

Phoenix Park Magazine Fort 2016 Excavations



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archaeology plan

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REPORT AUTHORS

Antoine Giacometti MA MIAI & Philippa Barry BCLG HDip MAHO
Paula Kehoe, monitoring archaeologist

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ABBREVIATIONS USED

DoHLGH	Dept. of Housing, Local Government & Heritage
NMI	National Museum of Ireland
NMS	National Monuments Service
OS	Ordnance Survey
RMP	Record of Monuments and Places
RPS	Record of Protected Structures
NIAH	National Inventory of Architectural Heritage
LAP	Local Area Plan

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Section 1 Introduction

Report summary

This report describes the result of archaeological work carried out from 08/06/2016 to 27/07/2016 for the Office of Public Works (OPW). As part of a wider plan to restore and present the Magazine Fort to the public, the Magazine Stores were cleaned and made safe, and the fort ramparts were excavated in two locations (A and C) to allow for the erection of temporary walkways and for future restoration of the parapet wall and walkway.

Five phases of work were carried out.

- a) Lifting and storing the walkway stone
- b) Reduction of rampart level
- c) Cleaning of cobbled surface
- d) Erection of temporary walkways

- e) Cleaning of Magazine Stores

Archaeological monitoring of these works revealed multiple phases of improvement from its construction in c. 1736 to its transfer to the OPW in 1988. These include a significant and previously-undocumented phase of improvement dating to the early 19th century, perhaps reflecting the threat imposed by the Napoleonic Wars, new information on the original configuration of the 18th century fort, and the recovery of numerous mid-20th century magazine boxes in the Magazine Stores.

In addition to this, a number of observations were made regarding non-impacted parts of the Magazine Fort, and these are documented in the second half of this report.



Areas A, B and C described in the report (no work took place in B)

Background

The Phoenix Park Magazine Fort is an impressive mid-18th century fortification situated in the south of the Phoenix Park, near the Island-bridge Gate, in Dublin 8.

In 1734 Lord Lieutenant Sackville, Duke of Dorset ordered the construction of a powder magazine in the Phoenix Park and an initial sum of £2,300 was made available for the project. Part of the impetus for the construction of the fort was the need for safe store for gunpowder. The Powder Tower in Dublin Castle had almost exploded during a fire at the castle in 1684, after which it was moved to a flanker at the Royal Hospital of Kilmainham (McParland 2001, 140). The relocation of the powder magazine to the Phoenix Park reduced the risk of large-scale damage in the event of an accident, while keeping the valuable stores in easy reach of Dublin Castle and the Royal Barracks (ibid, 4), and other nearby military institutions near the Phoenix Park.

The site selected for the fort was a hill with commanding views south across the Liffey valley, and across the river to the Dublin Mountains, named Thomas' Hill on the first-edition 6-inch map (OS 1837). Thomas' Hill was the site of an early seventeenth-century house built by Sir Edward Fisher c. 1611 (Litton-Falkiner 1901, 470). Fisher's dwelling was set in substantial grounds and included 300 acres of land and 60 acres of woodland, known as Kilmainham Wood. His holding became Crown property in 1618, and from at least 1619 the house was known as 'the Phenix'. The Phoenix House became the principal residence of the Chief Governors of Ireland until 1665, and its occupants included the Earls of Strafford, Henry Cromwell, and the Duke of Ormond (Ibid, 470-1). The house was augmented by its owners, including the addition of stables, an additional wing, and a chapel (Ball 1901, 182). Ormond's most significant achievement was the development of the landscape around the house. He purchased lands contiguous to Phoenix demesne enlarging the holding to above 2000 acres and commenced the construction of a stone wall emparking the lands for deer (Litton-Falkiner 1901, 476).

By 1734, when the Lord Lieutenant decided to build the Magazine Fort, the viceregal residence had long ago moved to Chapelizod (in 1665) and the Phoenix House had been demoted to a residence for the Lord Lieutenant's staff. In 1719, for example, it was occupied by an official with the title 'Gentleman of the Horse' (ibid, 473). The house was completely demolished during the construction of the fort, and the building was supposedly used as a quarry for stone (Litton-Falkiner 1900-2, 473; McCullen 2015, 4), but there is no evidence of any stone or brick of the Phoenix House being re-used anywhere in the Magazine Fort (Giacometti 2015, Gleeson 2017).

The Magazine Fort was designed by Irish Ordnance military engineer John Corneille (Casey 2005, 306). Construction was started in 1734 and completed in 1736 (McParland 2001, 140). Corneille's design was for a bastioned fort, a form whose origins lay in early modern Europe. The development of artillery from the 1400s had a profound impact on military architecture. Defences came to include thick earthen ramparts to absorb the shock of gun fire and wide platforms with space to mount cannon (Barrass 2011, 2). Bastioned forts first appeared in the first quarter of the sixteenth century in the north of Italy, and they remained a mainstay of military architecture into the nineteenth century (Kerrigan 1995).

The fort is quadrilateral in plan with demi-bastions on each corner. Its ramparts are thick stone-faced earth and rubble banks, and it is surrounded by a flat-bottomed dry ditch. The main gate to the fort had a date inscription of 1736 on the keystone and a Latin inscription above stating it was constructed during the reign of George III by Lord Lieutenant Lionel Sackville, Duke of Dorset. The gate was dismantled in the early 1970s by the Defence Forces (OPW File P2/144, 11) and these fragments are currently stored in the cooperage/wagon shed.

In addition to the ramparts, the earliest building at the site were the powder magazines. These have large brick vaults and incorporate complex ventilation systems within their thick brick walls. Two of the magazines are original to the fort, and the first documentation of powder and

shot supplied to the fort dates to 1738 (Kerrigan 1995, 136, cited in Arnold 2008, 7). Gunpowder was produced locally during the 18th century, for example at the Kilmatead Powder Mills in Clondalkin (SDLLS 2013). The magazine building was expanded in 1758, when the Duke of Bedford (Lord Lieutenant) requested the construction of an infill between the two original valued magazines (McCullen 2015, 4) designed by Thomas Eyre, Surveyor General. The Magazine Store design and engineering are heavily influenced by the 17th century work of Sebastien le Prêtre de Vauban, Chief Engineer to King Louis XIV of France (McParland 2001, 140; Gleeson 2017, 72-4).

One of the earliest depictions of the fort is on Roque's 1756 map of Dublin. The map shows the original rampart line with circular towers protruding from each corner. The fort is surrounded by a ditch which is crossed by a causeway leading to its east gate. Four buildings are depicted in the interior: the two magazines enclosed by a boundary wall, and two other structures either side of the entrance near the east wall. Brown's map of the Phoenix Park (1789) shows the magazine buildings and the drawbridge accessing the fort.

The fort was surveyed in 1793 by George Armitage. The survey shows the original ramparts with five internal buildings: the magazines, an ammunition magazine, officers' rooms, a guard room and a sentry box. The survey shows a howitzer gun protecting the entrance, which is accessed by a drawbridge over the ditch. It depicts ramps accessing the ramparts at the NE, SE, and SW bastions, and watchtowers at the corner of each bastion. A survey from 1806 (UK National Archives MPH 1/682/2) shows that the watchtowers were supplemented by wooden platforms, and additional stores, a cooperage, and a blast wall had been added to the fort buildings.

A ravelin or barrack block was added in 1801 to the east of the fort. The addition was designed by Francis Johnston (Casey 2005, 305), and comprised buildings arranged in a V-shape that housed quarters for sergeants, officers, and soldiers, as well as offices, a guard room and a cookhouse (Arnold 2008, 10). The ravelin was initially separated from the fort by the dry moat,

and was only connected with it later in the 19th century.

A second extensive programme of renovation took place at the fort after 1806, perhaps reflecting the threat imposed by the Napoleonic Wars. During this phase, the ramparts were widened at the bastions to accommodate gun platforms and four corner cavaliers, the parapet was raised, and a stepped parapet walkway was added (Giacometti 2015). These alterations considerably altered the fort and greatly improved its defensive nature.

The fort continued to develop in a piecemeal fashion throughout the 19th century. During this period additions include a new cooperage, cooperage stores, a wagon shed, an engine house, and stores (Arnold 2008, 8). Dated plans housed in the Military Archives provide 19th century dates for the construction of a new wagon shed (1875), a shifting room (1877), and an exam room/ laboratory (1878) (ibid, 9). Another phase of building occurred at the turn of the 20th century with the addition of ablution rooms, toilets, a women's wash-house and a coal store (ibid, 9, 11, 13). Circa 1903 plans were drawn up for the conversion of the cavaliers for use at guncotton stores. The fort was handed over to the Irish Army in December 1922 (McCullen 2015, 13). Other 20th century additions to the fort include the replacement of the NW cavalier with a concrete cordite store, the construction of a mass concrete sentry box, and an iron reception shed/bakery c.1921 (Arnold 2008, 7, 10).

The Magazine Fort was raided twice during the 20th century. On Easter Monday 1916 a failed attempt was made to blow up the fort, acting as a signal for the Rising. Another raid on the fort took place on 23 December 1939, when the IRA attacked with the aim of capturing munitions. The raid was initially successful but most of the stolen arms were recovered in the days following (McCullen 2015, 13). The fort was managed by the Irish Defence Forces until 1988, at which point the Commissioners of Public Works took over ownership (OPW File P2/144, 99).

Previous research on the fort

Unpublished reports and surveys of the Magazine Fort include a statement of significance prepared by Paul Arnold Architects in 2008, a comprehensive topographical survey by BPM Surveys Ltd in April 2008, a historical report on the fort by John McCullen in 2015, a detailed archaeological assessment and survey of three of the fort bastions by Giacometti and Campbell in 2016, and a thesis on the Magazine Stores and their conservation with an emphasis on brick by Pauline Gleeson in 2017.

Two unlicensed programmes of metal detection have been carried out near the fort. One of these in 1984 (NMI Topographical File IA/136/84) uncovered a cache of military equipment near the fort that included 18th century musket balls, an 18th century Scottish lead token, 19th century military uniform buttons, an eyelet-type fastener, a bone spoon and a horse-harness ring. It appears these were taken from the backfill of a pipeline being archaeologically-monitored by Margaret Gowan (NMI Files). The second is documented by McCullen (2015, 7) and relates to the discovery of a cannon now in Collins Barracks (no Topo file ref). There is no other record of the investigation and according to Lar Joye in the NMI the cannon in question originated from a ship rather than a fort (pers. com. 2016).

Archaeological testing was carried out at two locations in the rampart in 2010 (Johnston, unlicensed) which found relatively little of interest. A second programme of archaeological testing was carried out in 2015 in three locations of the rampart and identified three phases of rampart construction (Giacometti 2015, License 15E0540). A subsequent programme of archaeological monitoring (Giacometti 2016 & in prep, License 15E0540) uncovered further detail about the three phases of construction in the north-western demibastion, and documented military artefacts found in the Magazine Stores.

Archaeological significance

The Phoenix Park magazine fort is a Recorded Monument (RMP DU0018-0719) and Protected Structure (RPS 6896). The 2008 Statement of

Significance notes that it is one of the major surviving magazine forts in the country and, on the basis of its architectural, historical and technical aspects, assigns the fort complex a 'National' rating (Arnold 2008, 1-15), further noting that the fort's highly recognisable form makes it one of the Phoenix Park's most important landmarks (ibid).

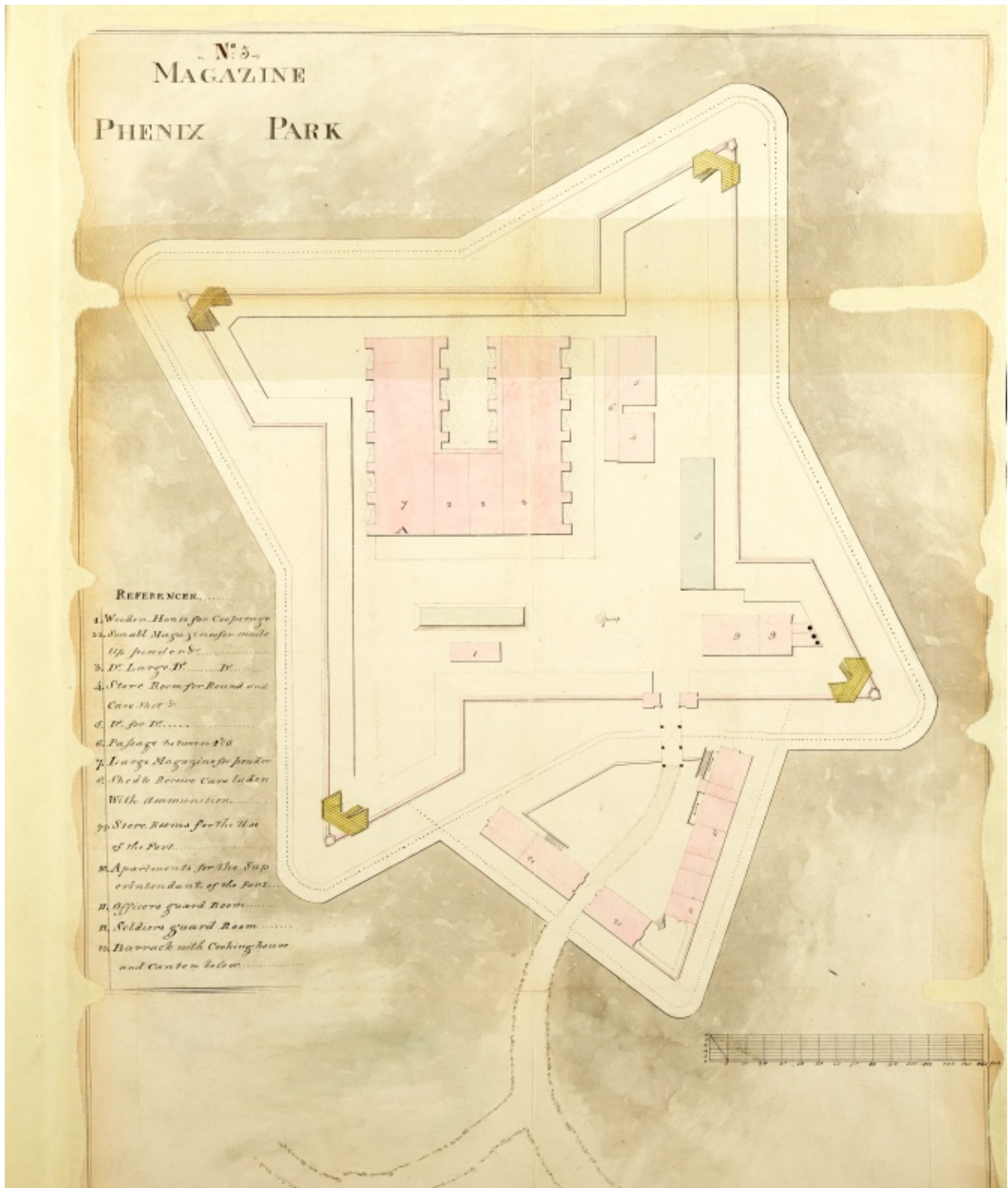
From an archaeological point of view, however, the fort forms a key element of the wider archaeological landscape of the Phoenix Park (RMP DU018-007---), which includes the 17th century deer park and the site of the 17th century Phoenix House (RMP DU018-0713), as well as numerous other archaeological monuments such as the nearby abandoned star fort ('Wharton's Folly'). It is also set within the wider historic military quarter of west Dublin which includes military and institutional buildings both within and outside the Phoenix Park including the Royal Hospital Kilmainham, Royal Infirmary, Collins Barracks, Ordnance Stores, etc. This setting enhances the archaeological significance of both the Magazine Fort and the Phoenix Park, and consideration should be given to the archaeology and landscaping of the areas surrounding the fort in future plans for the Phoenix Park.

Another key factor of national archaeological importance is the role the fort played in Irish independence, from symbol of the British military presence in Ireland to site of Nationalist struggle at key moments in history. In 1882 the Invincibles (Fenians) assassinated the British secretary Lord Frederick Cavendish nearby; in 1916 the Magazine Fort was captured by rebels and failed to explode properly to signal the beginning of the Easter Rising; in 1939 the IRA stole a huge quantity of arms in the Christmas Raid; and in 1941 the magazine fort was converted to the 'Paxo Plant', making chlorate weapon ammunition and grenades during the Emergency, the physical evidence for which is still present in the form of a kiln, mixing and kneading machinery.

Gleeson (2017, 18) sets out the factors that make the Phoenix Park magazine fort a national - if not international - archaeological monument: 'the rarity of the monument, its setting within the internationally important Phoenix

Park, its wider connection to military infrastructure of Dublin in the same period, its early use of brick in wide spanning structures, its design associated with Corneille, Eyre, Johnson and de Vauban and its role on Easter Sunday 1916'. Similar forts in other countries have become UNESCO World Heritage Sites, and at the very

least the Phoenix Park Magazine Fort should be treated as both a National Monument within the meaning of the National Monuments Acts 1930-2014, as well as a critical component of a wider archaeological landscape of national significance that encompasses the Phoenix Park as a whole.



1806 plan of 'No 3 Magazine Phenix [Phoenix] Park' Scale: 1 inch to 30 feet (UK National Archives MPH 1/682/2)

Section 2 Lifting and storing the stone

Introduction

This phase of work involved the cleaning of accumulated overlying debris on the rampart walkways, gun platforms and sentry platforms of Areas A and C, numbering and recording of each stone, lifting each stone, and the temporary storage of each stone.

The rampart walk

The rampart walkways at the Magazine Fort are constructed on two levels. The paving stones are finely cut granite slabs linked by lime mortared joggle joints, set over square-cut limestone blocks with straight sides and peck-dressed faces. They are bound by lime mortar and have been repointed using cement strap pointing. The granite slabs on the upper step were keyed into a crude trench cut out of

the earlier brick parapet wall. The walkway has an overall width of 1.44m. The lower step is c.410mm high (310mm limestone wall; 10mm granite slab) and 700-740mm wide. The top step is c.360-440mm high (340mm limestone wall; 100mm granite slab) and 690-700mm wide. Further detail of the walkway is recorded in the 2015 assessment. The core of the steps and raised walkway was rubble and soil and included discarded brick identical to that cut out of the parapet wall. The rampart walkways in Areas A and C (the southeast rampart and northeast rampart) had partially collapsed, due partly to having been constructed with inadequate foundations.

Vauban, an influential French military engineer, describes similar rampart walkways in his fourth book of his *New Treatise of Fortification* (1691, IV, Chap. VII). 'At the foot of the Parapet, upon the platform, are usually made two

Area A walkway prior to lifting





Area C walkways and platforms prior to lifting

little steps or small banks, of which the first is about two feet broad. Goldman makes it four feet, Freitag three, the Count of Pagan two. Monsieur Clermont the same; and one foot, and one foot and a half high: wherein they all agree. There are two made, for that the soldiers are

not all of an equal height. So that the low men are placed upon the upper step or bank next the Parapet, and the taller upon the lowermost: so that every one may have a view from the Parapet, and discharge at his ease.'

A build-up of organic material and debris measuring approximately 0.13m in depth was removed by hand using spades and shovels. The cleaning on the walkways, gun platforms and sentry platform (SP1) in Area A revealed no new features. In Area C the cleaning of the walkways and the two gun platforms (CC1 and CC2), revealed a previously suspected sentry post (SP2), initially identified in 2015. Cleaning of the west-facing gun platform in Area C (CC2) revealed that it was larger than it initially appeared and had been partially resurfaced in a thin layer of concrete. This was documented, then removed by hand using a wedge-point crowbar which could break up the concrete not damage the underlying stone.

Timber and ferrous metal fragments of a mechanism (possibly a crane or pylon) lying on the surface of the stone platform (SP2) and grass were recorded in situ, collected, and stored in Building B for future analysis.

Gun platforms

The two gun platforms were visible on the ground in Area C as sunken areas of differential vegetation (shorter and less lush vegetation). These match up with two visible gun openings (800mm wide internally by 1.48m-1.50m high (from top of sillstone to top of parapet capstone) set into the south and southwest parapet wall. The openings are lined with cut granite quoins and sills, and blocked up.

Following removal of the overburden by hand, the smaller gun platform in the south of Area C (CC1) was found to measure 3.7m in length and 3m in width, and be constructed out of twenty large granite paving stones.

The larger gun platform in the west of Area C (CC2) was longer than expected, extending 2.3m further north past the cement steps, which were built over it. It measured 3.75m in length and 7.5m in width. The construction of the cement steps partially removed the northern end of the platform. This wider platform was originally associated with two gun openings, the northernmost of which was blocked up in cement after 1944, but is still discernible from the exterior of the fort and in the darker colour of the render. The granite capstone covering the break in the wall must be a re-

placement from elsewhere and it does not have the circular impressions on the top that are seen on the other granite capstones. This would also suggest that the render covers, or that the 20th century cement reconstruction removes, another plaque noting direction or location from Area C. The arrangement of the double-gun platform and its proximity to the sentry post (SP2) is mirrored in Area A, the demi-bastion directly opposite Area C.

Area C gun platform CC2 prior to lifting





Sentry post SP2 (top) with machinery, and sentry post SP1 (below)

The sentry platforms probably held light wooden sentry shelters. The sentry posts are not positioned to provide views out from the fort walls. Rather, like the sentry walks and promenades in the interior of the fort, they provide views within the fort and around the magazines, and they may also allow an officer in the centre of the fort to rapidly ascertain all key lookout points are occupied.

