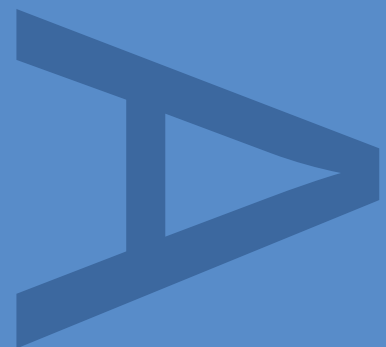


**HISTORIC BUILDING RECORDING OF A
WORLD WAR TWO DEFENCE INSTALLATION AT
LUCAS GREEN, WHITTLE-LE-WOODS,
CHORLEY, LANCASHIRE**

MARCH 2013



PRE-CONSTRUCT ARCHAEOLOGY

DOCUMENT VERIFICATION

**WORLD WAR TWO DEFENCE INSTALLATION
LUCAS GREEN, WHITTLE-LE-WOODS, CHORLEY, LANCASHIRE**

HISTORIC BUILDING RECORDING REPORT

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**Historic Building Recording of a World War Two Defence Installation at Lucas Green,
Whittle-le-Woods, Chorley, Lancashire**

National Grid Reference: SD 58251 20835

Site Code: LWC 13

Commissioning Client (on behalf of Redrow Homes (Lancashire) Limited):

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March 2013

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CONTENTS

List of Figures

	<i>page</i>
1. NON-TECHNICAL SUMMARY	1
2. INTRODUCTION	3
3. AIMS AND OBJECTIVES	28
4. METHODOLOGY	29
5. RESULTS OF THE BUILDING RECORDING	31
6. DISCUSSION AND CONCLUSION	53
7. ACKNOWLEDGEMENTS AND CREDITS	55
8. BIBLIOGRAPHY AND SOURCES CONSULTED	56
APPENDIX 1 CONTEXT INDEX	

List of Figures

	<i>page</i>	
Figure 1	Site Location	4
Figure 2	WW2 Defence Works Location	5
Figure 3	VPs in 44th AA Brigade Area, November 1939	24
Figure 4	Euxton VP LAA defence scheme, September 1939	25
Figure 5	DFW3 design of holdfast assembly for static Bofors LAA gun	26
Figure 6	DFW3 design of emplacements for mobile Bofors LAA gun	27
Figure 7	Plan of Lucas Green pillbox and gun emplacement	38
Figure 8	Horizontal cross-section of Lucas Green pillbox	39
Figure 9	North-west facing elevation of Lucas Green pillbox	40
Figure 10	Overall Lucas Green installation, looking north-east	41
Figure 11	LAA gun emplacement, from pillbox roof, looking south-west	41
Figure 12	LAA gun emplacement, looking south-east	42
Figure 13	LAA emplacement and LMG platform, working shot, looking south-west	42
Figure 14	Pillbox and LMG platform, looking north-east	43
Figure 15	Pillbox, south-west facing elevation, into LMG platform	43
Figure 16	Pillbox, south-east facing elevation	44
Figure 17	Pillbox, north-east facing elevation	44
Figure 18	Pillbox, north-west facing elevation	44
Figure 19	Pillbox, test-pit against north-west elevation	45
Figure 20	Pillbox, foundation in test-pit against north-west elevation	45
Figure 21	Pillbox, interior, entrance (anti-ricochet wall to left), looking south-west	46
Figure 22	Pillbox, interior, embrasure in north-west wall, looking north	46
Figure 23	Pillbox, interior, embrasure in south-east wall, looking south-east	47
Figure 24	Pillbox, interior, south-west and anti-ricochet walls, looking south-west	47
Figure 25	Pillbox, interior, north-east corner, looking north-west	47
Figure 26	LAA emplacement, predictor pit, looking south-west	48
Figure 27	LAA emplacement, south-east ammunition bay, [10], looking SSE	48
Figure 28	LAA emplacement, south-west ammunition bay, [11], looking WSW	49
Figure 29	LAA emplacement, north-west ammunition bay, [8], looking NNW	49
Figure 30	LAA emplacement, north-east ammunition bay, [9], looking north-east	49
Figure 31	LAA gun pedestal, looking south-west	50
Figure 32	LAA gun pedestal and cabling conduit, looking north	50
Figure 33	LAA gun pedestal with cabling aperture, looking north-east	51
Figure 34	LAA gun pedestal, metal frame, looking north-east	51
Figure 35	LAA gun pedestal, metal frame, stirrup bracket detail, looking north	52

