), which formed a long-lived partition



Illus 77 Brick and cement bases (K0360)–(K0363)



Illus 78 Brick-lined channels to the north of the circular bases

to the north of these cells, a series of 3.5m high red brick walls, (N0023)–(N0030) were recorded, while further brick walls, including (N0092), (N0098), (N0102) and (N0103), stood to the north and west, forming a grid pattern. Again, these walls may have formed a foundation for a floor or other structure. Further east/west-aligned brick walls, (N0120)/(N0122) and (N0150), approximately 30m in length, supported by brick buttresses, formed a basement corridor or pipe channel.

6.7.15 Lift shaft and corridor

To the north of the building identified as a purifying house was a substantial east/west-aligned brick structure, (N0154) (Illus 79), measuring 11.6m by 4.5m in plan and 2.9m in height. The 1.26m thick walls defined two separate areas: a square lift shaft (internally 1.8m square) to the west and a corridor to the east. A brick-lined shaft, (N0155), was attached to the western external wall of the lift shaft, probably to house a counterweight. An arched opening led east from the lift shaft into the attached corridor.

6.7.16 Flues in the west of the Gasworks

North of the lift shaft, brick flue (N0176) ran west into a square brick vent, (N0115), with a cast iron cover, (N0113), and a narrow vent with a smaller cast iron cover, (N0114). This abutted brick vent/shaft (N0111) to the north. To the east, flue (N0176) was overlain by brick vents, (N0233) and (N0234) (Illus 43). The flue continued to the east as (N0229) and as walls (N0231) and (N0232) and possibly joined north/south-aligned flue (N0075)/(N0275), into which several cast iron caps had been inserted, (N0259)–(N0262). A further section of possible flue wall, (B0093), was recorded to the north beyond wall (N0240), though this could be associated with Phase 3 structure (N0247)/(N0248)/(N0249) (see above).

6.7.17 Features to the north of the major Gasworks buildings

To the north of the north wall of the major 'Fire Department' building, (C0039), was a series of



Illus 79 General view of the lift shaft and corridor (N0154) from the west

red brick vents, drains and walls. Some of these features were possibly part of earlier phases. Brick walls (B0008) and (B0012) lined up with a square opening in the stone wall opposite the end of the retort bench furnaces. A large brick and concrete machine base, (B0044), aligned east/west, had eight iron pins projecting from its top and a square cut recess at its east end. To the north of this were two additional stone mountings, (B0048) and (B0049), again with iron pins. A further machine base, which included surviving timber beam fixtures (B0052), was located immediately to the west. Further brick walls and bases were recorded to the west, together with another brick-built vertical vent, (B0093), a section of concrete floor, (B0087), and a brick platform, (B0086).

6.7.18 'Tar House'

Iron tanks recorded in the north of the site formed part of the 'Tar House', depicted on the Ordnance Survey map of 1877. This element of the Gasworks, situated over the former location of the Phase 3 'Gas Holder', was marked by heavy contamination. Three iron plate tanks, (R038), (R039) and (R043), were recorded, each 1.5m deep and containing a mixture of shale and oily liquid. To the south of these tanks but within the same building, a brick wall, (R022), enclosed a complex of 15 brick cells (R027), 6m by 3m in plan, aligned east/west, and set over a brick and concrete base, 0.6m deep. It is possible this formed the foundation platform for a feature of the tar house, or of the two sets of condensers marked on the 1877 Ordnance Survey map.

6.7.19 Condensers or early boundary features

Two north/south-aligned stone wall base segments, (R018) and (R004), could potentially have been elements of boundary walls of the early Gasworks, as the area to their west was probably not incorporated into the Gasworks until its expansion in the 1840s. However, their cement bonding suggested that they belonged to the Gasworks and it is more likely that they were walls for the condensers depicted on the 1877 Ordnance Survey map (Illus 20). Wall (R004) stood to a maximum height of 1.4m, and was 0.8m wide and 8m long, while wall (R018), to its west was 10m in length.

6.7.20 Gasholder and tanks

A second gasholder base, (R016), of likely Phase 4 date, was recorded in the north-west of the site, one of those first depicted on the Ordnance Survey map of 1877, while nearby two large cast iron tanks were also recorded, (R011) and (R034). Tank (R011) was housed within a rectangular brick structure (R033), while a similar structure, (R028), measuring 4m by 2.5m in plan, was recorded between these two tanks.

6.8 Phase 5 (1906–1928)

When the Gasworks went out of use and was subsequently demolished in the early 20th century, written evidence suggests the area was turned into a park with a cinder football pitch, though no archaeological evidence for this was recorded (Baird 1959). The Gasworks structures were demolished and levelled, evidenced by the infilling of many of the deeper features with brick and stone rubble. The buildings of the Gasworks were demolished down to the ground floor level and cobble surfaces survived over much of the site along with the lower half of the retort furnaces and basement level features.

6.9 Phase 6 (1928 onwards)

The only archaeological features to clearly post-date the Gasworks belonged to the New Street Bus Depot that occupied the area until the beginning of the 21st century. The depot was largely demolished prior to the archaeological excavations but was recorded as part of a previous programme of work (Trickett 2005). However, 25 roof support foundation pillars were recorded during the excavation across the south and centre of the site, aligned in four rows running north/south in line with the pitched roof. Each of these large brick pillars was topped with a large concrete block. The pillars generally measured 1.75m by 1.60m in plan and they were between 2.5m and 3m in height. To the north, further concrete foundation blocks associated with the bus depot were identified, with some up to 2.5 metres square and 0.5m thick.

Further features attributed to the bus depot were five sections of concrete flooring that were interpreted as the bases of inspection pits, the side walls having been demolished. Two of these, (J0004) and (J0005), were aligned east/west and measured 6.95m by 1.0m in plan and were approximately

0.15m thick. Both floors contained a small sump area, each with an iron cover and surrounded by the remains of a brick wall. Two large cylindrical fuel tanks, (N0182) and (N0183), also belonged to the bus depot. These tanks, in the west of the excavated area, measured 9.5m in length and 2.5m in diameter and were enclosed within brick walls, (N0181). Drainage channels, such as (D0037)

and (H0007), and associated manholes, (E0004), (D0143), (H0039) and (G0022), which ran north/south across the site, were also associated with the depot. The works in the north of the former Gasworks revealed two brick walls, (R055) and (R056), associated with the bus depot (Illus 38); several further short segments of brick walls, (R008), (R009), (R010) and (R029), were also recorded.