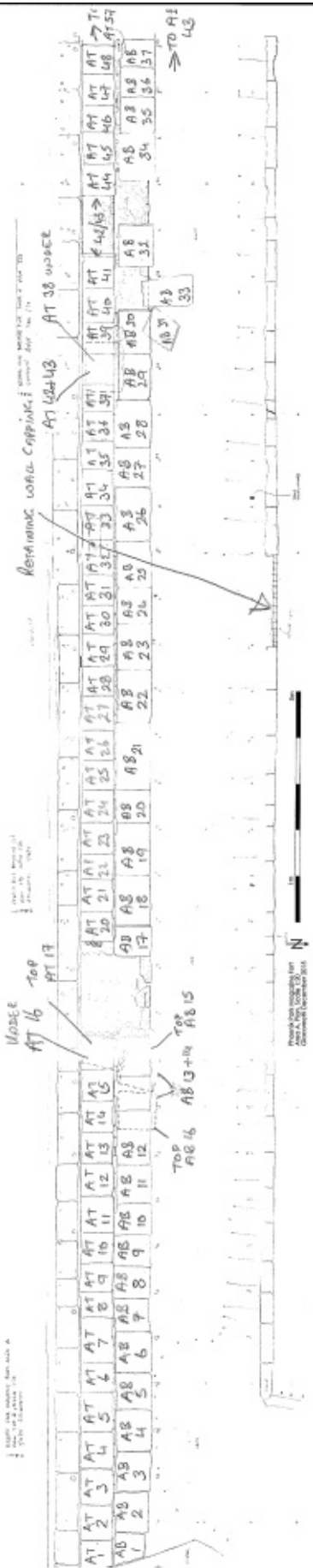
The Area A (SP1) and Area C (SP2) posts were identical and comprised six to eight granite flags set out in a square 1.8m across. The timber and ferrous fragments of a possible crane or pylon found on sentry box SP2 in Area C were recorded and photographed in situ, then wrapped in shrink wrap and placed in Building B with the granite slabs from the platforms.

Sentry posts

The position of granite sentry posts in the fort follow a clear pattern: one in each demi-bastion near the gun platforms, and one roughly in between each demi-bastion, making a total of eight. A ninth sentry post is situated in the centre of the fort. These are labelled as ‘sentry posts’ on the 1859 survey. They are consistent in size, at 1.80 x 1.80m square, construction, and location, and all are likely to be contemporary. The two sentry posts previously located in the northern ramparts are now missing.

Lifting and storing

The walkway stones were drawn and photographed in situ, then lifted, turned upside down and numbered on the underside using a white water-based paint using the following system: Area - Top/Bottom - Stone Number (from SE-NW) 1-57 (Area A) or 1-20 (Area C) . For example, stone AT1 is Area A, top row, stone 1 at east. AB10 is the tenth stone on the bottom row from the east. Stone CT3 is the third stone on the top row from the south in Area C. Damaged slabs were recorded as above, and when



Numbering of Area A walkway



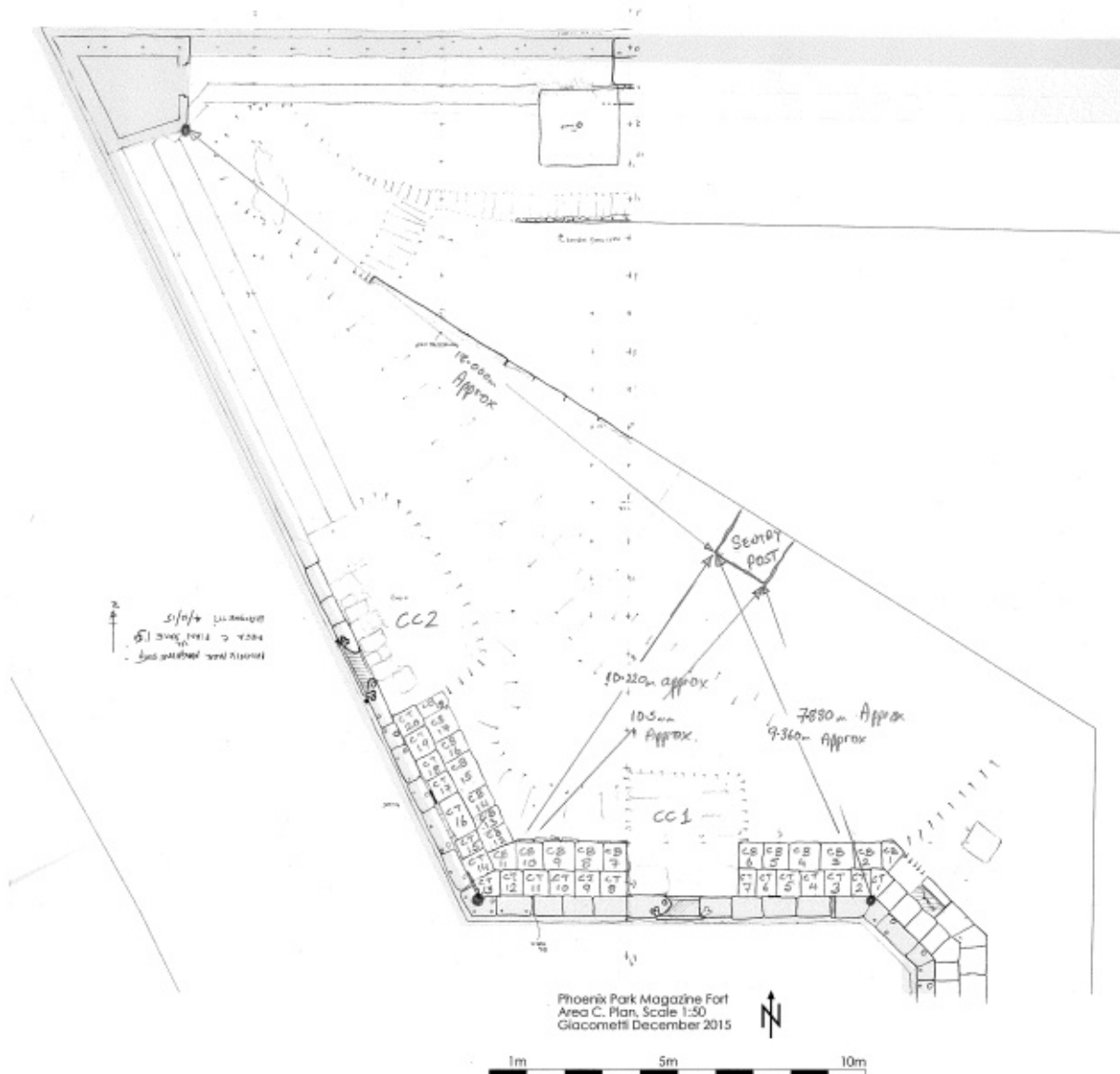
Area C - numbering of sentry post SP2

lifted were wrapped in shrink wrap so that all the fragments of the slab could be stored together. The pallets were also labelled in case the water-based paint used on the stone wore away.

Once the granite paving slabs of the walkway were lifted and stored, the retaining limestone risers from the face of the walkway were removed. It was not possible to number each facing stone individually, therefore they were stored in rubble bags according to their position within the walkway. For example, retaining stones for granite slabs 1-10 were in a bag marked 1-10A or 1-10C and stored close to the respective slabs.

All stones from Area A were stored in the Wagon Shed (Building E). All stones from Area C were stored in the Bakery/Reception Shed (Building B).

Ex situ granite paving blocks on the walkways were recorded and individually numbered as per



Area C - numbering of walkway and location of SP2

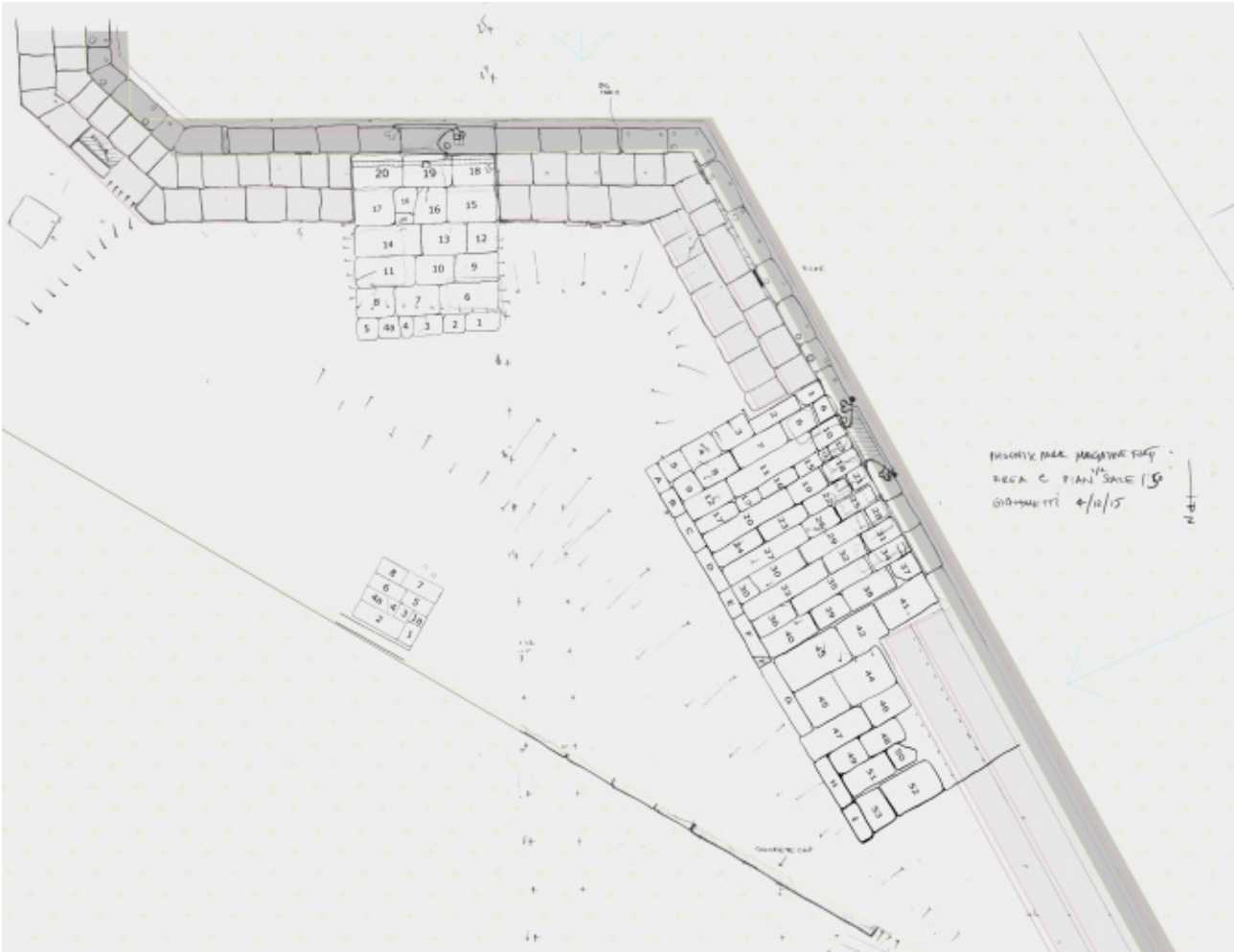
their presumed original locations and stored with the in situ blocks. A single ex-situ granite parapet wall or retaining wall capstone was lifted, not numbered, and stored with the paving stones at its location. The original position of this stone within the fort could not be determined.

The two gun platforms in Area C were lifted in the same way as the walkway stones, and numbered CC1 1-20 (Area C gun platform 1, to south, stones 1-20) and CC2 1-53 and kerbs A-I

(for gun platform 2 to the west). Arrows were sprayed on the underside of the stones pointing away from the wall to indicate direction which the stones were laid.

The sentry posts were composed of 6 (Area A) to 8 (Area C) granite paving slabs. These were termed SP1 in Area A and SP2 in Area C.

The timber and ferrous fragments of a possible crane or pylon found on sentry box SP2 in Area C were recorded and photographed in situ, then



Area C - numbering of gun platforms and sentry posts

wrapped in shrink wrap and placed in Building B with the granite slabs from the platforms.

Two capping stones from the inner rampart retaining wall were also removed to facilitate the temporary gangway walk.

Table explaining numbering of labelling and storing of masonry

Numbering	Area	Description	No. of stones
AT1-53	Area A	Upper step of walkway	53
AB1-47	Area A	Lower step of walkway	47
CT1-20	Area C	Upper step of walkway	20
CB1-18	Area C	Lower step of walkway	18
CC1 1-20	Area C	Gun platform (south)	20
CC2 1-53 & a-i	Area C	Gun platform (west)	62
SP1 1-6	Area A	Small platform	6
SP2 1-8	Area C	Small platform	8
N/a	Area A	parapet wall/retaining wall cap	1
Total granite blocks removed and stored			235

*** Note: this excludes uncounted limestone walkway retaining stones

Section 3 Ground Reduction



Following the removal of the stone walkways and platforms, the soil across the top of the rampart was carefully reduced by small mechanical excavator under archaeological supervision down to by 700mm in depth. Six features were identified (three drains, two walls, and a footing). The anticipated 19th century gravel path identified in the 2015 testing turned out to be a thin layer of gravel that extended across the entire area. During ground reduction works a segment of the earlier rampart retaining wall was uncovered in Area C. This was monitored closely to ensure the wall was not damaged by the machinery and was then cleaned by hand.

Area A

The uppermost layer in the Area A rampart was a dark brown sandy-clay topsoil containing infrequent inclusions of charcoal and pottery (C1) measuring 210mm deep. Below this was a loose mid-brown sandy-clay 210mm in depth (C2). Animal bone and oyster shell were identified near the base of the deposit. Bullets of probable 20th century date were found in this layer and in the layer below (15E0540:2:1 & 15E0540:3:2).

This was underlain by a thick layer of compact mid-brown sandy-clay (C3) containing fragments of red-brick, animal bone, oyster shell, pottery and sporadic flecks of charcoal. The layer was at least 400mm in depth and extended down below the base of the excavation. This layer was the primary fill material of the upper rampart, dating probably from the 18th century. Early 18th century pottery, including North-Devon gravel-tempered earthenware, Bristol-Staffordshire slipware, and a Dutch-style hand-painted tin-glazed wall tile (15E0540:3:3-9) support the interpretation of this fill as original to the 1736 construction of the fort.



Rampart ground reduction in Area A

Area C

A thick (400mm) deposit of heavily mortared rubble (C6) directly below both Area C gun platforms had been used to bed-in the granite flagstones. This was removed by machine. This layer had been previously misinterpreted as the earlier rampart wall during the 2015 testing programme. Two iron fittings found in this layer below gun emplacement CC1 may have been associated with the emplacements (15E0540:6:1-2).

Outside of the gun platforms, the uppermost layer in the Area C rampart was a dark brown sandy-clay topsoil containing infrequent inclusions of animal bone, charcoal and pottery (C4) measuring 200mm deep. This contained a cache of eight 20th century marbles (15E0540:4:4-10) that may have been hidden here by the caretaker's children or soldier's children. Below this was a pale brown silty-clay with frequent small stones, grit and gravel measuring c. 100mm deep (C5). This layer was patchy, but survived over most of Area C, and is likely to be the remains of the 19th century gravel surface recorded in



1m by 1m hand-excavated square test-pit through later rampart fill (C9)

Mechanical reduction of Area C, with exposure of earlier rampart wall in foreground





Gun emplacement drain base cut into outer rampart wall



Detail of gun emplacement following ground reduction



Profile below concrete walkway, showing gun platform and masonry fill directly below concrete

the 1859 survey. It contained a bullet (15E0540:5:1).

Below these upper layers the earlier rampart wall became visible, running northwest-southeast through the Area C rampart. Either side of the wall was a mid-brown sandy-clay with inclusions of broken red brick, pottery and sporadic flecks of charcoal. This was termed C9 (later rampart fill) to the northeast of the wall, and C17 (earlier rampart fill) to the southeast of the wall. Both layers measured at least 400mm deep and extended below the base of the excavation. A 1m by 1m and 1m deep test-pit in the later fill (C9) identified nothing of interest.

The broken red brick in the fill of the early rampart was carefully examined, in case it could have derived from the earlier Phoenix House. Some of the brick had evidence of a lime mortar indicating that they were at one time used as building material. However, the brick was identical to the brick in the parapet wall and the same as the brick in C3 in Area A. No evidence for 17th century brick was identified during the excavation. One sample of a brick dating to 1736 from the Magazine A, courtesy of Pauline Gleeson, was analysed by ALS and may be helpful in building up a future database to establish the origins of these early Irish red bricks.

Drains

Surface drains had previously been noted in the form of grooves along the edge of the gun platform closest to the parapet, draining into a hole in the platform. The underground parts of the drains were exposed following removal of the platform. The entry shaft of each drain was brick-lined and square in plan (0.2-0.27m across) and had been cut 0.25m deep into the original masonry rampart wall. The drain shaft was located centrally to the southern gun platform, but off-centre to the western gun platform. This off-centre location in the latter case was due to the former presence of two gun openings: the shaft is centred on the northern, now in-filled opening.

The drains themselves were lined with brick and measured 0.11m-0.14m. The brick was bonded by a distinctive pink lime mortar, and they were cut through the original rampart retaining wall, and also cut through the later rampart fill (C9). The two gun platform drains converged into a single larger drain which was capped with sandstone slabs, and ran into the later rampart retaining wall, which appeared to be broadly contemporary. The discovery of these drains is significant, because they demonstrate that the gun platforms belong fully to the later phase of the rampart (c. 1800) and were contemporary with the widening of the rampart.



Overview of gun emplacement drainage, facing south



Detail of section where gun drains converge into a stone-lined drain



Detail of brick-lined part of drain



Detail of early (1736) rampart retaining wall



Overview of early rampart retaining wall



View of early brick phase of outer rampart wall

Part of the fill of the drain (a fine black silt, C8) was hand excavated and a clay pipe stem was found. This is interesting as smoking was probably banned in the fort. It may suggest a naughty nineteenth century soldier was having a sneaky smoke at the gun platforms.

Earlier rampart wall

The early phase (c. 1738) of the internal rampart wall was identified during soil removal. Construction was of limestone with a lime mortar bonding, and was identical to the later wall (c. 1801) except for an angled capping of small stones on the interior side of the (missing) capping. This is not present in the later wall (which has a thick coat of crude lime mortar in the same location) but is present in the rampart wall to the southwest of the bastion, suggesting that the latter wall can also be dated to c. 1738. The original rampart measured c. 3.5m wide, which is the current width outside the demi-bastions. The capstones of the early phase wall had been removed at some stage, but the lime bedding for the capstones was present and suggested that a granite capping had been removed, and was probably reused on the later phase wall. The height of the wall was the same as the later wall in the southwest of Area C. However, whilst the later phase wall rises up to form the ramp up towards the cavalier, the early phase wall remained at the same level,



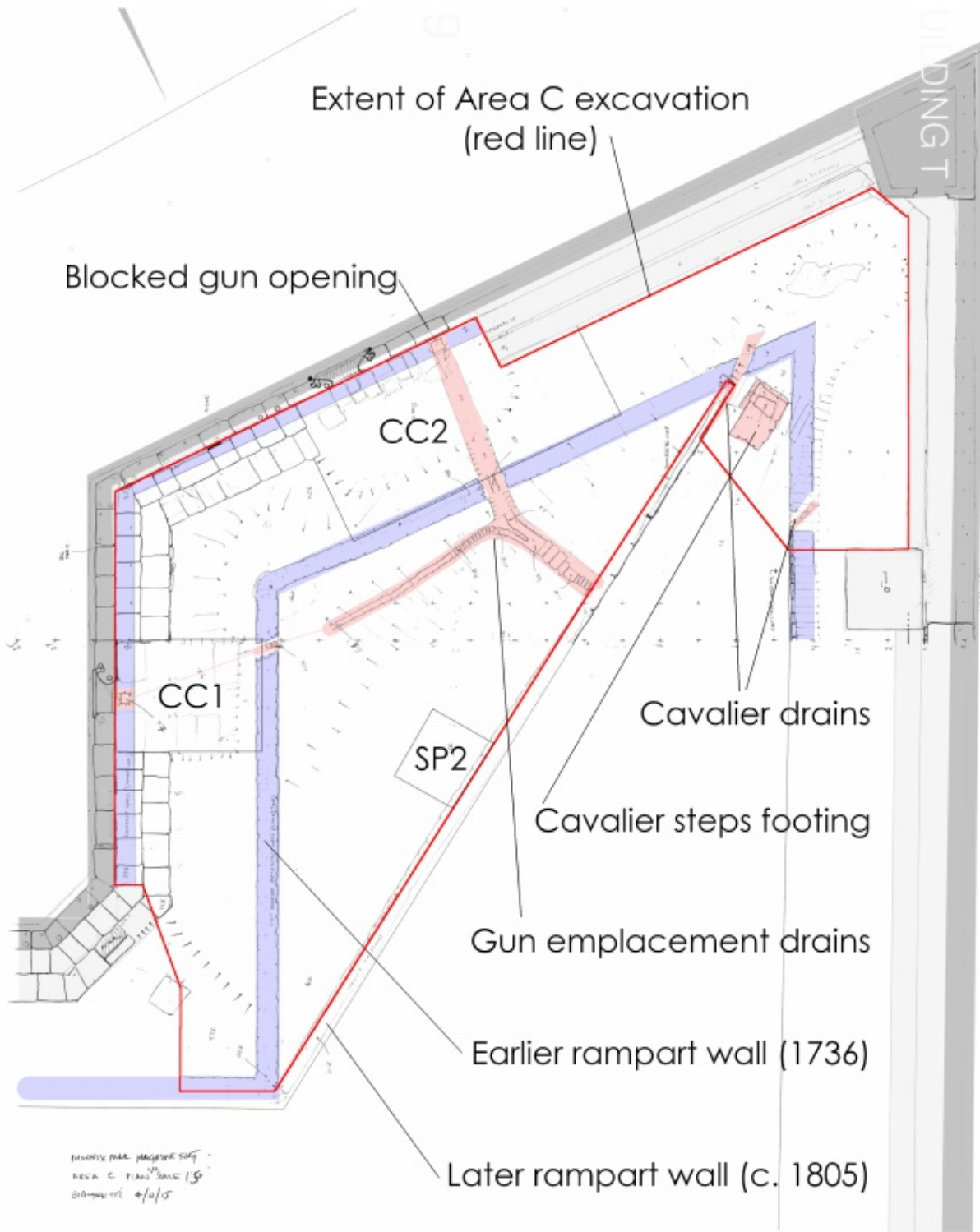
Excavation of corner of early rampart retaining wall, 1736, showing rectangular masonry footing for cavalier steps, c. 1801.



and so is c. 500mm below the later wall to the northwest.

Cavalier

Evidence for the former cavalier was identified in the form of a large cut filled with demolition rubble from the structure. This cut was respected by the edges of the concrete walkway renovation, and probably represents the early 20th century levelling of the damaged cavalier, parapet and walkway in advance of the concrete reconstruction of the bastion. Further traces of the former cavalier were found in the form of two drains and a footing, all situated to the southeast of the former cavalier. Fragments of fine English stoneware drinking vessels and bowls (15E0540:7:1-2) found in the cut of the cavalier drains date to the 18th or 19th century, fitting the 19th century date for the construction of the cavalier.