1. NON-TECHNICAL SUMMARY

- 1.1 Pre-Construct Archaeology was commissioned by Hyder Consulting, on behalf of Redrow Homes, to undertake historic building recording of a World War Two defensive installation located on Lucas Green, Whittle-le-Woods, near Chorley, Lancashire (National Grid Reference SD 58251 20835). The work was to provide a permanent record of the structure, in compliance with a condition of planning permission for a housing development at the approximately 7 ha site. The building recording was carried out to a standard equivalent to an English Heritage 'Level 2' record, with documentary research undertaken to place the structure in its historical context.
- 1.2 Ahead of the historic building recording, the defensive installation on Lucas Green was thought to comprise a brick and concrete pillbox, with an anti-aircraft (AA) gun mounting close by, built to defend the Royal Ordnance factory (ROF) established just before World War Two at nearby Euxton/Chorley. The pillbox was not listed (including local listing) and did not lie within a conservation area, but had been identified by the Local Planning Authority, Chorley Borough Council, on the advice of the Lancashire County Council Archaeology Service, as a non-designated heritage asset of local historic interest.
- 1.3 The work undertaken established that the Lucas Green installation consisted of a type DFW3/23 pillbox and an attached AA gun emplacement designed to accommodate a static Bofors 40mm light anti-aircraft (LAA) gun. The structures were built in brick and concrete. The pillbox comprised a roofed square chamber, backed by an open platform with a mounting for a Lewis AA light machine gun (LMG). The adjoining LAA gun emplacement was a circular structure comprising four main elements: external brick walls and ammunition bays; inner concrete floor surface with drainage system; centrally-located concrete holdfast pedestal for the Bofors gun and; raised pedestal on which an anti-aircraft fire-control predictor would have been sited.
- 1.4 Documentary research confirmed that the installation was built to defend ROF Euxton/Chorley against enemy attack, both from the ground and the air. It was probably built in the late summer or autumn of 1940, with documentary evidence indicating that four static Bofors guns were deployed by 80th LAA Battery of the 21st LAA Regiment in defence of the factory in mid-November of that year. The static guns were replaced by mobile Bofors guns the following February and it is likely that the LAA emplacement on Lucas Green went out of use after that date, although the pillbox was probably manned for some time after that, possibly by the Home Guard in 1943-44..
- 1.5 The Lucas Green installation survives in exceptional condition, with the exception of the now demolished upper part of the wall of the LMG platform of the pillbox. In overall terms, surviving World War Two LAA gun sites are relatively rare, with approximately only 40, out of the total of approximately 1,250 that were originally built in Britain, surviving to any coherent extent. Ground emplacements for static Bofors guns are particularly rare and the Lucas Green example is notable amongst this very small sub-group for its exceptional degree of preservation. With regards to its association with a pillbox, the Lucas Green LAA gun emplacement is potentially unique in the UK, certainly in terms of surviving examples.

- 1.6 The original intention had been to remove the wartime installation as part of the development. However, the work undertaken, which exposed the extent and nature of the overall installation, *i.e.* the pillbox, LMG platform and associated LAA gun emplacement, allowed the degree of preservation and significance of the overall installation to be fully appreciated. This led to a re-design of the development layout to allow the heritage asset to be preserved *in situ*, with Redrow Homes taking the lead role in this decision-making.