1m 5m



Finds from the excavation

Ceramic

- Bristol-Staffordshire slipware, one sherd (3:4), a basal fragment of mug or bowl, pale pink fabric with pale yellow glaze, generally dating to 1700-1720 but originating from the mid-17th century.
- North-Devon earthenware, four sherds (3:5-8) probably all from a single heavy storage pot with a plain rounded rim of late 17th or early 18th century date.
- Refined whiteware, one sherd in three fragments (3:3) from the base of a plate with transfer-printed multi-colour flowers, dating to the 19th or 20th century.
- Stoneware (English), four sherds. two sherds (1:1-2) are from 19th or 20th century utilitarian storage vessels, and two sherds (7:1-2) from fine 18th century drinking vessels or bowls.
- Clay pipe, two non-diagnostic stem fragments (4:11 & 8:1)
- Wall tile, one fragment (3:9) from a tin-glazed wall tile of Dutch style, with blue hand-painted decoration and corner motif. Tin-glazed floor tiles were in production in the Netherlands in the 16th century, and in Norwich and London by the end of the 16th century and continued to be manufactured well into the 18th century.

Glass and stone

- Marbles, six glass marbles (4:5-10) and 1 highly-polished white stone (4:12) that is likely to be related. Two are opaque and pearlescent in green and white and four are clear with 'cat's eye' coloured cores. All are 20th century in date.



Metal

- Six rusted iron fittings including nails (4:2, 9:10), a nut (4:3), a hoop (6:1) and two unidentified fittings (6:2 & 9:1).
- Three brass bullet casings (2:1, 3:2 & 5:1) and a coil of copper wire (4:1) with rubber casing adhering, from an electrical fitting

Composite

- One wooden stake and iron stake casing point (3:1).



Page 20, from left to right and top to bottom:
marbles 4:5-12 and stone 4:12; pottery and tile 3:3-0;
pottery 7:1-2; pottery 1:1-2; clay pipe 8:11

This page, from left to right and top to bottom:
wooden stake and iron stake casing point 3:1; iron fittings 6:1-2;
bullet 2:1; bullet 3:2; electrical wire 4:1



Section 4 Cleaning of cobbled surface

The cobbles in the centre of the main fort were cleaned using a RD80 brush cleaner. This was focused on the cobbles that would be walked on by the public visiting during the 2016 centenary event, and was therefore focused around the entrance to the ravelin and the central area of the main fort. The figure overleaf shows the cobbled areas of the fort in yellow, however the northernmost and westernmost areas of cobbling were not cleaned in this phase of works.

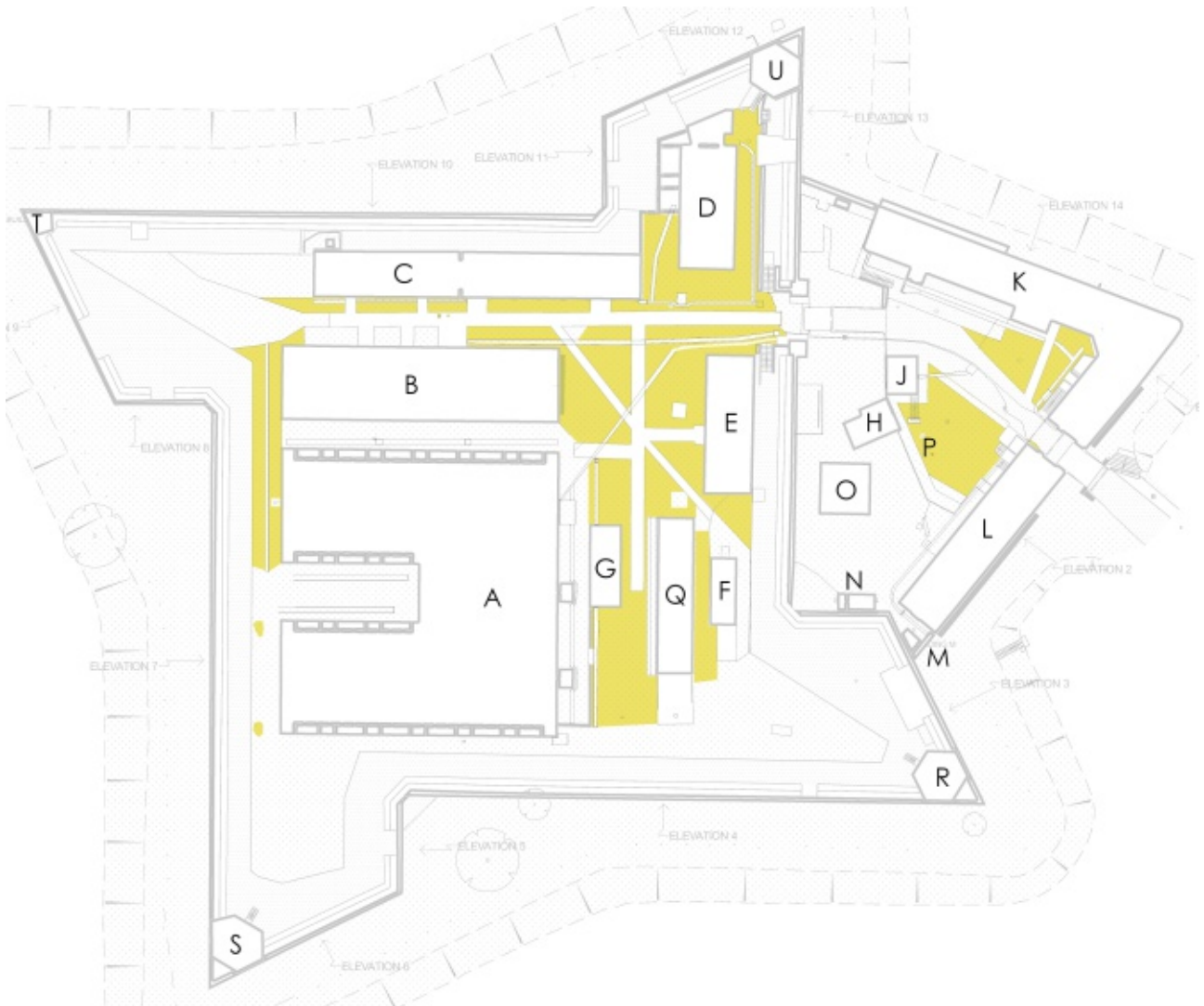
The cobbles are generally sub-rounded dark grey coloured stones 70-100mm in diameter. They appear to be set directly into gritty sandy soil with no trace of tar or bitumen or mortar bedding surviving, except alongside concrete paths or around manholes where they are set into concrete. They may have been set into sand



Iron object 18:2

Cobbles in main fort, from Folkestonejack 2016





which has since been mixed into the underlying soil. Linear arrangements of slightly larger rectangular-shaped cobbles formed surface gutters predating the 19th century brick drains.

The 1859 survey shades the cobbled areas in a light brown colour and identifies them as 'Pitch Pavement' in the key. A pitch pavement is made up of small stones set flat-side up and is a more correct term than cobbles to describe this surface. Confusingly, a later correction of the survey dating to 1881 labels an area of pitch/cobbling as 'gravel'. The reason for this is not known.

The cobbled surface is likely to be original to the construction of the fort in the 1730s and



Iron object 18:1

Iron object 18:2



Cobbles in main fort, from Folkestonejack 2016

was repaired and probably extended up to the end of the 19th century.

Bullet 18:3

Artefacts

Four artefacts were identified and assigned to C18 during the cleaning of the cobbles: two brass bullet casing fragments (18:3-4), the iron handle of a small pan or tool (18:2) and the square-sectioned point from a tool or furnishing (18:1). All are likely to be of 20th century date.



Section 5 Cleaning of magazine stores

Introduction

Stores A and C of Building A are among the earliest buildings inside the fort, dating to c. 1736. These have large brick vaults and incorporate complex ventilation systems within their thick brick walls. Two of the magazines are original to the fort, and the first documentation of powder and shot supplied to the fort dates to 1738 (Kerrigan 1995, 136, cited in Arnold 2008, 7). Gunpowder was produced locally during the 18th century, for example at the Kilmatead Powder Mills in Clondalkin (SDLLS 2013). The magazine building was expanded in 1758, when the Duke of Bedford (Lord Lieutenant) requested the construction of an infill between the two original valued magazines (McCullen 2015, 4) designed by Thomas Eyre, Surveyor General. The Magazine Store design and engineering are heavily influenced by the 17th century work of Sebastien le Prêtre de Vauban, Chief Engineer to King Louis XIV of France (McParland 2001, 140; Gleeson 2017, 72-4).

An in-depth description of the fabric and condition of the brickwork of the Magazines is contained in the thesis written by Pauline Gleeson (24/04/2017), whose fieldwork was undertaken during the 2016 works.

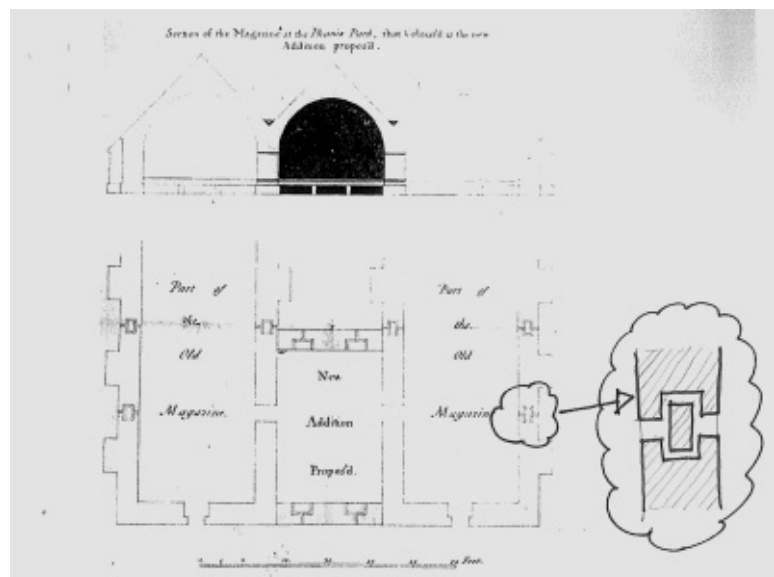
Methodology

The two earlier magazines have a wooden floor: in Building A this survives across the entire floor, and in Building C only a portion survives in the rear. The central building (B) has no floor. The floors sit on c. 1m high stilted walls above the ground. The floorboards are pegged with handmade wooden dowels in order to minimise the risk of sparking on metal nails (McCullen 2015, 6). The



Location of Stores A and C (part of Building A) in the Magazine Fort

'Section of the magazines at the Phoenix Park, 1758, with proposal to add another store between the two older ones' (PRO, T. 1/384/125) by T. Eyre, from E. McParland 2001, showing detail of air vent by Paul Kerrigan





Magazines Store A facing west



Store A Cavity 1



Store A Cavity 2



Store A Cavity 3

floors in Buildings A and C are likely to be original. Before works started, all three buildings were dirty and objects were scattered across the floors and under the floors, visible in breaks. The floorboards and dowels were examined and recorded by timber specialist Gordon Knaggs, who identified them as oak.

Objects under the floor visible through existing breaks, comprising mostly of modern beer cans, were removed. Large and obvious artefacts in Buildings A and C were placed in piles based on their locations within the fort and then examined by the archaeologist. Artefacts in two of these areas were retained as having archaeological interest (front part of Building A, back part of building A, contexts 15E540:11 & 12) comprising part of a window mesh and frame, a door frame, and two magazine boxes.

Following removal of the larger artefacts, the floor was first swept. Artefacts recovered during this work were recorded under context 15E540:10.

Next, the floor of Buildings A and C was hoovered with an industrial hoover and all material was sieved by an archaeologist and retained as appropriate (context 15E540:16). This material predominantly comprised window glass fragments, wooden dowels, and metal screws, nails and tacks (the latter probably from magazine boxes).

There were three large breaks in the wooden floor of Building A. These were numbered as follows:

- Cavity 1/ C13 is the largest break to the right as you enter the building;
- Cavity 2/ C14 is the smaller break with burnt edges to the left as you enter; and
- Cavity 3/ C15 is the break in the centre-rear of the building.

A specialist contractor trained at working in confined spaces (not an archaeologist) descended into Cavity 1 and began to clean out spoil and artefacts under archaeological supervision. A number of live bullets were immediately encountered, so the operation stopped, and the Defence Forces were contacted to remove the live ammunition and to make the area safe.

Tests were carried out on an unidentified black powder, and it was concluded this was not explosive.

Once it was safe to recommence work, the operation continued with a new, more limited methodology. Obvious and accessible artefacts visible in the cavities through the breaks in the floor were fished out from above, using a rubbish picker. The underfloor cavities were neither entered nor, consequently, fully cleaned.

All artefacts removed from the cavities were assessed by the archaeologist and all non-modern artefacts were retained, separated by cavity (15E540:13-15). These artefacts comprised mostly of magazine boxes. The cavity in Building C was not cleaned out.

All material removed from the Magazine Stores was sieved by an archaeologist through 5mm sieve mesh. No metal detection device was used, as it was not necessary.

Context register (Magazines)

Every artefact was assigned to one of the following context numbers:

- C10 Magazine Store A
Floor surface - general sweeping/hovering
- C11 Magazine Store A
Floor surface - near rear/west wall
- C12 Magazine Store A
Floor surface - near front/east wall
- C13 Magazine Store A
Underfloor Cavity 1 - largest cavity to NE
- C14 Magazine Store A
Underfloor Cavity 2 - burnt cavity to SE
- C15 Magazine Store A
Underfloor Cavity 3 - central rear cavity
- C16 Magazine Store C
Floor surface - general sweeping/hovering

Description of artefacts

Artefacts are described below by type. No ceramic artefacts, clay pipe or animal bone was recovered. Obviously modern (1980s+) items such as beer cans and cigarette butts, fragments of timber flooring other than dowels, very small non-diagnostic fragments of magazine boxes, and fragments of generic metal piping, were not retained.



C13 magazine box, from front



C13 magazine box, from rear



C13 magazine box, from side



C13 magazine box, detail of label



C13 magazine boxes



C13 magazine boxes



C13 magazine boxes



C12 magazine boxes

Magazine boxes

Two types of magazine boxes were recovered from Magazine Store Building A. The main type of box (Type A) is made of wood (pine?) and measures 400mm long, 210mm wide and 25mm tall. Two holes on each end hold a simple twisted rope handle. An opening in the top allows access to the contents. The box is internally lined with thin ferrous metal, which often survives better than the wooden box, with a sealed flap at the top for access. The boxes are painted green, perhaps as a wood preservative. These Type A magazine boxes would have carried .303 type VII ammunition for L Enfield Rifles which were used by the British military from c. 1910 and through to the late 1940s. The 12-8-18 on the label of one of the boxes may be a date, i.e. 1918.

Seven paper labels are present on the Type A boxes. Three front- and side-affixed labels read 'M G Bundle Packed' in black on white. Another front-affixed label reads '<1A> Safety Cartridges' in red on blue.

One box from C13 has three labels present on the outside of the metal flaps. The first reads 'Label 278; TAKE [illegible] loop and tear off the lid; [illegible] sharp pull...' in black on white. The second, which is partially over the first, reads '1277; 1248 CARTRIDGES SA BALL .303 Inch BUNDLE PACKED; K 12-8-18ZB [illegible] VII [illegible]' in green on white. The third label, stuck partially over the other two, reads '[illegible] No.' in red on white.

A fragment of a wood from a Type A magazine box from C13 is stamped with 'DUBLIN' in white. This may come from the base of a box.

A fragment of wood from an unidentified magazine box from C15 has a label that reads: '1240 ROUNDS ... SA...303 VII' in black on white.

Only one example of the second type of magazine box (Type B) was identified. This comprised a ferrous metal box of similar size to the Type A box with a fully open upper side and two leather strap handles attached with metal rivets to the box frame.



C13 magazine box, Type B, with leather handles



C12 magazine box fragments with labels and dowel



C13 magazine box fragments with rope



C12 magazine box fragments with labels



C13 magazine box fragment stamped DUBLIN



C12 magazine box, fragments with rope



C13 magazine box fragments



C14 magazine box, burnt, with linen backing

Three magazine box fragments had traces of textile padding: one had sponge, one had linen, and one had felt.

In total twelve reasonably-well preserved magazine boxes were recovered including a very well preserved one Type A from C13, a type B from C13, 8 Type A metal frames from C13, and 2 Type A metal frames from C12. A large number of metal, wood and rope fragments of magazine boxes were also retained from C10, C12, C13, C14 and C15.

Bullets

These were immediately sent to the Defence Forces in order to make them safe so they could be properly documented. The Defence Forces destroyed them for safety reasons, so they were never documented.

Rope

One fragment of rope was recovered from C10. It is thinner than the rope used for the known magazine boxes, but probably derives from one.

Wood

29 wooden dowels were recovered from Magazine Store A (22 from C10, 6 from C13 and 1 from C15). These handmade wooden dowels may be original to the floor, and possibly early 18th century in date.

Other small wooden items included a fragment of a thin wooden disc (C10) and four thick wooden washers (C10 & C16) from Magazine Stores A and C, all of which are likely to be later.

Slate

Three roof-slate samples were retained from C13. None have nail holes.

Metal

A number of screws, nails, staples and metal bars were recovered from C10, C13 and C17. These are probably from later fittings and fixtures such as the chicken wire frames around the vents and windows, as builders and occupants during the earliest phases of use were careful to avoid using metal objects inside the buildings. Seven tacks (one of which was pos-



C10 rope



C10 small wooden items, including dowels



C13 wooden dowels



C13 roof slate I



C10 metal artefacts



C10 glass



C13 metal artefacts



C13 glass



C14 Metal bars



Store A vent with chicken wire in situ



C14 folded magazine box



C14 magazine box frags with felt (left) and sponge (right)



C11 chicken wire frame, from rear window



Rear window of Building A, frame C11 comes from here



C12 wooden frame from Store A door



Front door Store A, frame C12 comes from here

sibly gilded) from C10 may have come from chicken wire frames, which are documented by McCullen (2015, 6).

Glass

Glass was recovered from C10, C13 and C17, mostly comprising of fragments of clear window panes. One of these had a fragment of a bright orange sticker adhered to it. Smaller amounts of lightbulb glass and clear utility bottle or vessel glass were also present.

One fragment of brown bottle glass (possibly from a beer bottle) was recovered from C13. One small blue glass counter or marble was recovered from C13.

Chicken wire frame

A roughly-built timber frame measuring 1720mm by 1050mm was identified in the rear of Magazine Store A (C11). It comprises five timbers (one is missing and one is broken) fixed with metal screws to create two openings, and painted green. Chicken wire was stretched across it and tacked on. It is almost certainly from the rear window of the store.

Similar frames are present in situ in the ventilation holes in Magazine Store A, and in a number of other buildings. The ventilation holes in Magazine Store C do not have chicken wire frames, and instead have metal bars which may predate the chicken wire.

Door frame

A carved and curved red or brown-painted piece of wood from Magazine Store A (C12) is likely to come from the door frame.

Section 6 Other Observations

Building A

A 1903 drawing of the roof construction suggests that there may have been modifications made. Doodles on the drawing show pulley systems that may have been added to aid movement of stores.

The floors of Magazine C were partially renewed in 1927 - the original 9'x 2' flooring (supported by joists on dwarf walls) was seriously affected by dry-rot. At the time, Magazine C was being used to store 9,000,000 rounds of .303 ammunition. When requesting sanction on 03/02/1927, it was considered that most of the floor would be replaced but the intention was to make good the dwarf walls, disinfect the walls and floor and relay a floor of a similar type. The cost of £230 materials and £160 labour was approved. A corresponding report has not yet been found. However, a small section of wooden planks immediately west of the concrete appears to be later. It is possibly the repairs were not successful and were replaced with concrete.

Buggle's correspondence

On 17/09/1936, Cmdt S. Buggle, Army Ordnance Depot Island Bridge, wrote to the Director of Ordnance at the Department of Defence. He requested the services of a plasterer, as the Army Corps of Engineers (ACE) had only one plasterer then engaged in other urgent work. He noted that cracks were present in the gables of the A and C magazines which allowed in water and that the walls were damp. He stated that Magazine Regulations regarding ventilation were of little value and the conditions were accelerating the deterioration of the materials. J. J. Comerford, in response to this being queried by the Director, noted on 21/11/36 that the cracks were normal due to the great age of the building and that the item was dealt with. However, on 3/08/1937, Buggle stated that fresh cracks had already appeared and that they should be

'dealt with definitely'. He suggested that all the old plaster should be stripped off the northern gables and it should be re-coated with 'composition' and pebble dashed. The southern gables should also be coated and pebble-dashed (this may mean that only the northern gables were previously coated).

The following day, Buggle wrote to the Engineering Officer of the Eastern Command. Stating that a new depot was being considered (possibly at the Curragh, as this is where much of the Magazine Fort's stores ended up), he suggested ammunition would still be stored in the Magazines and reiterated his pebble-dash suggestion.

Buggle also noted (item 6) in the 1936 letter that the ventilators on the Magazines should be fitted with a mechanism to be opened from the ground. The doors were very heavy, and an NCO had to reach from a ladder to open them. He recommended that wire screens be fitted on the inside of the ventilators as missiles such as grenades could easily be thrown through from the Park. Under item 7, Buggle noted that the flags in the Magazine yard were loose and should be reset in cement. Concrete at the entrance doors was also broken and the water traps were loose. Under item 8, Buggle suggested that the Johnston Gate should be 'altered' as lorries with covers could pass under it and ammunition had to be 'man-handled' to the outside entrance. This pre-dates the late 1960s or early 1970s partial demolition of the gate and suggests a long period of frustration.

Building B

Building B, the corrugated light steel shed, is on the site of an earlier ammunition building that was extant in 1793 and 1806. By 1861, the building is gone and replaced by grass. A 1904 proposal for modifications to Magazine C and

the construction of a small arms and ammunition store, states that the wooden structure would be built on brick rubble, suggesting that perhaps the remains of the earlier store was constructed in brick and was there under the grass.

The 1904 plan was probably not followed through as it includes the insertion of a door being placed at the rear of Magazine C which did not occur. However, if it was constructed and used for the storage of small arms and ammunition in the early 20th century, it may have been the same building recorded as having been set alight during the 1916 raid. The 1916 raiders attempted to gain entry to the gun cotton store to set fire to it, but were unable, so they saturated a small-arms/ammunition store with paraffin oil and set their tin-can bombs.

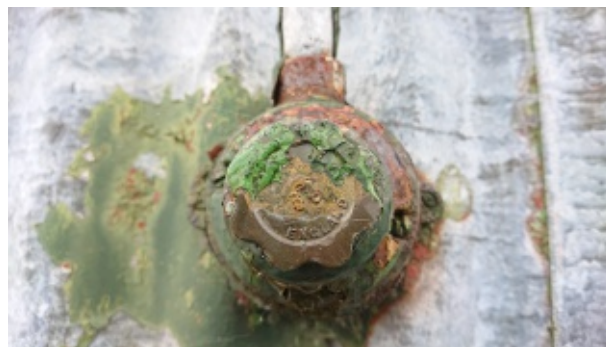
If Building B existed in 1916 it is likely to have been the building set alight in the raid, and then subsequently rebuilt in its current form in the 1921. The other possible candidates for the building set alight in the 1916 raid are Building L (used as a store in 1925 after the British occupation), or Building D (combustible and implement store in 1883, fuse and small arms store in 1925). Building D shows signs of heavy modification, particularly to the doors (metal security) and their lintels (concrete), which could have followed an explosion. Building L does not show signs of having suffered an explosion. The gun-cotton store in Cavalier 1 was supposedly not accessed by those raiders but it does have a blackened appearance and is missing the internal division seen in Cavalier 2.

The current building was constructed in 1921. The temporary-nature of the metal construction may have resulted from the British forces suspecting they would be leaving the fort the following year.

In November 1942, the QMG was requested to sanction the expenditure of £250 (materials £140) on repairs to the corrugated iron roof and the installation of new lights. The request states that this building in the 'mine yard' held ammunition and empty boxes and the natural lighting was poor. Cmdt Gleeson noted that 'considerable quantity of stores is being transferred to the Curragh' and that the 'use of this



Plans for a small arms and ammunition store, 1904, in same location as existing Building B



'Max Lume' branding on electrical fitting of Building B, dating to c. 1940s

building may need to be examined'. The roof was completed in the same year and was £100 cheaper as similar material was found in Requisitions. The lighting appears to have been the brand 'Max-lume'. The logo which appears to be a magnet around which a wire is coiled, is found on fixtures throughout the yard, and predates the chlorate and paxo plants.

For details on the modifications to Building B in relation to the Chlorates Drying Plant, see the relevant section below.

Building C

Building C is in fact two separate buildings. The eastern half was erected between 1793 and 1806, and the western extension was added between 1806 and 1861 and connected with the earlier part after 1944. The western extension was originally a store with an internal division in



Building C, western side, showing remains of wooden partition of fireworks c. 1901 store to left of image, removed in the 1940s. Note also letters B and K in the niche.

the middle. The original cooerage was east of the blast wall where Building F is now. The eastern end of Building C strongly resembles Building E. Both are wagon sheds, constructed against the rampart walls, with beams running from the outer granite and oak pillars. In 1883 the western side was the cooerage and the eastern side was a gun-carriage shed. In 1901 the cooerage became a 'fireworks store'. Two internal divisions were in place and traces of the eastern division are visible on the walls, due to the whitewashing on either side and the letters denoting areas.

On 25/02/1927, ACE writes to QMG that S&O require further accommodation (having previously renovated Building E) and the western side of Building C was to be furnished with a new floor, permanent front walls, electric lights, steel casement window sashes, etc. S&O believed the stock was being packed too closely and suffering as a result. The cost was £89 materials and £70 labour.

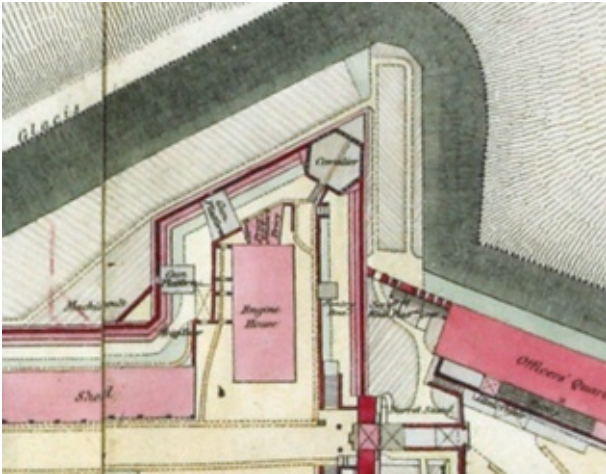
Buggle, in his letter dated 04/08/1937, states that the no. 16 store is filled with ammunition. Its doors are in bad repair and the south-facing windows are not shuttered, taking in the sun most of the day. Building C is the only stores

building with south facing windows (sun is mostly blocked by the Magazines in Building B).

Building D

A structure was in place here from at least 1793, operating as a guardroom with a sentry box to the rear, where the men's WC is now. This structure was maintained throughout the evolution of the fort, constraining the widening of this demi-bastion. This explains why the adjacent gun platform is cramped compared to the others in the fort. It is angled to allow a cannon to be rolled back from the ope but not to fall from the rampart in the tight turning space allowed. The gun platform is not on the 1861 map but does appear in 1877 on the plan depicting the new wagon shed, shifting room and modified examining room.

The two southern long rooms of D are floored with granite setts, which in the western half become large granite slabs to the north. These facilitated the storage of engines. The building may have been remodelled or rebuilt during the construction of the ravelin in 1801. The rounded ceiling in the soldiers' WC mimic those found in Building K, supporting this idea. The



Building D shown on 1861 plan, showing absence of gun emplacement to west



Building D showing unusual construction of brick and timber late 19th century wall, mirroring Building F.



Building D showing reinforcement of doorways, possibly related to additional security and repair following 1916

arches between the building and the stores (X and Y) cut into the rampart likely date to the same period.

In 1861, the building is labelled as an 'engine house' with WCs to rear. In 1877, the building is divided in half, lengthways. By 1901, the build-

ing has been re-divided. The northern half is now stores (implements and combustibles) and another WC has replaced a urinal at the rear. Of note is that the stores (Buildings X and Y) cut into the rampart are never drawn correctly in any of the maps until 1925. That year, the building is completely given over to storage of small arms, safety fuses and detonators.

The western wall entrances to the northern stores have been rebuilt and strengthened with metal sheeting on the doors and concrete lintels. Window bars also have been inserted at the rear. This modification may be related to the activity in Easter 1916 if this building was damaged in the raid, or related to the 1940s Paxo Plant.

The rear stores were later given new roofs, visible in a conservation report in 2008, but were quite severely damaged in a fire afterwards. The timber frames for the floor are visible but covered in slate debris. Remains of the foundation or an earlier structure, if the building was rebuilt, might be found below.

Building E

Building E, the wagon shed, replaced an earlier structure shown in 1793 with three rooms labelled as 'officers' rooms'. This building was situated where the capped well is now, and extended south and west of it. By 1806 this structure was gone and only the well is shown.

Between 1861 and 1875 a small wagon shed was built here, and plans were drafted to extend it in 1875. The earliest section of the shed is the southern end. The roof tiles were reused in the extension and it is possible that the stone was also reused. The change in masonry style can be seen internally. The work was ordered 24/07/1875 and completed 05/10/1875. The shed was open to the west with large beams supporting the roof and a pebble floor.

In 1926, JJ Comerford ACE wrote to the QMG with changes required by the Supply and Ordnance Sub-department that were 'pretty considerable'. They wished to install new concrete floors and build up the front of the wagon shed as an ammunition store. The floor was to be pre-prepared with a damp proof course as

the ammunition and explosives had to be kept thoroughly dry. The cost was to be £124.10.0, sanctioned on 09/02/1926. We know this is Building E, because it is described as the smaller of the two wagon sheds when Building C wagon shed is later filled in. It is also recorded at that time as 'the Pontoon shed'.

There are large sections of render on the rear wall that may relate to different phases of use in the shed or are part of repairs. The 2008 condition report suggests that these are holes. Buggle in his 1936 letter states that a wall in Store No. 14 is close to collapse, possibly referring to Building E. A large hole is open under the second section from the north and is filled with modern rubbish and rubble. A 2008 condition report stated that there is no foundation and that it is built directly on gravel.

Building F

Building F is known as the examining room. In 1806, this building was labelled as the cooperage. The cooperage building is probably the same as the existing building, as the 1861 plan shows a water tank against its north wall, which is still in place today. The walls of the examining room are constructed from degraded brick with heavy mortar. The bricks are laid in sections defined by wooden beams, in a similar fashion to the dividing wall in the northern half of Building D (that division is not depicted until the late 19th century). The 1875/7 doorstep is also similar in mass to those inserted into Building D.

The 1877 drawing of works for its conversion to the examining room shows a new door was inserted into building F with a dividing wall and a seat for the changing of shoes. The internal wall and seating layout on the 1877 plan are not the same as the existing layout. The brick remnants of the 1877 wall can be seen at the base of the current division. A later concrete block second wall runs north-south, from the north wall, to meet the line of the earlier division. The earlier division was rebuilt in concrete blocks with a serving hatch inserted to the new room created in the northwest corner and a door from the porch/seating area in the northeast corner into the larger southern room. The seat



Building F interior showing steel frame, possibly c. 1940s



Building F exterior showing water tank, possibly replacing 19th century cistern

was built facing the door. The north-west corner room had a second hatch on the outer western wall, presumably to service handcarts.

The walls are lined internally with wooden

planks, many of which have graffiti including soldiers' names and mechanical/electrical sketches. These could date to the 1940s period, contemporary with the Paxo Plant.

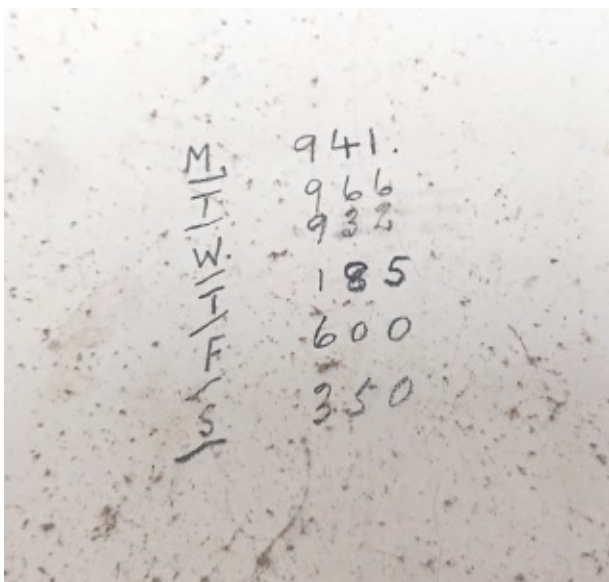
The outer wall is rendered similarly to building G. The three windows do not have granite sills and are later. Originally, the building seems to have had two windows and a possible third converted to a doorway in 1875-7.



Building G exterior



Building G graffiti on interior dated to 1946



Building G graffiti on interior showing daily numbers, possibly production levels of grenades during the 1940s

At a later stage, possibly in the 1940s, a steel frame was inserted into the building, probably to take the weight of the roof from the brick walls. The simple structure is marked with letters explaining the construction - vertical beams are labelled 'b', 'd' and the horizontal beam above is marked 'b x d'. The concrete floor was probably poured at this time and there are pipe connections emerging from the concrete. A concrete ramp extends out the former double doors suggesting that something may have been wheeled into this area. Military Archives have a file relating to the laying of concrete routes for handcarts transporting explosives dating to 1927-28 but the route does not fully extend to the examining room.

Building G

Building G, the shifting room, was constructed in 1877, along with the extension to the wagon shed and the conversion of the examining room. Both the wagon shed, and the shifting room are constructed of calp limestone, but the shifting room had an additional internal lining of brick, except along the western wall.

The shifting room and north-south wall running along the same line as the building controls access to the magazine stores and evolved over the 19th and 20th centuries. Prior to the construction of Building G, a walled-in section in front of the Magazines, surfaced in a limestone pavement, formed the magazine yard. This was surrounded by a wall (built between 1736 and 1861) with three entrances, one providing access to each of the magazines. A sentry walk along the blast wall provided a clear view of access and egress from the doors in the wall surrounding the magazine yard.

An 1868 drawing shows proposals to block the three outer doorways and open a single northern doorway to access the magazine yard and stores.

Once the shifting room was constructed in 1877, the southern and northern doors were blocked up (the northern part of the wall is now gone). Entry to magazine stores A and B was restricted to via the shifting room. Magazine store C was accessed separately, via a

separate opening to the north. A ladder shed and shelter was also built along the wall.

The shifting room controlled access and PPE to the Magazines. Soldiers were not permitted to access the stores without their 'magazine boots'. The original layout of the shifting room was entry via a northern door, normal footwear removed in the first room and (possibly) magazine boots put on in the second room (benches were throughout). The soldiers then walked along a suspended wooden platform that was constructed over the limestone paving to the doors of the stores. Moveable parts of the platform were placed at the doors of the Magazines.

In 1904, the outline of the shifting room appears the same, but porches have been added to the magazine doors. The planks are still in situ and a barrier prevents access from Store C to Store B, suggesting that whatever is in Store C can be treated differently and does not require access via the shifting room or magazine boots. The door lintel is painted 'Magazines A & B'.

Between 1915 and 1925 an extension is built to the northern side of the building. The 1925 plan is drawn incorrectly: the building is a few metres south of where it should be. Using the quoins of the original northeast corner of the building as one side of the new entrance, the extension housed an equipment room to the north with another door on the west side into the magazine stores. This is now a window but the lined and ruled render is much brighter than the original. The shifting room with a bench was housed in the corridor from the new entrance. The original building, having lost its internal division, became an examining room, with a serving hatch inserted on the eastern wall. Three fire extinguishers were placed on the new northern wall. The remainder of the northern boundary wall for the magazine stores was probably demolished with the original doorway into Magazine C in the 1960s or 1970s.

It is likely that this building was in use as part of the Paxo Plant in the 1940s. Apart from the poor condition of the roof in 2008, the building appears (from the outside) to be in good order. Its roof was not maintained as well as the

other buildings, so perhaps it was deemed contaminated and abandoned. Graffiti in pencil and carved into the plaster is present on the walls, and includes calculations in pounds, shillings and pence. Some of the graffiti dates to 1946, and it is similar in content to graffiti in the examining room (F). Faces drawn in the Men's Hut and the Shifting Room are by the same artist. One note (see bottom image on page 38) may detail seem to be production levels of grenades from Monday to Saturday. The lighting fuses for the Magazines are located in building G, with the wiring details noted in pencil on the wall.

Building K

Building K was originally two stories on the northern side only, and the corner section was unroofed and functioned as a fifth demi-bastion. The corner is roofed by 1861, but the eastern end of the building remained single story without the basement level. The current west-facing doorway was not open and the closest windows to the south were two separate entrances - the rooms were not connected. A third entrance further north led to the guardroom.

In 1866, when drawings were made for a proposed drawbridge into the ravelin, it appears that the basement level was in place, but the steps do not originate from the south as they do now. Only the south corner of the building is visible.

By 1883, the current door is closed and the window to its immediate east is now the doorway. The wall between the guardroom and the office is removed. The soldiers' guardroom remains a single-story construction. The basement level is created with the store-keepers office below and the officers' guard room above but the access is not clear in the plan as the railings or boundary wall is not drawn in the same way as the rest of the railings.

By 1925, the building has been reconfigured again, the current door is opened, and the former door is turned into a window with a new granite sill. A porch is made from the new en-

trance so that access is granted only to the NCO's room. The soldiers' guardroom remains in its extended state. The railings are in their present setting and the steps leading down to the basement level from the east are in place. At basement level a single door leads to the Batty office and an office.

However, there are three currently unaccounted for modifications:

- a) There is a staircase leading upwards from the basement level towards the soldiers' guardroom. Three steps are still extant.
- b) There is a break in the railings across from the easternmost window. This is not the door open in 1861 but was open in 2008.
- c) The wall between the soldiers' guard room and the offices was re-erected.

The northern side of the building did not go through such dramatic change. The room nearest to the soldiers' guard room is also single story. There was an awning that covered the basement-level, providing cover for staff going between the kitchen and the stores. In 1861, it is just shown as officers' quarters and the 1883 plan is the first indication of divisions therein. Officers' quarters are on top with one office and the staff, stores and a kitchen are below. In 1901 and 1925, there is little change apart from a corridor running the length of the building rather than the rooms being accessed individually.

Comdt Buggle, in his longer letter of concerns (4th of August 1937) states that there was a hole outside the door of Captain Curran's house where the roadway had collapsed and required filling in. Presumably, this refers to the western end of Building K, where in 1925, the upper level officer's quarters were accessed via the western porch and door. He also states in item 13.3 that the 'breastworks opposite the main gate are falling down'. This may mean that the glacis required reinforcement. Post-Christmas 1939 raid alternations to the guardroom are described below.

On 20/5/1965 a request was made for £75 purchase and installation of a Truburn range, to



Graffiti in Building L dating to 1914, surviving below a layer of paint

replace an unserviceable cooker in the caretaker's quarter. The Suplus range with boiler that was being replaced was not on record. Later in 1969, £332 was requested for improvements and renovations to the quarters. No record of previous work existed and the 'decorative condition is very bad'. The toilet suite and bath were defective and required replacement. The three bedrooms, sitting room, bathroom, kitchen, and toilet, required repainting on the ceilings, walls and woodwork. A new 'low level' toilet was to be purchased.

During the 1973 Corrigan inspection for OPW, one of the photographs taken shows a possible glass house or conservatory at the northern end of Building K close to the bridge. There is a stone marked "CE" on the lower level footpath outside Building K, its purpose is not yet clear, but it is close to the drains.

Building L

Building L was originally shorter, extended to the south for married soldiers' quarters by 1877.

This may have happened at the same time as the construction of the basement level of Building L, as the calp limestone construction is similar. Evidence for the end of the earlier building is found on the roof, where the granite capstones remain; internally upstairs, the granite bases of the rooves are incorporated into the walls and the battered outer wall is still present.

In 1883, the staff sergeants' office and cook house have swapped locations - this is possibly when the stove is installed and an external chimney for the stove pipe is built. A passage is created to the cookhouse. Between here and 1925, the upper-level division between the two buildings is broken through.

In 1925, the building is no longer residential. A passage into the foreman's office is created (now gone). The upper level is stores, the basement housing gelignite, clothing, bolts, and tools. This may be alluded to by Buggle in his letter in 04/08/1937. He states that Stores 10, 11 and 12 are floored with cobbles and so ammunition cannot be suitably stored there. Buildings C (Store no. 16) and E (Store no. 14?) were already converted to concrete floors in 1927 and Building B was built with concrete floors. Building D has granite block floors to the front and wooden floors to the rear. The magazines in 1937 have wooden floors. A rough cobble floor may be observed in the southernmost room of Building K today, though wooden floors have been inserted in the other rooms. Further confirmation is provided as he continues that passers-by could easily throw grenades through the windows in that block, so screens should be fitted. Buggle also mentions that the piers supporting the door frame of No. 10 store are rotted. It is also possible that he refers to Building K which has three downstairs rooms and more windows, but we know that this house is residential for Captain Curran. However, the upper level of Building L housed the No. 1 and No. 2 stores in 1925, so 3-7 could have been the basement, 8 and 9 the coal stores, 10-12 Building K basement.

The ash pit was situated where the 1877 married quarters building now stands. That building was probably one of the reasons that the southern postern gate was closed – the gap between the rampart wall and the house wall became quite

small and unsuitable for heavy traffic. The ash bin moved to a purpose-built box next to the water tank and coal cellars (this area is still sooty and full of rubbish, but by 1901 was under the mâchicouli - the ground level in that area is still high and likely to be full of discarded material.

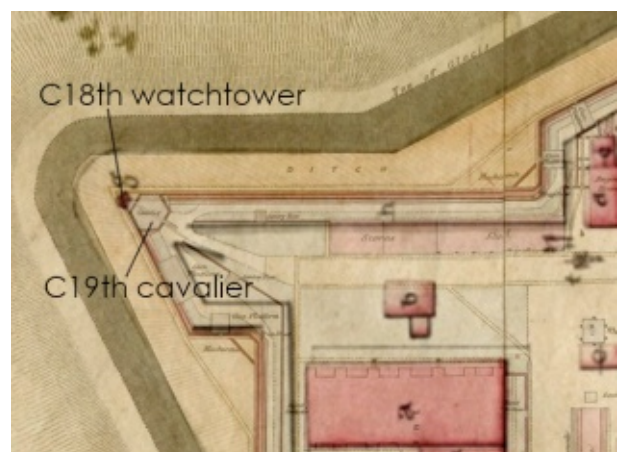
Building Q- Blast wall

The blast wall was constructed between 1793 and 1806. It was probably constructed to protect the magazine stores from an explosion in the cooperage (building F). A well lies to the south of the blast wall, now possibly under a concrete surface. A temporary structure was built against its southern side, and the remains of the roofing mortar are still on the wall. A telegraph or telephone pole is attached on the western side of the wall and probably connected the Building G shifting room or the magazines to the line coming from the ravelin.

Cavaliers

When it was originally constructed, the magazine fort had four small watchtowers set at each corner of the four demi-bastions. These are depicted on the earliest plan of the Fort by Armitage (1793). Another depiction of the watchtowers appears on an image published in c. 1795 by Francis Dukes (National Library NGL11732). This image is likely have been cre-

Armitage map 1793 superimposed on 1859-61 survey, showing relative positions of 18th century watchtowers and 19th century cavaliers



ated before 1758, based on the absence of Magazine B and the absence of Sarah Bridge (built 1793) on a contemporary engraving by the same artist (National Library NGL.11901). The Dukes image shows these were large enough to house one person only, and are very similar to the watchtowers at Charles Fort in Kinsale, but square in form rather than circular as in Kinsale. The watchtowers are also depicted on Joseph Tudor's image of Dublin, which also predates Sarah Bridge (1793). On this, the towers appear to be red brick, like the parapet walls, but capped in a lighter coloured material.

By c. 1798 the watchtowers had been supplemented by wooden platforms that appear to have held wooden towers. These are visible on the 1806 plan of the fort, as well as two paintings: one by Thomas Roberts, published c. 1816 but no date on painting, showing wooden tower and guns (British Library Maps K.top.53.17.2.D), and William Ashford's 'View of Dublin from Chapelizod' 1795-8 (NGL.4318). These show the wooden towers rising up higher than the brick watchtowers. The wooden platforms, which held the towers, have a very similar footprint to the later cavaliers.