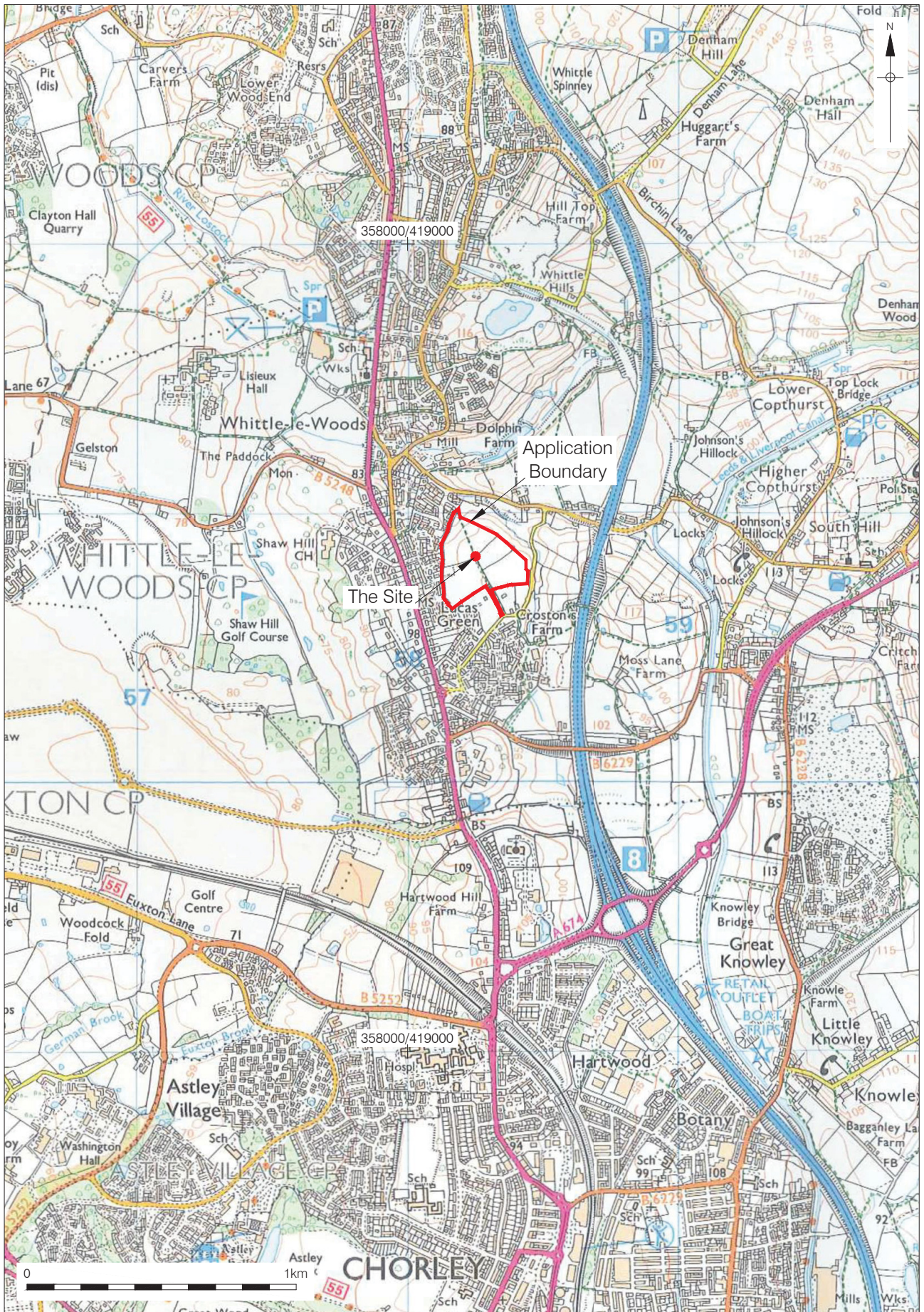
2. INTRODUCTION

2.1 General Background

- 2.1.1 Pre-Construct Archaeology was commissioned by Hyder Consulting, on behalf of Redrow Homes, to undertake historic building recording of a World War Two defensive installation on Lucas Green, Whittle-le-Woods, Lancashire. The work was required by the Local Planning Authority, Chorley Borough Council, as a condition of planning permission for a housing development.
- 2.1.2 Ahead of the work, the defensive installation was thought to comprise a brick and concrete pillbox, with anti-aircraft gun mounting close by. Initial investigation of the installation in January 2013 established that the pillbox was backed to the south-west by an AA LMG platform, into which a LAA gun emplacement was incorporated. Central to the emplacement was the aforementioned mounting, a concrete holdfast pedestal upon which a static Bofors 40mm LAA gun would have been mounted. The scope of work was therefore extended to fully expose and record the structural installation, with this work undertaken February-March 2013.
- 2.1.3 Recording of the installation was carried out to a standard equivalent to an English Heritage 'Level 2' record (English Heritage, 2006a). The project was designed according to English Heritage guidelines set out in *Management of Research Projects in the Historic Environment* (MoRPHE) (English Heritage, 2006b).
- 2.1.4 The installation was exposed and cleaned by hand. A detailed photographic record was made and various scale drawings were compiled. Documentary research was undertaken at various sources to set the results of the recording in historical context.
- 2.1.5 At the time of writing, the Site Archive, comprising written, drawn, and photographic records, is housed at the Northern Office of PCA, Unit N19a Tursdale Business Park, Durham, DH6 5PG. When complete, the Site Archive will be deposited with the Museum of Lancashire, Stanley Street, Preston, PR1 4YP, under the site code LWC 13. The Online Access to the Index of Archaeological Investigations (OASIS) reference number for the project is: preconst1-146755.