The towers were demolished and replaced by the existing cavaliers between 1806 and 1861. This was most likely done in the early 19th century during the rebuilding of the rampart wall and walkways, possibly during the Napoleonic Wars. The cavaliers were later converted to cordite, wet and dry guncotton stores in c. 1903. Cmdt Buggle in his 1937 letter,



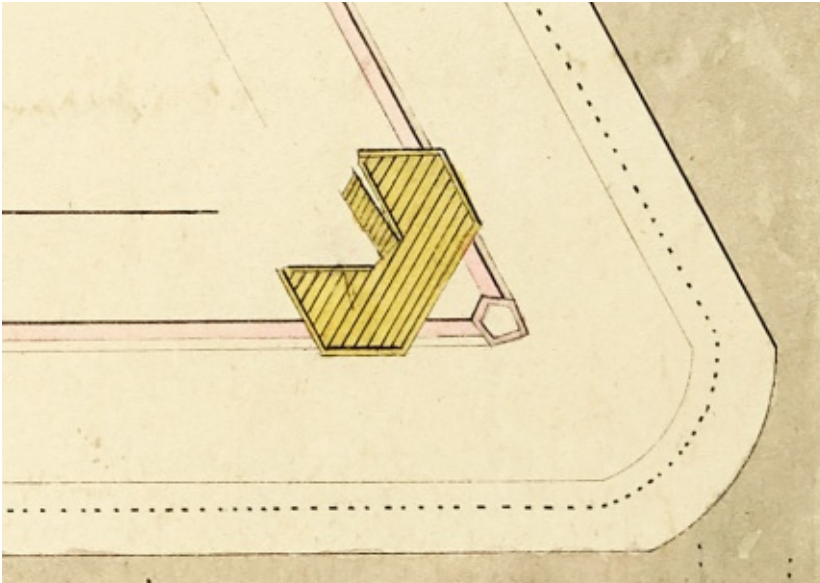
'Powder Magazine taken across the river', F. Dukes, Howland Street. c. 1795 (National Library NGL.11733)



Extract from Joseph Tudor's image of Dublin, contrast adjusted to clarify magazine fort



Magazine Fort, published by Francis Dukes (National Library NGL.11732)



Wooden platforms on 1806 plan of 'No 3 Magazine Phenix Park' (UK National Archives MPH 1/682/2)



Thomas Roberts, published c. 1816, showing wooden tower and guns (British Library Maps K.top.53.17.2.D)



William Ashford's view of Dublin from Chapelizod 1795-8 (NGI.4318) showing wooden tower with flag

under item 4, stated that all the cavalier ventilation shutters required handles for opening and hooks to be kept open. He also wanted screens inside the windows, which were normally closed by doors.

An alarm system ran from cavaliers (later referred to as Sentry posts) to guardroom. In August 8th, 1939, F. Kineen, Engineers division wrote to the QMG to state that continual patching to the alarm system was costing as much as a replacement. He requested sanction to rewire with screw tubing at a cost of £46 (£31 materials). The alarm system had been in place since the British occupation, so the repair was approved. Presumably, this was achieved, however the Christmas raid of 1939 triggered a Commission of Inquiry which made a set of recommendations about the security measures in the Fort. This included a new electric siren alarm system as the IRA cut the phone lines and the first guard who freed himself had to fire a rocket to raise the alarm at the nearby barracks. There is currently no visible evidence for these connections in the cavaliers.

Building R- Cavalier 1

This cavalier is accessible. It does not have an internal doorway like Cavalier 2. It is possibly the inaccessible gun-cotton store described by O'Daly in his account of events in 1916. At this point, it was fenced off. It is rendered like the other

stores but was not modified on top like Cavalier. It is not clear if there was originally a wall and door internally or if it was demolished. In the 1925 map it is marked as a wet gun cotton store. A large rectangular tank, painted green, sits outside the cavalier, its purpose is currently unknown.

In his 1936 letter, Comdt Buggle notes a cement hole in a concrete platform near No. 1 cavalier which might cause a sentry to trip and fall heavily in the dark. There is some concrete at the rear of the cannon emplacement. Buggle also notes a large crack in the No. 1 cavalier (04/08/1937 item 5) on the outside wall and states that the walls are 'still weeping'.

Building S – Cavalier 2

Cavalier 2 was not accessed but a large crack in the wall permitted the light of a torch. An internal division appears to be intact and there may be a bench. The outer wall is badly cracked. It has been modified on top to a more pill-box style roof which may have been too heavy for the original structure. Presumably, this happened at the same time as the rebuilding of Cavalier 3.

Building T- Cavalier 3

This structure is now a Pill-box style unit, possibly dating to the Emergency in the 1940s, and post-dating 1944.

A plan exists for the conversion of Cavalier 3 to a Gun Cotton Store in 1903, drawn in ink but added to in pencil, in the same or similar hand. It shows an insertion of a dividing wall, creating a 'shifting' room at the front of the building with a bench.

On 17/09/1936, Commandant S. Buggle, Army Ordnance Depot Island Bridge, writes to the Director of Ordnance at the Department of Defence. He requests the services of a plasterer as ACE's only plasterer was engaged in other urgent work. He states that there is a leak in the roof of Cavalier No. 3, which is filled with pools of water after showers. It is, at that stage, storing all heavy explosives (including dry gun cotton and ammonal which would be 'rendered useless by moisture') and is supposed to be under Magazine conditions. The mopping up of the pools introduced articles that were serious

breaches of the Magazine Regulations. Comerford responding to the Director of Ordnance notes on 21/11/36 that the crack is repaired, but Buggle states that it is still affected in heavy rain in 03/08/1937.

The cavalier is still in situ in 1944 and is depicted on a plan for the creation of the Paxo and Chlorate Drying plants. Its form is a circular outer wall, with the steps and inner NW-SW aligned wall and it is labelled 'cordite EXPnd'.

Building U-Cavalier 4

This cavalier was a blank ammunition store in the 1925 map. It has not been accessed and it is not clear whether it has the dividing wall seen in Cavalier 2. Buggle in his 1937 letter, under item 3, mentions that the ventilator in the outside wall of Cavalier 4 required a bend to be fitted to prevent entrance of water and required a means to be kept open.

Buildings X and Y

Building X is a coal vault with the south facing doorway directly west of Building D. It currently houses a collection of cobbles, possibly dating to the creation of the concrete paths in 1925. Building Y is north of this vault. It has a four-cornered vault and doorway. The vault extends from the end of building x to the rampart wall. While Building X is usually marked from 1883, building Y is not marked on plans until 1925. Both also appear on the plan to construct the Paxo and Chlorate Drying Plants in 1944 (possible date).

Moat/Glacis

A pump is depicted in the plans coming into Area B, immediately north of Cavalier 3.

In 1908, an unclimbable 5'6" steel fence was installed to prevent undesirable persons using the ditch as a screen. The chevaux de frise was removed (McCullen, 2015, 8). An outside fence is reported by Buggle in 1937 as being badly rusted. It is described as an iron railing and an inner wood paling was noted as rotten.

In 1944, work was sanctioned on the defective

iron railings on the outer fixed boundary. A dwarf concrete wall plinth was built to house 1450 ft of railing. The work was completed in 1945.

In 1946, £490 was requested to replace the timber palisade, which had iron spikes on top of struts and was 90 years old, with a barbed wire fence 7'6" high, supported by concrete posts. The wood was turned into 48 tonnes of wood fuel. Misgivings were raised, but countered by the fact that the timber palisade was only one of four defences, the others being an outer barbed wire fence, an unclimbable iron railing and the fort wall proper and fosse.

In May 1948, the OPW wrote to Defence to request that the barbed wire fence erected during the Emergency is removed. OPW also requested if they could install seats near the fort (these were removed after the Christmas raid of 1939). Memos suggest that there were 'no dangerous or attractive stores' in the fort and no objection is noted. Due to a labour shortage, the fence was not removed until November.

A request for an update on the 'new palisade'

(this was probably the 1946 fence) was made on 14/1/1949 and stated to be at 20% completion. It was finally completed in September 1949 and was over budget at £506-31 due to a wage increase.

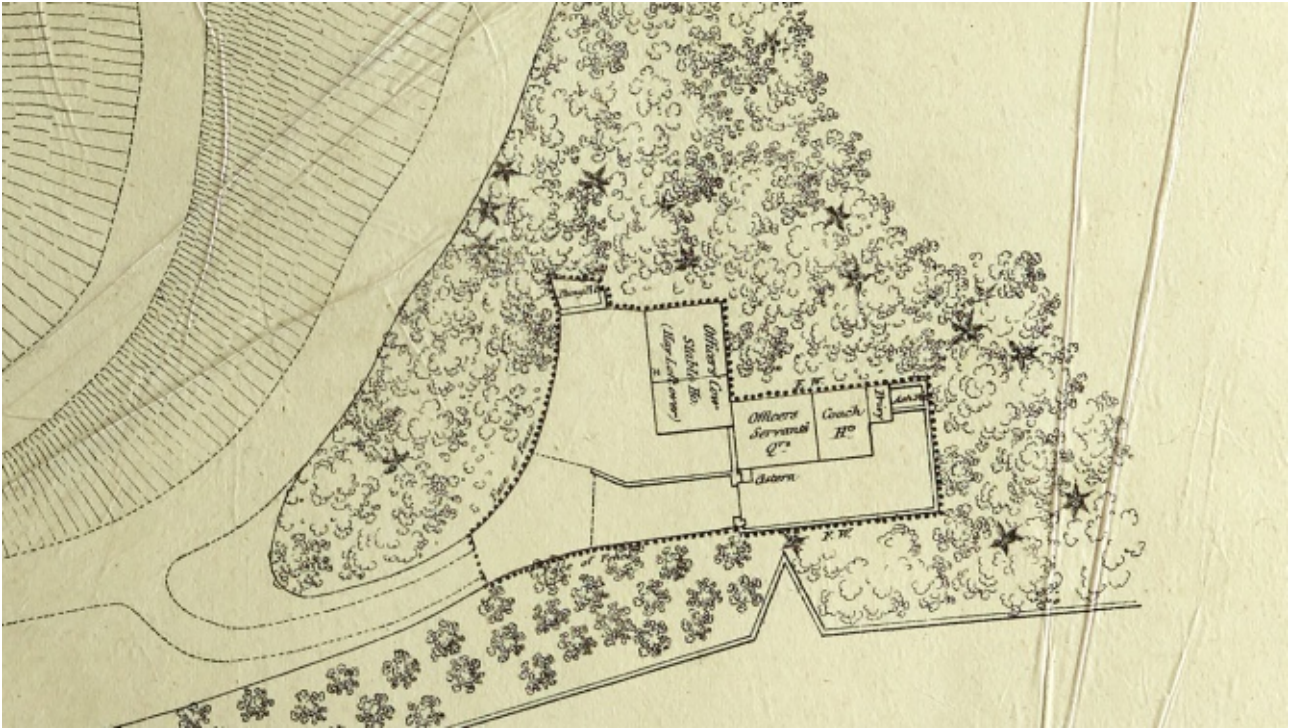
Rampart and parapet walls

Buggle noted in his 1936 letter that no repair had ever been made to the outside walls. His August 3rd, 1937 letter noted new cracks north of No. 1 Cavalier and south of the rifle range, where there was a definite bulge in the wall. His letter the following day to the Engineer Officer notes the same ('north of No. 1 near old [12 par bay?] and cracks have been covered'). There is a suspected repair facing out over the ravelin from rear of Building E and an obvious yellow repair immediately north of the Cavalier 1 which looks like a material used to fill cracks in the magazines.

More interestingly, he noted that an explosion has occurred in 1932 on the outer wall and that it had not been repaired – but he makes no mention of where that was; he assumed the

Exterior of rampart wall showing repair north of Cavalier 1, mentioned by Buggle in 1936





Glacis Cottage, extract from 1859 survey of fort published 1861 (Kew Archives WO 78/4743/15)

reader knew exactly. The area around the gun emplacements in the north-eastern demi-bastion has obvious repairs and may have been the site of the explosion. The unsympathetic repairs weigh heavily on the structure and a granite element of the gun op rest on the former gun platform (now concrete) while another granite piece lies in the glacis. Another possible candidate is the northwest demi-bastion (Area C) where the rampart wall was rebuilt in concrete, however the WW2 pillbox post-dates to after 1944.

Glacis Cottage

Glacis Cottage is considered in the 2008 Paul Arnold Statement of Significance to be part of the curtilage of the Magazine Fort. On the 1850 outline, the building is noted simply as ‘stables’. On the 1861 map, the northernmost structure is an officers’ cow stable with hay loft over and a dung heap to the northwest. The more southern building housed the officers’ servants, the coach house, privy and an ash pit. In 1883, the servants’ room was given over to married quarters. It is not modified in the ink-over version of the 1883 which is likely to be from 1925 and the

1925 map does not feature the cottage at all.

It is not yet clear when the house drops out of use, but it is likely to be the ‘dwelling’ referred to in the 1957 discussions (see below) on storing explosives. The house has been heavily modified or may have been rebuilt, it now more closely resembles a bungalow from the outside, though the boundary wall bears some resemblance to the earlier rampart walls. In the 1940s it was used by the OPW to hold seats looking over the fort, so was presumably no longer in military ownership at that date.

Surfaces

JJ Comerford, ACE wrote to QMG at Parkgate Street on 11/06/1927. Officers in the Supply and Ordnance division had requested that the ‘kidney stone’ roads be put in a safe condition as they had concerns about wheeling handcarts containing explosives over the cobbles. This suggests that the road was no longer asphalt as previously marked in the 1861 map. Comerford stated that ‘lifting and relaying will not meet the case’ and suggested the stones be removed and



Glacis Cottage to the south of the magazine fort, which formerly functioned as officers quarters and stables

replaced with a reinforced concrete 4' thick and 5'6" wide. Side tracks to the ammunition and explosives stores were also required (this would be the Magazines and Building G, Buildings C and B and Buildings E and F. The work was budgeted at £110 (£75 materials) and it was intended to use civilian personnel of the Eastern Command Army Corps of Engineers to lay the road. However, the price did not include lifting the stones. This had been envisaged as work for the military fatigue men from the personnel of the Magazine Fort. It entailed a large amount of excavation and they could not be continuously spared. Their contribution of a few days is described as 'negligible' in the scheme of the work. The labour budget doubled to £70.16.0. The work appears to have been completed by 1928. The 1974 inspection photos by Corrigan show less concrete on the road from the inner gateway to the magazines. It is therefore possible that more of the road survives than initially thought. However, in the ravelin, which bore the brunt of heavy traffic until the 1970s, the same camber has not been observed and it is likely that any asphalt or cobbles are gone.

Buggle devoted part 2 of his 1936 letter (to Director of Ordnance, Dept. of Defence) to the weeds in the fort. He had been informed that

neither tar nor cement would be suitable to suffocate the weeds, but they were not being issued weed killer. He lamented the amount of time that specially trained and remunerated ammunition engineers spent pulling weeds. Fatigue parties from Island Bridge Barracks could not be supplied in their place and he urged that a special case be put forward to the QMG. In 1937, he devoted further space to obtaining a supply of weed killer. The cobbles in the inner and outer yards did not suppress the weeds and the soldiers were suffering with low morale from continually pulling weeds to no end. This, he states, 'tends to make men careless in the execution of their duties and I must regard this point as serious in an ammunition depot.'

It is suspected that the granite sentry posts may have been the bases for wooden sentry huts, but no evidence remains. These types of huts are alluded to by de Vauban as being almost mobile units. Buggle in his longer 1937 letter mentions that a 'sentry box' in the Johnston ravelin has rotted and requires repair. The box was likely at the northern most corner of Building K where a granite platform was in place and from which a sentry walk led west, parallel to the road. It is logical that some form of cover was provided for a guard on duty on the gate and this may

have been a precursor or complement to the Police hut mentioned in 1940 (likely the sentry tower, building J).

Fire system

Fire buckets were hung from the walls at Magazine A, Building F and Building E. A Fire box was in place at Building C in 1974, one of the doors is now in storage in Building E. Fire extinguishers were at every door and three at north wall of Building G.

Buggle noted in his 1937 letter that 650ft of hose was available, but 800ft was needed. Some of the fire extinguishers were missing the bottom brackets and seemed dangerous where they were suspended over yards and passages.

Easter 1916

Details of the 1916 raid on the Fort can be found in the oral testimonies of participants housed by the Military Archives and available to read online.

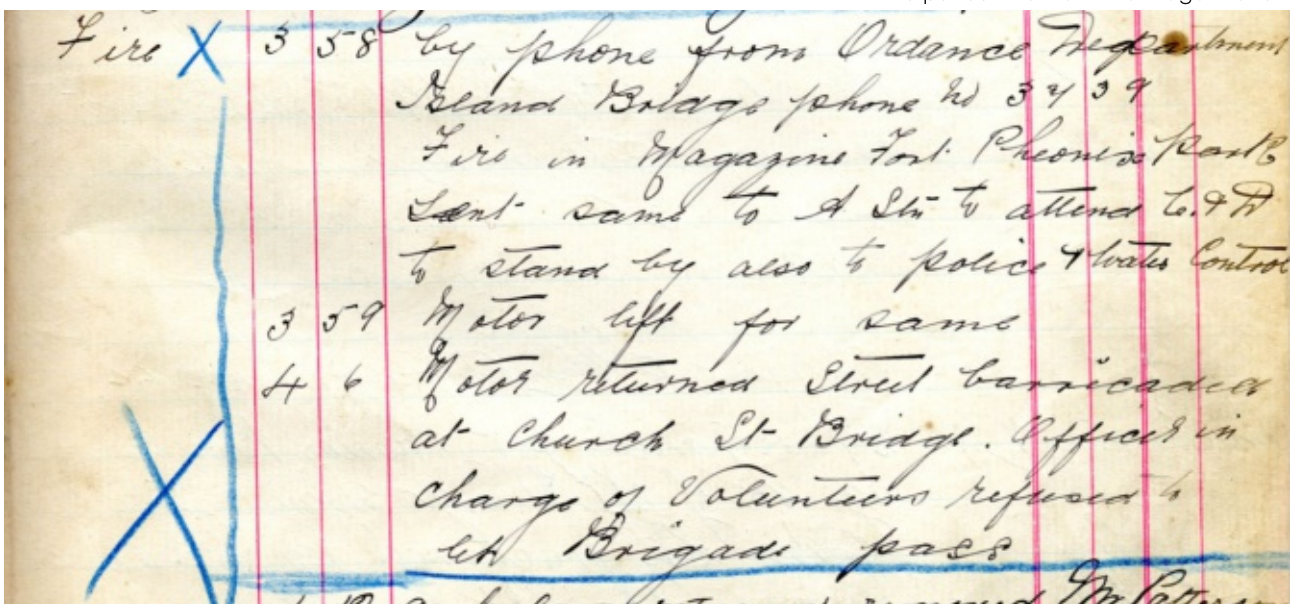
Donal O'Hannigan was the first to notice that the sentries would leave their posts to pursue footballs that went over the barbed wire on the

north and west side of the fort.

Patrick O'Daly, who had worked as a carpenter, for Thompson's Fairview Building Contractors, in the Fort, led the attack. He had reported to Seán MacDermott on the strength of the garrison, the layout of the Fort, the location of keys, tools, and stores. He had become friendly with the Sergeant Storekeeper by bringing him the 'odd half pint of whiskey'. He was aware of their store of .303 ammunition which Tomás McDonagh wanted blown up. He provided Patrick O'Daly's second-in-command, Garry Holohan with bags of explosives and fuses - the expected explosion would be the signal for the start of the Rising.

Posing as a football team, O'Daly distracted the sentry standing outside the gate, as Paddy Boland jumped him. O'Daly made for the guardroom and the garrison of 10-12 surrendered, their stacked rifles collected. The keys were kept in a glass case in the guardroom and were numbered but O'Daly could not tell the number of the gun-cotton store which was 'way off to the left' (Cavalier 1) and had a light railing around it and was marked 'out of bounds to all staff'. He put his boot through the glass key case. The 'balustrade' sentry was shot on the parapet by Garry Holohan as he charged him with his bayonet pointed.

Excerpt from 1916 Rising Dublin Fire Brigade Logbook, stating that 'officers in charge of volunteers refused to let brigade pass' to put out the fire in the magazine fort



RAID ON ARMY FORT

Startling Coup In Dublin

A SENSATIONAL raid for arms was carried out on the Magazine Fort, Phoenix Park, on Saturday night last, when a number of men, entering the Fort by a stratagem, removed a large quantity of small arms ammunition in lorries;

1939 Irish Independent headline

1939 Longford Leader heading

1,000,000 ROUNDS OF AMMUNITION

Taken In Daring Armed Raid

FIFTY MEN WITH FOUR LORRIES

The National Arsenal, known as the Magazine Fort, in the Phoenix Park, Dublin, was broken into by armed men on Saturday night, and over 1,000,000 rounds of ammunition removed.

During the raid, which was carried out by between forty and fifty men, a sergeant, Mr. James Heenan, received a severe head injury and is in a critical condition in St. Stephen's Hospital.

Thirteen men, who were arrested later in the Park by military forces from Islandbridge Barracks, and who are alleged to have had revolvers in their possession are lodged in Arbour Hill Prison.

The military guard at the Magazine Fort has been placed under detention.

Several shots were fired following the raid, but no one was injured by the fire.

The affair was perfectly planned, and the precision with which it was carried out enabled the raiders to use four lorries to carry off the ammunition—over two hundred cases of it, with five thousand rounds in each case—and get away before any alarm was raised.

FOUR HOURS' WORK

And this, after over-powering the guard—corporal, acting-corporal, and eight other ranks—with quiet efficiency and within a few seconds; possessing themselves of the keys of the ammunition vault, and labouriously loading the heavy cases into the lorries. It took the men the greater part of four hours to carry out the whole task—from about midnight—and during that period there was nothing to arouse the slightest suspicion on the part of the military authorities in the Islandbridge Barracks, little more than 500 yards away.

HOW SENTRIES WERE DISARMED.

A notable feature of the raid was the exceptionally clever manner in which one man disarmed all the sentries. This man, dressed in uniform, walked up to the gate and told the military policeman on duty that he had a parcel for the officer in charge. The military policeman opened the gate, and was immediately disarmed and handed over to two others of the raiders.

The uniformed raider then walked leisurely along the wall inside the fort until he came to the first sentry post. The sentry, a Volunteer, did not pay any particular attention to the uniformed figure, and the first thing he knew of the raid was when he looked down the muzzle of a revolver. The sentry was disarmed. The uniformed raider proceeded to the next post and in the same manner disarmed the sentry there.

With the three guards—the military policeman and the two sentries—disarmed, the fort was virtually at the mercy of the raiders, who found it comparatively easy to round up the rest of the military and herd them into a room.

The alarm was raised after the raiders had departed by a guard who broke free and fired rockets, which were answered from Portobello and Islandbridge Barracks.

A strict watch is being kept all along the border and at each frontier post.

The raiders opened the ammunition, paraffin oil and tool stores and, using sledgehammers and hatchets, they broke open the ammunition boxes and saturated the store with paraffin oil. Throwing in tin-can bombs, they set the fuses in the small arms ammunition store. They released their prisoners, including Mrs Playfair and her two sons, one of whom, George, 23, was killed by Garry Holohon, while running to house with a telephone to raise the alarm. They then locked the outer gate and took the key. Eamon Martin wrote that the 'vaults' were opened but no high explosives were found on account of them being needed in the European war.

The fire-brigade was blocked coming out of town to the fire by the Irish Volunteers. Another truck got through on a different route, but the firefighters were unable to gain access, 'having to play upon the outbreak from the boundary wall.' This detail is from the 1916 Rising Dublin Fire Brigade Logbook available online (DCC Fire Brigade).

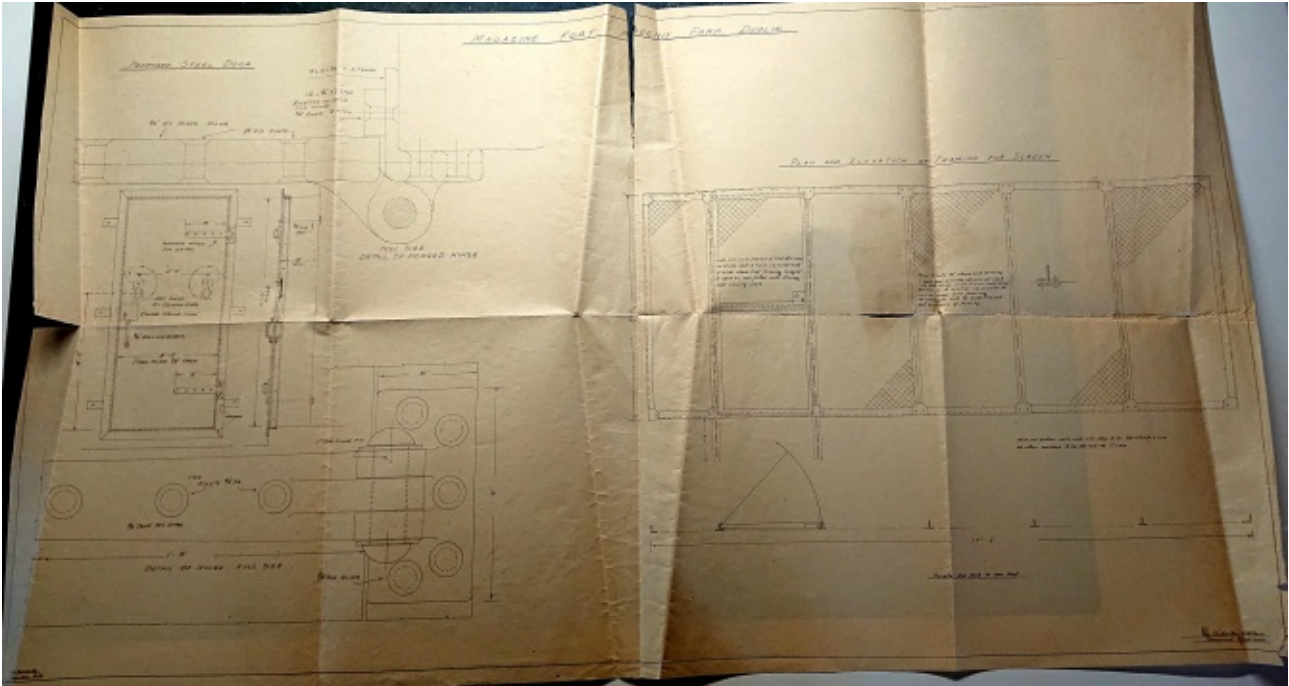
Evacuation of the Fort 1922

With the signing of the Treaty, a large and complicated operation of evacuation of British forces from Ireland began. The process was divided into three stages, the last being the evacuation of Dublin city. Before plans were finalised, all units were put on high alert and officers had to be armed when in uniform. The Dublin Barracks were connected securely using radio, flags, and heliographs (Kinsella 1998, 4, 12). In November 1922, two officers and 34 men of other ranks were stationed at the Magazine Fort. The Magazine Fort was among the last eighteen properties to be evacuated on the 17th of December (Kinsella 1998, 17-18).

Christmas Raid 1939

The IRA raided the fort, which was then the National Arsenal, on 23/12/1939. Over 1m rounds of ammunition were removed by fifty men and four lorries. Details of the raid are well-documented (e.g. IGP 2002; IRN 2017).

On the day of the raid, the Officer in Charge (OIC) had an NCO, six men with rifles and one



Plan for 'cage' installed outside guardroom with steel frame, 2' mesh chain link fencing with concrete plinth and self-locking door' following 1939 raid

J&C McLoughlin stamp on existing inner metal gate of ravelin, installed after 1939 raid

Lewis Gun, with one MP and one fire picket at his disposal. The 7th Dublin infantry Battalion (Reserves at Portobello Cathal Brugha) supplied the garrison and the fire picket was supplied by Islandbridge Clancy Barracks. The OIC left the fort for the city. Later in the evening the MP at the gate answered a bell from a uniformed man claiming to have a parcel for the OIC. He bent down to unbolt the gate and as he rose a gun was pointed at his face. The uniformed man then walked along the parapet to the first sentry post (cavalier). The sentry was disarmed, and both men were used as shields to gain entry and take surrender of the men in the guardroom. Meanwhile, the uniformed man proceeded to the next sentry post and did the same. The fire picket were disarmed by a second team. Lorries were seen coming and going from the depot over four hours. The OIC was met by two IRA men on a tour of the Fort, as he didn't know the password they had given to their disguised uniform men, he was captured. There were no deaths but James Hewson, a lodge or gatekeeper near the fort, received severe head injuries when he came upon cut telephone wires and was brought to Steevens' Hospital.

The alarm was finally raised when a guard broke free and fired rockets drawing the attention of Islandbridge and Portobello (the phone lines



had been cut). Islandbridge had been deliberately distracted during the raid by shots fired at the MP on those gates.

In the aftermath, Commandant Michael Kilkelly was encouraged to retire. He had taken a call from Islandbridge while at a party in Collins Barracks and asked the caller if they couldn't deal with a few shots. This was the duty officer who attempted to leave Islandbridge when shots had been fired at the gate. The Orderly Officer, who answered the phone and passed it to Kilkelly, and Captain Curran OIC of the Magazine Fort, who had been out at confession during the raid, were also dismissed.

Following the Christmas Raid 1939, a Commission of Inquiry was put in place to establish the facts and what systems could be improved. It was found that heavy modifications were required for the guardroom and entrance. The January 1940 recommendations were as follows:

- 1) Removal of existing set of wooden gates
- 2) Installation of strong iron gates 9ft high internally and externally
- 3) Outer gates to be remote controlled
- 4) Cage installed outside guardroom with steel frame, 2' mesh chain link fencing with concrete plinth and self-locking door
- 5) Remove of the area's railing and cover roof with the chain-link fencing
- 6) Installation of breastwork 4' high, 11' foot wide in front of guardroom
- 7) Stripping of eaves of adjoining building, raising parapet wall in brick 2' high with lead gutter
- 8) Take down of front of guardroom and rebuilding in 9' thick brickwork with new armour-plated steel door with loopholes and self-closing lock
- 9) Electrical alarm connecting entries (cavaliers) and guard room

The cost was £530 (material £425) and was hastily moved through the departments. Five tenders were received for the installation of the gates. Despite the stamp of J&C McLoughlin on the extant gate, they did not win the tender as they had the highest price. Fed. Engineers were successful but later requested higher fees as the price of steel had increased. The design of the gate is almost identical to the one drawn, so it is possible that J&C McLoughlin either built a replacement, they made repairs to the competitors gate, or Fed. Engineers failed to produce the gates and the tender was withdrawn. The work was confirmed as having been completed on 20/12/40 but the alarm system

work had been cancelled.

In 1940 Defence wrote to OPW and requested that the seven seats facing the Fort be moved 'arising out of the recent raid' as they afforded a vantage point to 'evilly disposed persons'. Minutes between OPW officers suggested that the work be done 'in a casual way' by Park staff to avoid 'fuss'. The seats were removed to Glacis Cottage 'away from the public eye' until Defence approved a location for them. They would later be returned after the war.

Paxo Plant and Chlorate Plant

The magazine fort contains numerous artefacts, fittings and building interventions from the 1940s that directly relate to a secretive military weapon-production project. Following the Christmas Raid stores were moving to the larger army camp in the Curragh. However, at the onset of the war, the fort found a new strategic purpose for the making of bombs, and the drying of potassium chlorate which was being manufactured in Parkgate Street. The Paxo Plant (grenade manufacture) may have been run solely by the army, but the Chlorate Plant was done under the Research and Development branch of the Army and the Emergency Scientific Research Bureau (ESRB) was which was set up in 1941.

The Paxo Plant operated in the Magazine Fort from 1941 or just before. Paxo is a colloquial term referring to potassium chlorate and paraffin wax. It was one of three improvised grenades fuels (including Warflour and Irish Cheddar) used by the IRA (SWB 2015) and the Irish Volunteers (Military Archives BMH.WS1208) and knowledge of the production likely came from the Civil War era. Thus far, no data is available on what specific type of grenade was produced. When the government was criticised by Patrick McGilligan in March 1946 on the dangers of the Parkgate Plants, the Minister for Defence, Oscar Traynor, responded that one to one and a half million grenades were manufactured and placed in readiness all over the country. They remained stockpiled into the 1970s (Myles 2008, 61). The buildings involved in the Paxo Plant are likely to be Buildings D, F and G. It is possible that the rav-

elin buildings may also have been involved.

Paxo Plant and Chlorates Plant seem to be used interchangeably in contemporary documents, despite the Paxo Plant having been established first.

The Chlorate Plant

The ESRB operated at least thirteen Plants related to the processing of potassium chlorate and phosphorus. Plant no.7 was the Chlorate Drying Plant at the Magazine Fort, which dried potassium chlorate produced in Plant no.6, a cell building in the northwest corner of the Parkgate site (Myles, 2008, 57). The Chlorate Drying Plant was initially built out of the Army Vote budget in 1944. In 1941, the ESRB 'had gone out of funds' (minutes of conference 1946) and the Army paid the ESRB for its work to date and took over. The Army did not pay the Bureau for the plant. Work first began on Yellow-phosphorus for the army and then crude Sesquisulfide and later, Chlorate. Later, Chlorate output was increased to supply Maguire & Paterson and fine sesqui-sulphides and red phosphorus plants were set up for this venture.

The Emergency Scientific Research Bureau was

in operation from 1941 to 1945. The Bureau reported directly to An Taoiseach's Office, and offered advice on substitute transport fuels, advice on materials in short supply such as alum, oils, solvents, fertilizers, salvage of waste and the utilisation of seaweed and peat, the latter following on from work by the Irish Research Council (Bradley, 1991, 117).

In February 1941, De Valera requested that the Bureau research the possibility of manufacturing red phosphorus, phosphorus sesqui-sulphide and potassium chlorate. Messrs Maguire and Paterson Ltd. (the only Irish match manufacturer, hereinafter M&P) funded Southern Chemicals Ltd. to carry out experimental works on production. At the same time, Prof KC Bailey, TCD, and Prof TJ Nolan, UCD investigated the manufacture of the chemicals, and Maguire of M&P, a friend of De Valera would attempt to open supply lines from Britain (Myles 2008, 57).

Prof Nolan managed the production of potassium chlorate by the electrolysis of sodium chlorate solution, producing a concentrated solution which, when treated with an aqueous extract of kelp, produced potassium chlorate

Paxo Plant kiln, in Building B



(Bradley 1991, 152). The supplies of M&P dwindled in September 1941 heralding the impending closure of the Dublin factory. The Belfast factory was unable to take its place, not least because the Belfast matches were found to be unacceptable by the southern public (Bradley 1991, 153). Secret diplomatic relations restored a minimal supply, halting the research into phosphorus production in June, however, in August, the Department of Defence sought ur-

gent supplies of phosphorus and phosphorus sesqui-sulphide.

As a result, the ESRB decided to start experiments on production of large amounts of phosphorus. Two methods were selected, but the less dangerous method was successful and so followed. This was the reduction of phosphate rock (imported Florida pebble and local Clare phosphate) by heating it with carbon and silica in an electric arc furnace (Bradley 1991, 156-7). The test arc furnace in UCD Engineering was 10kw and once they had information on how the Tennessee Valley Authority operated their plant, they decided to build a 100kw plant which would be run by Major Flanagan and his second in command, Comdt McDonald.

Paxo plant building B showing unidentified machinery base, possibly for a grinder. Traces of the per-1940s steel wall removed for the Paxo Plant are visible in the floor in the right foreground



‘This larger plant consisted of a single furnace with a vertical electrode eight inches in diameter connected to two coke filled condensing cylinders in series through which the furnace gases passed in countercurrent to a water spray. The condensed phosphorus dripped into a water-filled tank directly below the cylinders. The graphite electrodes had to be obtained initially from the United States [Acheson Graphite Division of National Carbon Company Inc, New York \$1460.98 for 2000 pcs in 1943 including rail freight – Military Archives Docket]; subsequently a technique for the home manufacture of electrodes was developed with the cooperation of Messrs Electrodes Ltd., a subsidiary of Southern Chemicals Ltd’ (Bradley 1991, 157-158).

The army provided the Parkgate Street site where the phosphorus was produced. The site had to be close to UCD and the Bureau (45 St. Stephens Green East) and had to have water and electricity. Unfortunately, it was also close to the public, keeping Major Vivian De Valera busy with complainants (Myles 2008, 61). The site had been a former laundry with various outbuildings. The Plant ne-

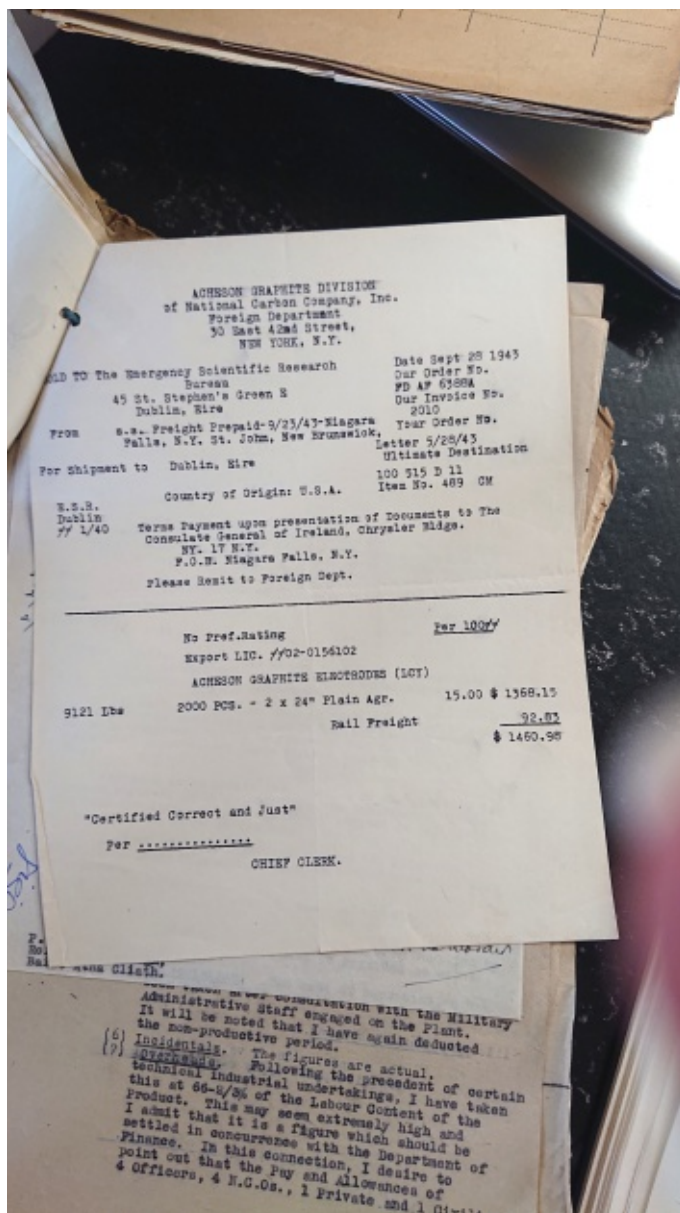
cessitated the construction of a structure to house the furnace and condensing system and held showers on each floor to douse the clothes of the operators in case of fire (Bradley, 1991, 159-160). The Parkgate Plant was operational in February 1942.

The Parkgate Plant was usually staffed by an engineer, a non-commissioned officer and four men on eight-hour shifts but operated on a 24-hour basis. The men selected for this work had passed stringent medical and dental checks, and Major Flanagan noted that men considered fit for normal duties did not make it to the Plant (Flanagan 1946; Bradley 1991, 160). Regular production got underway in June 1942, and by December six tonnes had been produced. The original programme required thirteen tons. This was achieved by September 1943, but another thirteen tons was ordered, so a second furnace was installed. With other improvements, the cost of production halved, and output almost doubled. (Bradley 1991, 161).

Production also began on phosphorus sesqui-sulphide at Parkgate, with a dedicated plant built by end of August 1942. Production continued for two years and over five tons were produced and mostly given to the army (Bradley, 1991, 167-168).

Production was sometimes halted by storage issues and capacity further along the munitions production chain. When work started on the Magazine Fort, there was some urgency in the construction because Parkgate Street was already underway.

In May 1942, the Bureau turned its attention to the manufacture of explosives both for industry and the army. In March 1943, they began investigations, but the Taoiseach's Office wrote to the Bureau in October stating that supplies of gelignite had improved and that supplies of potassium nitrate needed for gunpowder were low (Bradley 1991, 165). Industrial explosives were set aside but work on potassium chlorate continued. On May 6th, 1943, the army began work on the foundations of the chlorate plant, funded by the army. The chlorate production



Documents relating to the Paxo Plant electrodes

plant was built beside the tennis courts at Parkgate Street in 1944, it was up to full capacity by September and by December 3.5 tons of potassium chlorate had been produced. By the beginning of 1944, six cwts of pure potassium chlorate was delivered to the army. By the end of January 1945, production was 2.5 tons per week. At a conference in November 1944, which discussed the winding up of the Bureau, it was agreed that the Plant be kept going to meet the demands of the army and that it be turned over to the army for this purpose. When it ceased production on March 31st, 1945, 35 tons had been produced (Bradley 1991, 167, 230).



Paxo Plant plans mixers and access hatch

Modifications to the Magazine Fort

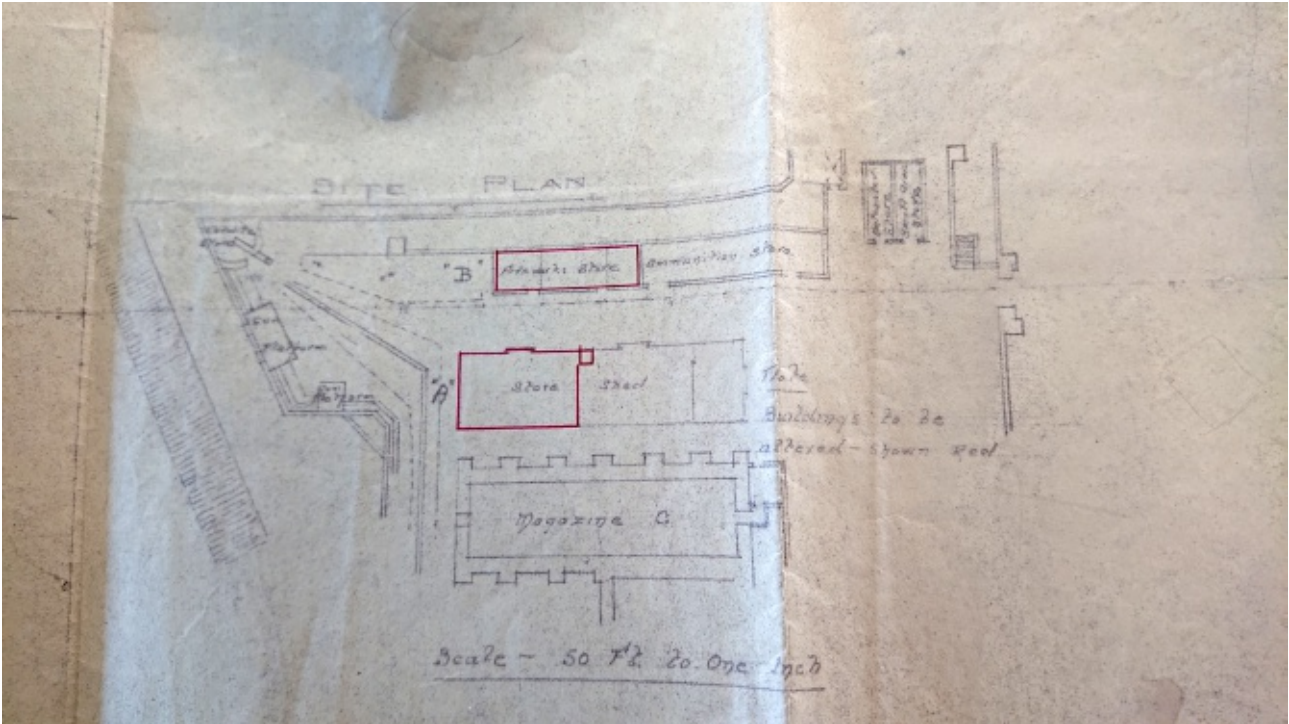
On 18/1/1941, Major Flanagan sought sanction for alterations to buildings in the Fort. This seems to be primarily for the Paxo Plant. He required linoleum for both floors and benches and an alternative heating system, as fires in selected buildings were forbidden. It is not clear if he is saying that the buildings in use for the filling of grenades and the manufacture of firing sets had fireplaces or if he is talking about portable stoves. The only buildings with chimneys were Buildings K and L and the sentry post, Building J. The heaters requested were not for comfort but to avoid humid conditions for the materials. He suggested panel radiators in keeping with Magazine Regulations part 1, paragraph 81. He also stated they were urgently needed if they were to keep pace with the output of grenade bodies (coming from Inchicore Railway works – Myles 2008, 57).