2.2 Site Location and Description

- 2.2.1 The Lucas Green development site covers c. 7 ha, centred on National Grid Reference SD 58251 20835 in the village suburb of Whittle-le-Woods, c. 2 km to the north of Chorley, Lancashire (Figure 1). The site is located on the east side of Whittle-le-Woods, between the A6 Preston Road and the M61. The defensive installation is positioned centrally within the overall site (Figure 2). An access track, part of a public right of way which crosses the site, runs to the south-east of the structure to meet Lucas Lane, which itself joins the A6 to Town Lane, to the south-west and north-east of the site, respectively.



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Figure 1
Site Location
1:20,000 at A4



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Figure 2
 WW2 Defence Works Location
 1:2,000 at A4

2.2.2 The site is bounded to the north-west, west and south-west by modern era housing and to the south-east by two properties on Lucas Lane, Lucas Green Farm and Lucas Green, the latter a modern bungalow set in its own grounds. To the north-east, east and south-east, beyond the boundary of the development area, the land falls away, to Town Lane to the north-east and beyond Lucas Lane to the east

2.2.3 Apart from the wartime defensive installation, and possibly some post-medieval/modern era quarrying, the site is previously undeveloped. At the time of the work herein described it comprised open grassland, used for livestock grazing, with light tree cover and hedgerows on the boundaries and within the site. The site appears platform-like, relatively flat at c. 93m OD, with the significant fall in the land to the north-east, east and south-east giving the site extensive clear views in those directions. The topography of the site would have been a significant factor in its choice as the location for an AA installation to defend the Royal Ordnance factory sited c. 1 km to the west and south-west at Euxton, on the northern edge of Chorley. A key requirement for anti-aircraft positions was that they commanded an extensive, if not all-round, field-of-fire.

2.3 Planning Background

2.3.1 Outline planning permission (planning application reference 11/00992/OUTMAJ, lodged November 2011) was granted by the Planning Inspectorate in September 2012 for the development of the Lucas Green site ('Land to the north and west of Lucas Lane, Whittle-le-Woods, Chorley, PR6 7GY') for up to 135 dwellings. This followed an appeal by Redrow Homes (Lancashire) Limited against a decision in February 2012 by Chorley Borough Council to refuse full planning permission, as sought by the application.

2.3.2 Statutory protection for historically important buildings and structures is derived from the *Planning (Listed Buildings and Conservation Areas) Act 1990*. UK Government policy regarding the historic environment is currently set out in Part 12, 'Conserving and Enhancing the Historic Environment', of the *National Planning Policy Framework (NPPF)* (Department of Communities and Local Government 2012). The site does not lie within a conservation area and the wartime defence installation upon it was not listed (including 'local listing'), therefore it could not be considered a 'designated heritage asset' under the terms of national legislation and guidance relating to the protection of historic buildings and structures.

2.3.3 The archaeological policies of Lancashire County Council are based on guidance given by national government which at the time of the planning application were set out in *Planning Policy Statement 5 'Planning for the Historic Environment'* (PPS5) (Department for Communities and Local Government 2010). Despite the deletion (in March 2012) of PPS5 and its replacement with the NPPF, the *PPS5 Practice Guide* (English Heritage, Department of Culture, Media and Sport and DCLG 2010) remains a valid and UK Government endorsed document.

- 2.3.4 During the planning application process for the site, Lancashire County Council Archaeology Service identified the pillbox (Lancashire Historic Environment Record PRN 36036 and Defence of Britain site reference S0003341)¹ as being of historical interest at a local level, thus it constituted a 'non-designated heritage asset', and was afforded some degree of protection under the terms of PPS5 and, after March 2012, the NPPF. The Archaeology Service therefore recommended that the pillbox and nearby gun mounting be recorded (prior to the assumed removal as part of the development proposal) and that such recording be secured by a condition which should be attached to any planning permission which may be granted.
- 2.3.5 When, following the aforementioned appeal by Redrow Homes, outline planning permission was granted in September 2012, a condition was duly attached, in line with the recommendation of Lancashire County Council Archaeology Service. The condition (no. 19) stated that '*No development shall take place until a full record of the pillbox and gun mounting on the site has been prepared, submitted to and approved in writing by the Local Planning Authority. Thereafter, the pillbox and gun mounting may be removed.*'