On 11/02/1941 sanction was given for eight 600-watt electric tubular heater which are ten foot long. It is noted that when Defence lighting work was completed at the Fort, space was made on the distribution board. The cost is £45. Flanagan wrote again on the 13/3/1941 to update that the benches have been installed and

the linoleum had been laid. Alternative light and heating were yet to be completed. Grenade deliveries from [IS Rq] (Inchicore Railway Works) in liners were awaited. The heating was completed on 2/5/1941.

Gleeson wrote on 3/12/41 requesting sanction for a convector heater, 2kw in the painting and packing room (of the Paxo Plant), a cost of £7. An undated plan, probably 1944, attributed to the Army Command Engineers (possibly Capt. JJ Sherry) is entitled Magazine Fort - Proposed conversion of existing buildings in Paxo Plant and Chlorate Drying Plant. It is currently the last available plan of the fort. It shows the Johnston Gate pillars, the oft forgotten sentry post at Building D (Detonator Store and Small Arms store, northern half not shown), Building C (here called 'B' - Fireworks and Ammunition stores), Building B (here called 'A' store shed) and Magazine C. It also depicts Cavalier 3 as intact as well as the double gun platform (now single) and the single gun platform.

An accompanying undated, probably 1944, engineering report, likely drafted by Keenan, described the necessity and plan. It did not mention the ESRB but rather the Research and

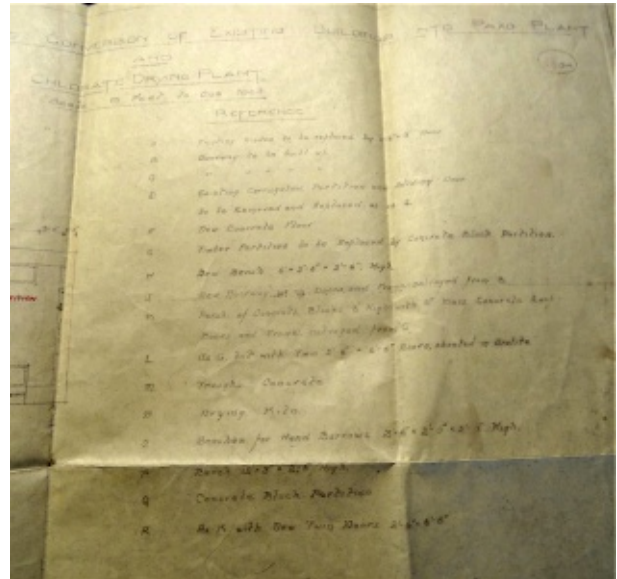


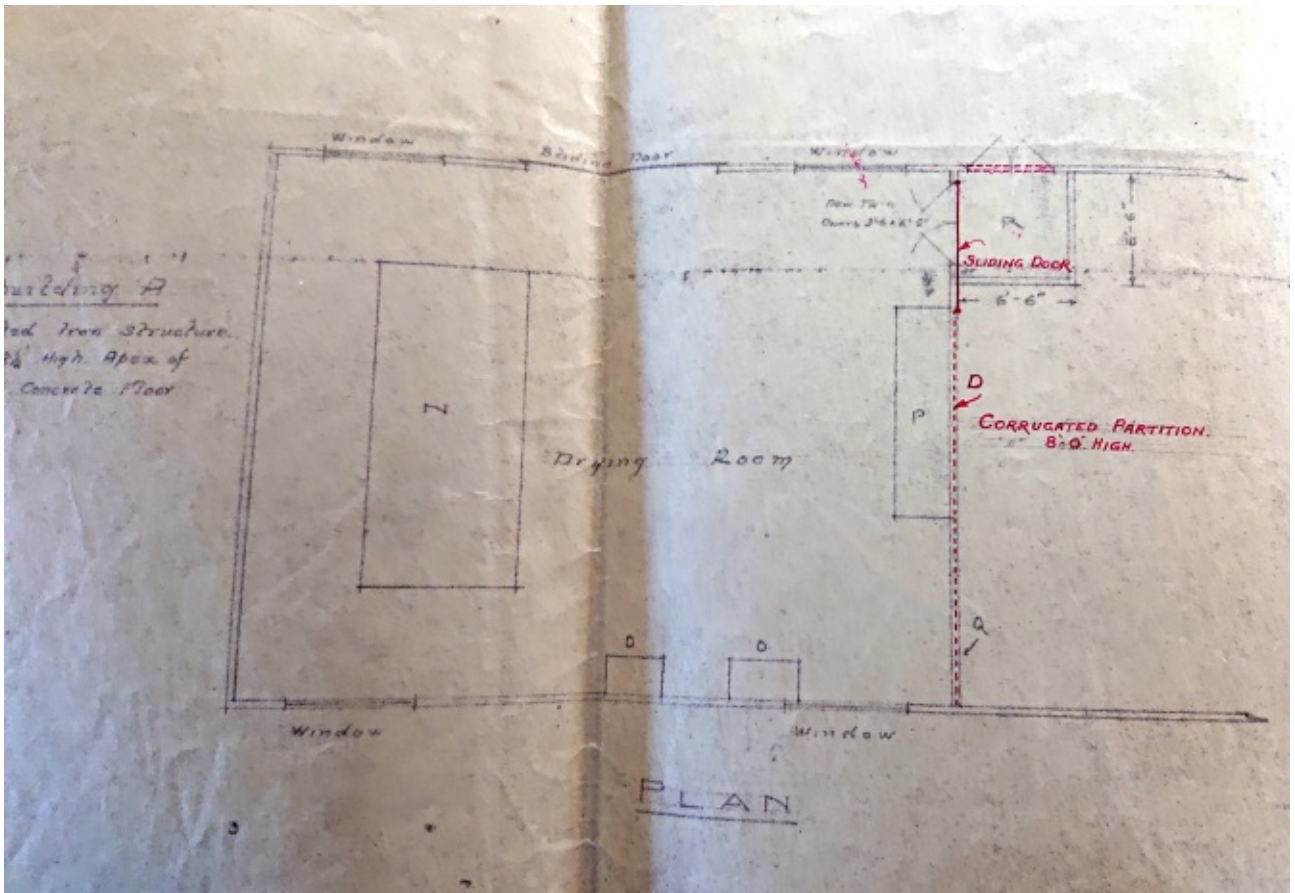
Paxo Plant overall plan

Paxo Plant plans key, refer to plans overleaf

Production Branch of D.O.D. The report highlighted that further works would be required by the Research Department; the particulars would not be known until the main work progressed. The projected cost was £780 (materials £560). Mr Almond at a Finance meeting gave oral sanction on 15/09/1944.

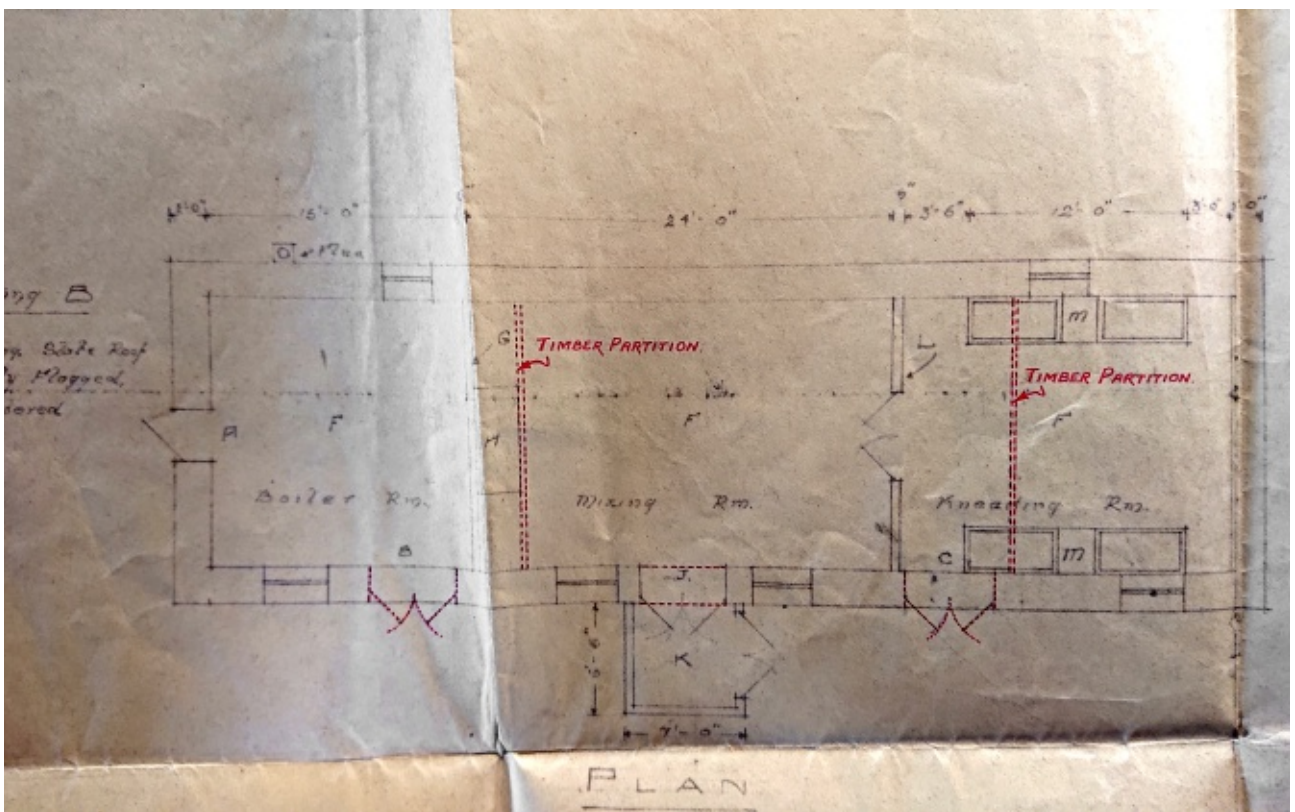
The west section of Building C ('B') was marked for modifications which included the removal of two wooden partitions and the insertion of two concrete walls, almost evenly dividing the space into thirds; the insertion of a door in the west wall; blocking up of the outer doors; insertion of a central door and porch; insertion of bench in the boiler room; insertion of concrete troughs in the kneading room. The wall between the two parts of Building C was shown as solid. In the 1944 engineering report Building C was described as having had timber and flag floors that were to be removed. A connecting door between the kneading and mixing room was to be made fireproof. Four troughs with dished surfaces and a smooth hard finish were to be constructed to Research Department dimensions. Wiring was to be provided to a motor for a grinding mill (two would be sold in





Paxo Plant modifications to Building B, here labelled as Building A

Paxo Plant modifications to Building C, here labelled as Building B

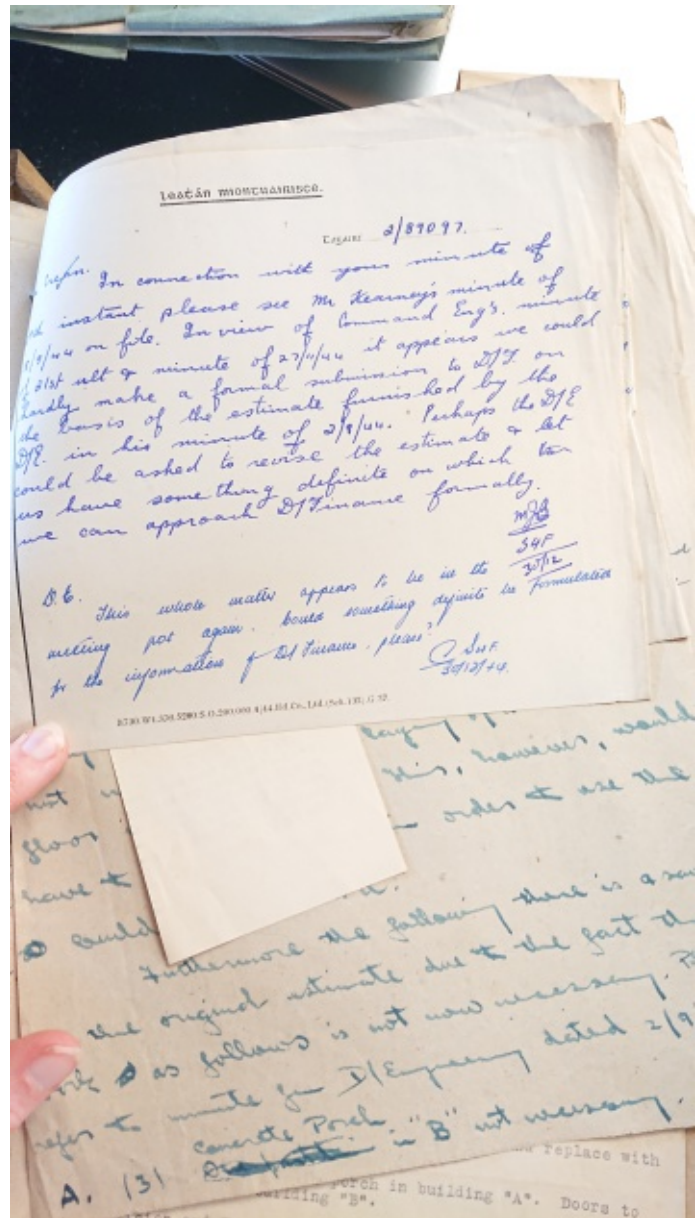


1946) and the water supply was to be extended to the boiler house. An external flue was to be erected for the boiler and installed by contract.

Building B (there 'A') was scheduled for less alteration. The corrugated partition would be replaced by a concrete block wall, the kiln would be built, accompanied by 13ft bench and two hand-barrow benches and an internal porch would be inserted for access.

The outer kiln walls were to be concrete blocks; the inner walls, mass concrete 'with perforations in base to act as air outlets from ovens to flue...flues to be provided between inner and outer walls'. The roof of the oven was to be in reinforced concrete with a manhole, the insulated plate to be provided by research section. A chamber to house the air heating unit was to sit on top of the oven. Glass wool was to insulate the inner walls of the flue and ovens. The oven doors were to be flat iron frames, sheeted with Duralite and insulated with glass wool. The trays would hold asbestos sheet shelves secured to the framework. A butterfly damper was to be located in the wall between the two ovens. Wiring was to be provided to the fan which would force air through the kiln and a 3-phase extension was to be provided to the building.

The layout today is quite different, as information from the ESRB came in a 'piecemeal' fashion. Keenan of Maintenance Company wrote to Commander of Engineering on November 21, 1944 to state that the layout had to be altered, despite 30% of the work having been completed. The main change was that three new 6' concrete block walls would be inserted in Building B (his 'A') and that the 'storerooms' would require six new door opens and a window. Keenan seems to be the author of the original report as he refers to the design. He introduced the 25' chimney stack in stock brick on a concrete foundation. The additional works would cost £183. Keenan was assured by Cmdt McDonald that if Maintenance could not source materials, the ESRB would manage 'al-



Documents indicating concerns about the costs for the experimental plant

most immediate delivery'. The concrete blocks used for the walls have high levels of large inclusions which may relate to the shortage of coal and raw materials reaching the concrete plant at Drogheda.

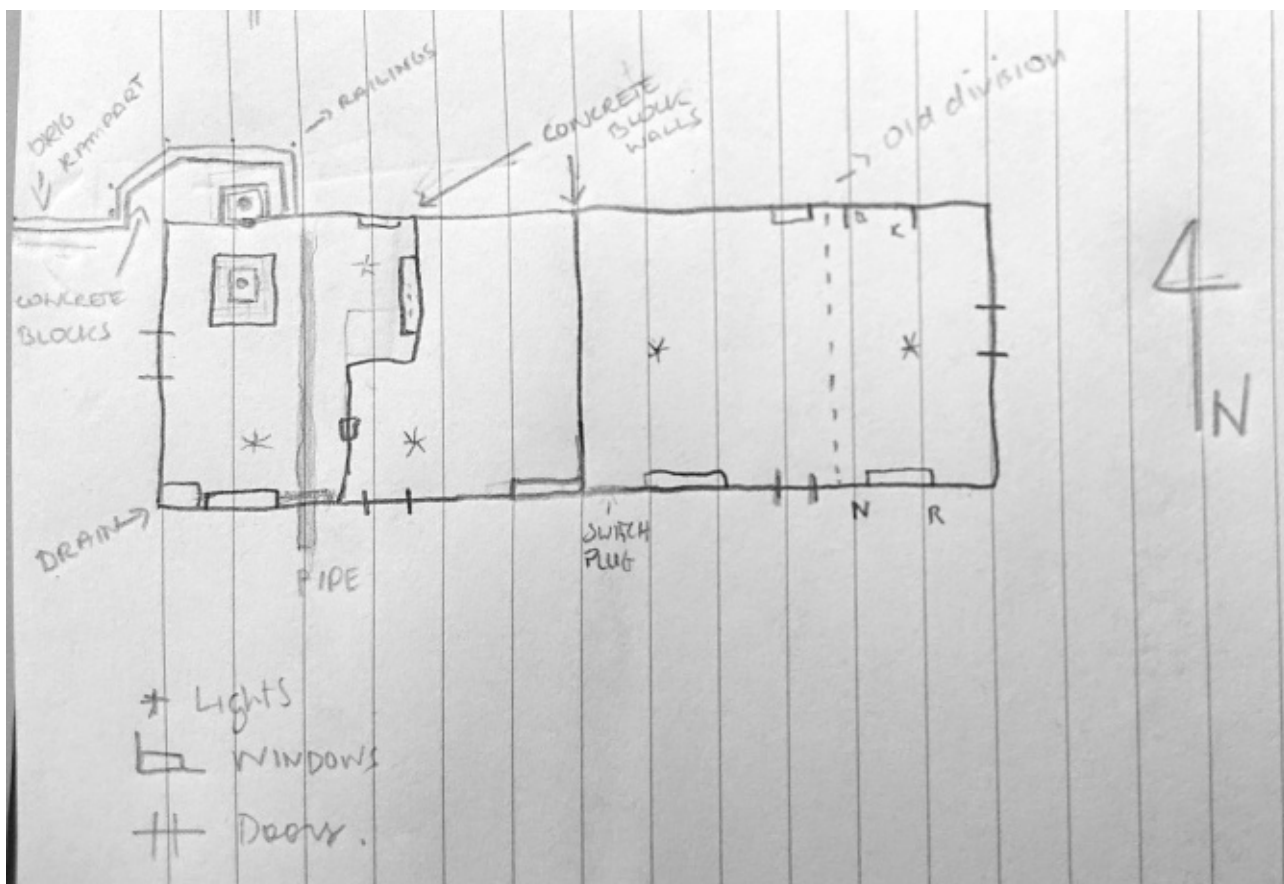
A later letter in McDonald's hand stated that the alterations were made, in consultation with Professor Hogan and Dr Wheeler of the ESRB, to reduce fire risk as much as possible. The only work that had been completed and then not necessary was the concrete floor in Building C, but this probably would have had to have been done later to use the building as a store. McDonald states that there were money savings as

the concrete porch was not necessary, the concrete partition was not to be done and the door opes in B were not to be built up, nor new ones opened. He stressed that the type of chimney needed should have been known and that Magill did not give him the impression that the chimney had been left out of the estimate. He also stated that a representative of Hadens indicated the type chimney required on 24/10/1944 (GN Haden and Sons Ltd were heating engineers, who had specialised in warm air stoves as early as 1816, in the UK, with an office in Belfast).

This change raised alarm in Defence and Finance. A minute on the file notes that Finance requested a submission on the works 'in connection with the production of chlorates', following the oral sanction given by Almond on 16/9/1944 and confirmed 18/9/1944. However, it had not been included in a submission to Finance and the writer (possibly Comerford) could not recollect anything about the £560 materials/ £220 labour bill on

29/12/44. A replying minute (MB) stated that given what had already passed, they would need the Engineers to revise the estimate to something definite. Colonel Gleeson, Director of Engineering had written to the QMG requesting sanction for alterations on 29/11/44 and this was copied in from another file (2/74561). It is this letter that states that chlorates were accumulating at Parkgate Street and that the work urgently needed to be progressed. Gleeson wrote a minute dated 04/01/1945, stating that the Command Engineer thought labour budget too low, so the overall budget was then £1135, up from 965 and previously £780. He found it 'virtually impossible' to estimate the cost and that they 'can get no assurance as to when the full requirements of the Bureau shall be fully set'. He suggested that full particulars should be sought from Ordnance Branch, 'which initiated all the proposals... [as it is] quite impossible for this department to give an up-to-date picture of their intentions'.

Archaeological sketch plan of Building C



In a minute to the QMG, Burgess asked Ordnance to indicate its plans, as Finance was labouring under the impression that the cost would be £780. Major Flanagan was asked to contact Engineering and 'go fully into the matter' so that the submission to Finance may cover and anticipate the costs.

In October 1944, the first official submission to Runaidhe Finance on the costs and completions so far on the plants at Parkgate and the Magazine Fort was made. It clarified the current position and requested sanction on a further £198.13.5 (materials £82) for a contract job to house 'scientific apparatus for testing gunpowder and further similar works are proposed at a cost of £185 (£125). The author, which is most likely Runaí/Secretary of Defence but the minute has been torn, wrote that it 'was impossible to furnish any reliable estimate' for the essential work to put 'phosphorus and potassium chlorate' into production. He was also unable segregate expenditure into separate financial years nor could they separate between phosphorus and potassium chlorate plants.

Almond sanctioned the work but pointed out that given the 'circumstances of urgency' the absence of estimates 'would not have precluded [the minister's] approval and that un-delayed oral sanction, at least, should have been sought. He also stated that the Bureau were to be reimbursed for their expenditure for the year 1945 as all phosphorus produced that year was to be taken by the Army. Runaí Defence then wrote to Gleeson, and without blaming the Director, stated that no further work should be undertaken without authorization so that 'the Secretariat will not again be placed in the undesirable position in which it has found itself recently'. He also understood that the Bureau 'will be going out of existence altogether in the near future'.