2.4 Historical Background

2.4.1 Construction of ROF Euxton/Chorley, 1936-39

- 2.4.1.1 As the threat of war in Europe became increasingly apparent in the mid-1930s, the British Government began to invest in the expansion of the country's armaments industry, which had been in decline since the end of the First World War. Although much of the industry was in private hands, certain elements had traditionally been dominated by the state, not least the manufacture of munitions and small arms, which took place at the government factories at Enfield, Waltham Abbey and the Royal Arsenal, Woolwich. The latter establishment also housed the Royal Filling Factories, at which munitions of all calibres were filled with explosives and propellants.
- 2.4.1.2 Fearful of the potentially devastating impact of an aerial bombardment against Britain, in early 1936 the Government appointed a committee to develop a number of large new filling factories to which production could be transferred from the vulnerable works at Woolwich. Criteria considered by the committee during the process of selecting suitable sites for the new factories included distance from nearby centres of population, provision of road and rail facilities, access to water and proximity to labour (TNA SUPP 5/1260).
- 2.4.1.3 The committee selected sites for the new Royal Ordnance factories (ROFs) at Euxton/Chorley, Lancashire (Filling Factory No. 1), Bridgend, Glamorgan (Filling Factory No. 2) and Glascoed, Monmouthshire (Filling Factory No. 3). War Office approval for the construction of the first two factories was granted in December 1936 and for the third the following June; development of a further seven filling factories (Swynnerton (Staffordshire), Risley (Lancashire), Kirkby (Merseyside), Thorpe Arch (North Yorkshire), Aycliffe (County Durham), Healey Hall (Lancashire) and Hereford) were approved between June 1939 and March 1940 (TNA SUPP 5/1260).

¹ *The Defence of Britain Project*, administered by the Council for British Archaeology 1995-2001, recorded the 20th century militarised landscape of the United Kingdom, with the aim of informing the responsible heritage agencies at both local and national level with a view to the future preservation of surviving structures.

2.4.1.4 The site of the proposed Euxton/Chorley ROF covered an area of c. 900 acres and was located to the north-east of the village of Euxton, on the north-western edge of the town of Chorley² (TNA WORK 26/11A/1: 24/10/1936). Tenders for the construction of magazines, process- and ancillary buildings were invited from a number of approved contractors in November 1936, by which date the value of the contract (exclusive of the manufacture of additional magazines at Heapey) was estimated to be worth £5.5 million (TNA WORK 26/11A/1: 05/11/1936). The contract for the works was awarded to Sir Lindsay Parkinson & Co. Ltd of Shaftesbury Avenue, London WC2 on 18 December 1936, subject to completion within 24 months of commencement (TNA WORK 26/11A/1: 18/11/1936). Work began in early 1937, following which a number of additional contracts including construction of a new fuse powder factory, were added later that year (TNA WORK 26/12/5: 07/11/1938). During the 'Munich Crisis' of September 1938 emergency measures were taken to bring forward the date of opening, and personnel were brought in from Woolwich to start the production process (TNA SUPP 5/1260). In the event, filling of a small quantity of primers was underway by early January 1939, although productive capacity remained extremely limited until April, when the filling of detonators began (TNA SUPP 5/1260).

2.4.1.5 The construction of ROF Euxton/Chorley involved significant quantities of building materials, including 30 million bricks and 1 million cubic yards of concrete, which were used to construct 1,500 buildings, 50 miles of road and 25 miles of railway at the site (Edgerton, 2011: 201). By November 1938, the cost of construction had risen to more than £6.2 million, eventually rising to around £11 million by 1940 (Edgerton, 2011: 201; TNA WORK 26/12/5: 07/11/1938). The factory was officially opened by King George VI in spring 1939 and full-scale production was underway when the Second World War broke out that September. Manufacturing was carried across seven separate sections (primers, pellets and powder bags, fuses, powder, cordite and assembly of quick-firing ammunition, filling of shells and bombs, and magazines and distribution), the buildings of which were surrounded by large earthwork baulks designed to contain explosions in the event of an accident (TNA SUPP 5/1231; Edgerton, 2011: 200-1). At the peak of production in 1942 the factory employed 35,000 personnel, who were responsible for filling more than 23.3 million 25 pdr HE shells and nearly 10.3 million 3" mortar bombs during the Second World War (TNA SUPP 5/1260).