Work for housing the scientific apparatus to test gunpowder at the Magazine Fort was completed on 24/11/1944. Work on the Paxo Plant was completed on 2/2/1945 at a cost of £758.2.7 to Army/Engineer Stores but further materials were vouchered by the ESRB.

Today it is clear that most modifications were made to Building B and as a result it became



The concrete blocks used for the Paxo Plant walls in Building B have high levels of large inclusions, which may relate to the shortage of coal and raw materials at the Drogheda concrete plant

known as the Bakery. Three concrete walls were erected and as was set out in the plans, there is no connection, apart from a small serving hatch (planned on the back of the drawings) between the kiln and the mixing room. The first room is the kneading room and houses two concrete block structures with dished tops (four had been proposed). It is connected to the mixing room, housing two mixing urns or chemical reaction pots that take water into the outer surface and drain off to the floor. There may have been more or other furniture south of them as the room is well lit in that corner. A tilted mixing or grinding bowl may also have been in place. In the kiln room, the internal porch in Building B is set at a different angle and not roofed in 6' concrete. The western sliding door is removed.

Building C was also adapted for the Paxo Plant. The 1940s drawing shows the removal of the two wooden divisions. The plans however are not how the work turned out. The floor in the cooperage was dropped below the wall foundation stones, a dog-legged concrete block wall with serving hatch was built, a new concrete floor with drains to the south wall and the internal southwest corner was poured. Finally, a very rough concrete base with steel supports was built against the eastern wall. The window on the western wall was converted to a door and a step was built in. The window bars may also date to this period. This was to be the boiler room with two rooms to the east. However, the ESRB had a change of heart and the knead-

ing and mixing rooms were placed inside the Bakery shed with the drying kiln. Later again, they announced the need for a chimney flue to extend over the parapet wall, causing consternation in Defence and Finance. The chimney barely featured on the initial plan and necessitated the excavation of the rampart with a replacement of the wall in concrete blocks and a railings. A high-level pipe exited the building through the south-facing wall and was connec-

ted to a boiler and may have connected to the kiln. The boiler is now gone but a pipe runs from where it was through the front wall of Building C. Neither a connection to Building B nor the purpose for the boiler has been established.

The showers in Building N may have been installed in the 1940s as part of the Paxo Plant.

Summary of Major Flanagan's letter to the Quartermaster General on 13/11/1945 on the Plants

- Potassium Chlorate, Sesqui-sulphide of phosphorus and Amorphous phosphorus are being produced
- Maguire and Paterson to that date have received 58 tons of potassium chlorate, 3,618 lb of sesqui-sulphide of phosphorus and 420 ½ lb of amorphous phosphorus.
- M&P have paid £15,000 for 41 tons of potassium chlorate
- M&P had asked for a reduction in supply since August 1944 but would be increasing back to 2 tons per week after January 1946
- Flanagan was aiming at 500lb per week of sesqui-sulphide and 60-80lb per week of amorphous phosphorus (he would need another reaction pot)
- Sesqui-sulphide is the most dangerous and time consuming
- There are two types of complaint circulating about the plants:
 - o Emanations from the Chlorate Plant damaging shrubs and plants in the People's Gardens, Phoenix Park
 - & This is to do with the Chlorate Plant
 - & A conference between Defence, Agriculture and OPW was held
 - & OPW considered November and December to be the most damaging months
 - & Industry and Trade therefore wanted to close the Plant for November and December 1945
 - & Flanagan agreed – Plant needed overhauling
 - & Plan prepared for 'counteracting the nuisance' at £620 (previously £2000)
 - o Unpleasant odour in Infirmary Road area
 - & Caused by the Sesqui-sulphide Plant
 - & Certain amounts of intermittent fumes from the Yellow Phosphorus, Amorphous Phosphorus plants and from the Kiln
 - & Scheme drafted for Sesqui-sulphide and Amorphous plants
 - & Kiln – trying to get phosphate rock calcined at source
 - & Yellow phosphorus smoke cannot be avoided – generally dissipated before it reached the boundary wall
- Men at the sesqui-sulphide plant are suffering with eye trouble despite rigid precautions
- Men selected for the work must be specially medically and dentally examined: 'we had a good number of men perfectly healthy and fit for Army service but were rejected for employment here'
- Electrodes needed from USA
- YP plant is being restarted on the 14th November, it requires overhaul but will be run as long as can be safely done – awaiting carbon black furnace linings
- S and AP plants – costing ventilation and installation of reaction pot
- Drying plant Magazine Fort – working very satisfactorily. All most chlorate produced has been dried and that plant is being stripped, examined, and cleaned.
- Demobilisation arrangements – question of non-regular technical officers and other ranks
 - o Captain A McCann oversees the Magazine Fort Plant on temporary commission, though wishing to remain, is over prescribed age
 - o Already losing civilian staff chemists and engineers to permanent roles elsewhere
 - o NCOs that set up the plants and worked there would be a loss if let go
 - o The work was not 'very enticing'
- Despite running plants not being a normal part of the work of Army, Flanagan states that the Department should have an interest in the continuance of the Plants so that a home supplies of chlorates explosives, smoke and incendiary material would always be assured
- Flanagan was aware that the formation of a chemical company to ensure supplies of chlorate and phosphorus was in discussion, he was prepared to furnish the company with details of the processes figured out during the life of the plant
- Flanagan did however seek clarification as to what was going to happen and was he to keep production going until this company took over, at which point he expected the factory would be moved to a non-residential area or would be operated as they stand
- Flanagan was very keen that the men know what their future was to be and the uncertainty 'weighs very much with them at present'

Wind-down of the ESRB and the Plants

Major Flanagan writes a long letter to the Quartermaster General on the 13th of November 1945 on the Plants at Parkgate and the Magazine Fort (see box on previous page).

A 24/11/1945 minute from a colonel in Defence (not Gleeson) stated that the likelihood of Flanagan's staff being retained was 'very slender' but if they became dispersed, it would almost be impossible to run the plant. The contracts officer was instructed by the Assistant Secretary, Sean Moran, to inform Industry and Commerce that 'all feasible steps' should be taken to retain the staff and to ascertain their plans for the plants.

A conference was held on 30/11/1945 to discuss the future of the Plant. In attendance were Dr Van Der Lee (manager, Alcohol Factories/Monarchana Alcóil na hÉireann Teó), Mr Murray, Dept. Industry and Commerce, Major Flanagan, and Mr Carr (Defence). Mr StJohn Connolly presided. The government had decided that a Bill should be prepared to establish a Government Chemical company. They had considered building 'up an organisation in the present Alcohol Company' to produce chlorate and sesqui-sulphide. Mr Carr thought that neither OPW nor Defence would consent to the Parkgate site being used and, in any case, Defence was now anxious to be relieved of the plants. Dr Van Der Lee thought that production would move to his factory in Louth, but housing would be problematic. Furthermore, the plants had never been constructed as permanent fixtures and were unlikely to survive a transfer, but parts could be moved. Major Flanagan and Mr Carr wished that the employees would have some indication of their future employment. Mr Van Der Lee did not have staff trained in the production and that he would 'look to the existing organisation as the nucleus of a new staff'. An inspection was agreed for the 6th of December. Moran, the QMG and Contracts Officer met with J Williams, S Hogan, and CS Almond at the Parkgate. Almond was on the board of the Alcohol Factory.

On January 11, 1946, Peadar Mac Mathúna, Runaí Defence wrote to his equivalent in Industry and Commerce, reiterating how anxious

Defence was to be relieved of the Plant. At a meeting on January 15, with Almond in the Chair, Flanagan again advocated on behalf of his staff, on the notion of 'risk pay' as there was a risk to the health of the employees. Defence had accepted the risk of Workmen's compensation and Alcohol Company would have to pass this to an assurance firm. Flanagan stated that civilian staff that left, 'did so to better themselves' owing to the instability of the Plant work. Almond asked Flanagan to convey to the staff that they would be kept on. Van Der Lee wanted to take only civilians employed in technical work, Defence countered that they were all technical. Flanagan also encouraged the retention of the Supervising Foreman at the Magazine Fort, an 'oldish' man, who could not return to the Department of Defence. Major Flanagan was asked how much time he spent on the Plants - 2/3 of his time and was otherwise engaged in inspecting explosives. Commandant McDonald, Major Flanagan's second in command was sought back at his post by Ordnance Depot. Captain McCann, working as a chemist

Paxo Plant Building B, showing concrete-roofed drain under floor drain and steel frame near wall hatch





Paxo Plant detail from kiln, showing a butterfly damper and decorative hinge

would not be kept on (seemingly too expensive). Another officer, Captain Gahan would only be considered if he took a pay cut. Lieutenant Donovan, a temporary officer engineer was looking for a good salary and when the board heard that he might be taken by the Irish American Oil Company, and was 'the backbone of the concern', it was agreed that they would interview him.

As regards the fort, it seems that the Alcohol Company were considering continuing operations there and that 'they would still need the drying process'. However, it still contained Army stores and it was hard to get admission to the Fort. So, Captain McCann's job was safe. The remainder of the staff, apart from a draughtsman, would continue with the Plant and the officers were set to be interviewed by the board.

Flanagan stated that there were 99 men employed on the plants but usually 12-14 out sick per day due to recurring burns and accidents. Almond asked how the Department ensured the civilians were sufficiently fed 'to make them stand up to the work' – they were given an extra ration and a dining room was provided at the Plant but otherwise it was up to them.

Flanagan was told to proceed with repairs and purchases of supplies and that the Board would buy the Plant and stocks. He advised the Board that 'tests' were available at St Bricin's Hospital and the Ordnance Workshops Islandbridge. However, May 2nd is the last appearance of the Alcohol Company in the file. The idea didn't come about.

A week prior to the completion of modifications to the Parkgate site in April, Major Flanagan was told that the Plants were likely to be decommissioned. M&P had sourced their own supplies of phosphorus and politically Parkgate was too difficult. Patrick McGilligan told the Dáil in March 1946: 'people were nearly poisoned...devasted back gardens...affected in health... [those who hung out clothes] found themselves very much worse off in their wardrobes than ever before. I cannot understand why this highly poisonous gas attack was made in a congested built up area in the city' (Myles, 2008, 61).

By November, Major Flanagan was itemising the break-up, sale, and disposal of the Plant. It was not without incident. Destruction ground was prepared at Kilbride Camp, where sixty



Paxo Plant kneading stations, possibly misinterpreted as being for bread-making

tonnes of grenades, phosphorus sludge, firing liquid, etc., were buried in trenches and warning notices placed on the fenced off area. One man burnt his hand and two small fires occurred on the lorries transporting the materials. The bodies of the lorries were contaminated with phosphorus and the floorboards were likely replaced. Sixty tonnes of kelp potash at the fort were packed into two bags and sent by railway and canal to new owners. The transformer stations were stripped down, and the equipment was removed. Five tons of potassium chlorate, 760lbs of sesqui-sulphide of phosphorus and 120 lbs of amorphous phosphorus were delivered to Maguire and Paterson. Contaminated materials were due to be collected by a ship called 'Shark' which would dump the material at sea. Certain chemicals were returned to manufacturers. The men appeared to have been moved into training and were on the ranges. The laundry gate was 'permanently locked' and the police withdrawn.

Irish Shell Ltd. took back six barrels of fuel oil and ten drums of benzine. In consideration of some incident at the [ferries?] works, five drums including a damaged one were accepted back and destroyed. Major Flanagan attempted to get

82 empty carboys returned and credited but for some reason, the contracts officer wanted to offer the empty carboys to six departments causing a headache for Flanagan and dragging the matter out to March. Major Flanagan finally managed to wind up the accounts in September 1947 and the file was closed.

Bread making in the Fort

Building B is often referred to as the Bakery given the presence of the mixing bowls and the ovens (now known to be a kiln). The story circulates that the ovens were used to bake bread in the time of the Emergency, either as public welfare or for the army. While both Bryan and Bradley discuss the wheat shortages and impacts on the public, neither of them make mention of a bread bakery in the Fort. Furthermore, the food assistance described by Bryan (171) is a Food Allowance Order 1941 that issues vouchers rather than food.

Flour supplies were caught up in the trade sanctions imposed by Britain during the Emergency. During the 2020 lockdown, flour supplies were also choked but this did not have a meaningful

impact on dietary concerns. During the Emergency, it had considerable impact on poorer families who had hitherto almost subsisted on bread and spread, up to 32 pound-loaves weekly per household (Bryan 2014, 13, 105).

The government had to deal with this in three ways. Firstly, the extraction percentage of flour was increased from 70% to 100% by May 1942, producing a brown-grey, coarse bread. The phrase 'black bread' was even banned by the censor in 1941 (Bryan 2014, 104).

In May 1943, the Dietetic Council of the Medical Association of Ireland had reported an increase in the incidence of rickets and advised the reduction of extraction back to 85% with a concurrent addition of calcium to the flour. This led to the ESRB investigating sources of calcium carbonate from Irish limestones with the help of the Irish Geological Society (Bradley 1991, 101, 180). This, coupled with the addition of barley flour to the 85% mix, became the new advice for the public on baking. The Emergency generation seemingly learned to relish brown bread (Bradley 1991, 288).

Secondly, while bread was not officially rationed until 1947, bread and flour supplies were tightly controlled, and production occurred only under licence. However, flour prices were subsidized to mitigate a rise in the price of bread flour (Bryan 2014, 105). Controls extended to the hospitality sector who had to print 'it is illegal to service wheaten foods with more than one course' and could only supply one portion of bread at a meal of two courses unless the customer paid extra (Bryan 2014, 106).

Thirdly, the Minister for Agriculture, James Ryan, announced on October 15 1943 that it was mandatory for farmers with holdings of five statute acres to devote a portion of his land to wheat, depending on which district the farm found itself (Bryan 2014, 101-2).

In 1942, following a shortfall of 100,000 tons in the wheat harvest, the government urged the public to reduce consumption by 20%. This prompted panic buying of bread with queues forming outside bakeries, causing further hardship on the poor. Bryan cites an example of one family of three adults and eight children who

ordinarily would consume 38 loaves per week but could then only source 19 (2014, 107). This was to be followed by rationing in 1942, but this was averted by the sale of beer. Ireland was not aware of the British sanctions until August 1943, taking Britain's own shortages at face value. In early 1942 Ireland stopped beer exports to Britain, on foot of the wheat shortage and this prompted an agreement. As Northern Ireland obtained 80% of its beer from Ireland, Britain agreed to ship 30,000 tons of wheat in exchange for 1,000,000 barrels of beer. In addition, Guinness was assigned 300 tons of slack coal weekly to meet demand and Drogheda Cement was also allocated coal to supply NI with cement (Bradley 1991, 348 -appendix 3: War Cabinet Committee on Economic Policy Towards Éire).

Imperial Chemicals Industries

On 06/01/1956, RI Gill from Imperial Chemicals Industries (Export) Ltd. (ICI) wrote to the Secretary of the Department of the Defence, inquiring whether that company could lease the Magazine Stores. Their own planned 30 tonne magazine at Mooretown, Dublin had not been approved by local authorities. He noted that the Avoca Mines required 15 tonnes of explosives per month and that demand continued to increase. A 15-tonne annexe in Waterford was also months from completion. He offered to make the magazines ready for whatever level of storage could be licenced by the Department of Justice.

Internal minutes show that the stores, at that stage, were holding barrack services, gelignite and civil defence stores (according to QMG), and this lease would necessitate building works, the provision of military guard and the taking of responsibility for non-military stores. The Secretary responded in February that storage could not be accommodated.

One year later, on 17/01/1957, the Garda Commissioner wrote to the Chief of Staff, Major Gen. PA Mulcahy, requesting that temporary accommodation be provided to ICI as a result of a break-in to the stores at Mooretown, which had revealed that the doors were not sufficiently secure. The new doors would take 2-3 months

and while stocks would shortly be exhausted, the Commissioner hoped that the Magazine Fort could accommodate a new delivery of gelignite, detonators, and fuse. Mulcahy responded that they would. A minute suggests that the Store A Magazine and Store No. 14 (possibly building D or E) were prepared. The QMG, Lillis, wrote to Mulcahy on January 19th to highlight that while the accommodation could be provided, the stores were not up to Magazine Regulations as the fort was close to Glacis cottage (then a dwelling house) and the caretaker and family lived in the fort. He also noted that two members of AGS would always attend the representatives of the ICI when visiting the fort, and that this was to happen only two days per week. A guard and fire picquet were also being arranged.

Mulcahy wrote to the Commissioner on the 18th January 1957 to say the storage would be available from the 21st, reiterating its temporary and non-compliant nature. On the 22nd January, Cmdt McClusker Command QM, wrote to the Officer in charge of Barrack Services, requesting the terms and conditions of the letting for the information of the General Officer Commanding. Memos between the Department of Defence and the QMG show that deep concern was felt about the lack of compliance with Magazine Regulations and the lack of indemnity from ICI. Meanwhile, the Defence Secretary wrote to the Finance Secretary making them aware of the letting on 25th January and requesting a covering sanction. They did not intend a charge.

On May 17th, 1957 (four months after the original letter), Major General Egan, General Officer Commanding of the Eastern Command, wrote to the Chief of Staff Mulcahy. He stated that two NCOs and six staff were placed at the Magazine Fort on January 22nd for what was supposed to be a period of six weeks. Sixteen weeks later, repairs were still not completed at Mooretown and Egan had little confidence in the new estimate of a few weeks. Due to low staff numbers, those staff were enduring heavy guard duty and morale was suffering as a consequence. He suggested that ICI not 'wear out their welcome' of free storage and free protection. Mulcahy noted on the letter that a charge

for storage might encourage ICI to move and forwarded the file to QMG, who urged the Defence Secretary to send a strongly worded letter to ICI. Similar was issued by Defence to Justice, and a Justice minute stated that Gill had mentioned that the door had been ordered, due for installation by July. On August 17th, Captain Horgan, A/Adjutant Eastern Command wrote to Mulcahy stating Moortown was now repaired. At this stage, minutes suggest that access to the Fort, save for the withdrawal, should be removed. The situation continued into September; fresh deliveries were made to Moortown, but stocks remained at the Magazine Fort. Finally, on October 2nd, Cmdt McClusker noted that ICI had finally vacated the Fort and no damage or deficiencies had occurred as a result of the letting. Thus, the file was closed.

1960s and 1970s

On 27/07/1972, a request was made for £185 (materials £85) for a chain link partition to be installed in Magazine A to separate the Command Pool stores from whatever else was currently being stored there. It seems that the Command Pool stores accommodation was taken over by the Sick Lines for the Equitation School, who had lost their accommodation in McKee barracks. Command Pool was also to be accommodated in McKee barracks but a delivery of riot equipment (likely related to the Troubles) meant that space was at a premium. Chain link was found ex Stores on 09/11/72.

The OPW file on the Magazine Fort notes that the Duke of Dorset gate was demolished to allow access to the interior of the Fort. It is possible that the demolition of the front facade of Magazine C and its replacement with sliding steel doors occurred at the same time, in the late 1960s or early 1970s. The entrance made was tall enough to allow a lorry to reverse into the Magazine, which may also be why the floor was replaced in concrete and the yard wall was demolished. However, the Magazine C alterations may have occurred earlier as this magazine was used for storage of less combustible items from the 1900s.

OPW seeks to take over the Fort

The OPW Files contain information on the transfer of the Magazine Fort from the defence forces. In 1973, a report on the Fort was written by Bolton Street architectural students. The students suggest the current storage use of the fort was inappropriate and that OPW should make use of it for Park Offices or a restaurant. Berkery, Parks Section, OPW asked Runáí Defence if the fort was still required. He was directed to respond that it cannot be evacuated in the foreseeable future.

The OPW, however, remained concerned as they are aware that the Johnston gate has been dismantled 'in the last few years' and the gate had been similar to that in Charles Fort (1667-70, renovations 1757-59 included the gate arch) but 'more monumental'. Berkery writes again to the Secretary, noting OPW disappointment that the Fort is still required and requests that elements of the gate are retained. In July 1973, Defence Secretary minutes that the gate was dismantled to facilitate Signal Corps Wireless vehicles into the Fort and that the inscribed slab was broken during this work but that the stones were available. RP Corrigan visits the Fort in October 1974 and makes a report. He states that only four Portland stones remain. He notes that the remaining piers are to be removed to facilitate 'the anchorage of a wireless mast' by Army Signal Corps. He also states that the storage involves 'old bikes and mattresses...disused cars'. He recommends that the issue of taking the Fort into OPW care be taken up at ministerial level before it is too late. He adds later that the balance of stone is in the fort but that the gate was not recorded or numbered.

It is decided that the Parks Secretary would write to the Minister for Defence in July 1975 to explain OPW interest and concerns about the Fort. In March 1976, OPW seeks alternative accommodation for the Military storage in the Fort and the Communications Centre that had been created in the Fort. At this point, Infirm-ary Road is being considered as new offices for Defence and has a fall-out proofed basement that may be used for communications but is thought to be some five years away. In the meantime, in 1976, the National Monuments

Advisory Council recommends to Dublin Corporation that the Magazine Fort be listed as 'worthy of preservation' in the Dublin City Development Plan.

The Fort is described as 'appropriated to the Dept of Defence' in 1975 and in 1977 when responding to NMAC, the Director states that they are communicating with Defence 'with a view to regaining possession'. The building is not included in List 3 Important State-Owned Buildings for Preservation in 1977. Sanction to commence tender stage on the new Defence building was given in 1979 due to economic concerns, not tendered until 1985/6. The Chairman of the Commissioners writes in November 1986 to establish if Defence still required the Fort. Defence replies that it is no longer needed but that a caretaker lives there who would require employment. Mr Christopher Ryan had been caretaker since 1982 and would ordinarily retire in 1990. OPW agree to take Ryan into employment.

The Fort was finally handed over to the OPW on 1/7/1988. The Military Authorities had previously commissioned a feasibility study on a military museum in the Fort. This proposed to demolish all buildings within the wall and erect a new purpose-built building. In an OPW inspection, it was felt that buildings of architectural and historical interest should be retained. Consideration was given in 1988 as to how to present the fort as a smaller 'Charles Fort', or as a military museum.

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