2.4.2 *The defence of ROFs against ground attack*

2.4.2.1 During the early months of World War Two, many factories, public utilities and transport hubs in Britain were assigned a degree of protection against sabotage or ground attack. In most instances this entailed a permanent police or military presence at the factory gates, which was typically withdrawn as the widely-feared threat of sabotage by an enemy 'fifth-column' dissipated. However, a select group of industrial establishments, including aircraft factories, fuel plants and the ROFs were considered to be of such importance to the war effort as to warrant the provision of permanent fixed defences (Osborne, 2004: 85).

² ROF Chorley was also known as ROF Euxton. War diaries produced by Anti-Aircraft Command formations during World War Two usually referred to the factory as ROF Euxton; papers produced by General Headquarters (GHQ) Home Forces generally referred to it as ROF Chorley. Such was the extent of the overall factory site, it effectively stretched from the northern limit of the village of Euxton to the northern central edge of the town of Chorley.

2.4.2.2 Many of these factories were defended by pillboxes or guard-posts built in accordance with designs published by a department of the War Office Directorate of Fortifications and Works dedicated to the design of fixed anti-invasion defences (DFW3), which was established in May 1940 (Osborne, 2008: 77). DFW3 published a series of designs for hardened defensive structures, which included at least nine standardised pillbox designs (named Types DFW3/22-28a). Blueprints were issued to Royal Engineers units responsible for the construction of defensive works, which in turn supervised the civilian contractors who built them. The decision to construct a particular type of pillbox depended upon local tactical considerations, which in turn determined the weapons best suited for defensive use. Local commanders used the official designs merely as a guide, so that many variations upon the basic DFW3 types emerged.

2.4.2.3 While many of the pillboxes defending ROFs were variants of the DFW3 series, a number of surviving examples were built to designs unique to the factories and Royal Navy shore installations, adapted to specific functions or local circumstances (Osborne, 2008: 190). One of the more common varieties found at ROFs was a square structure, with wide 'letter-box' loopholes and a low semi-sunken entrance protected by a half-height blast wall, a variant of which – also installed to protect ROF Chorley - survives by the eastern edge of Mossfield Nature Reserve, adjacent to Shaw Hill Golf Course (NGR SD 5720 2042, c. 1 km to the south-west of Lucas Green). The Lucas Green pillbox was a mostly brick-built variant of the DFW3/23 type pillbox, comprising a square chamber backed by an open platform with a mounting for an anti-aircraft LMG.

2.4.3 *The defence of ROFs against aerial attack, 1937-39*

2.4.3.1 In the autumn of 1937, Sir Thomas Inskip, Minister for the Co-Ordination of Defence in Neville Chamberlain's National Government, was instructed to prepare a plan to accelerate the production of AA armaments for use in the Air Defence of Great Britain (ADGB). In order to hasten the supply of the heavy anti-aircraft (HAA) guns required to take on large formations of enemy bombers, Inskip decided to scrap existing plans to build up a force equipped mainly with the mobile variant of the newly introduced 3.7" AA gun, in favour of accepting a large proportion of the new guns on static mountings, which were cheaper and quicker to manufacture (Dobinson, 2001: 121-4). This decision transformed the composition of Britain's HAA defences, resulting in the construction of a much greater number of fixed gunsites than previously envisaged.

2.4.3.2 Inskip also addressed Britain's woeful shortage of light anti-aircraft (LAA) guns, which were used to defend ground targets against attacks by low-flying enemy aircraft. When the report was prepared, orders had been placed for 300 Vickers twin-barrelled 2-pdr 'pom-pom' guns and 100 Swedish manufactured 40mm calibre Bofors guns for use in the LAA role, although none of these weapons had yet been delivered (Dobinson, 2001: 105-6; 123-4).

- 2.4.3.3 To fill the gap, a quantity of multiple-barrelled Mark VIII 2-pdrs were diverted from Admiralty contracts, while a licence was obtained from Bofors to manufacture their weapon in British arms factories (Dobinson, 2001: 124). Like HAA guns, Bofors guns could be used in conjunction with fire-control instruments designed to lay gunfire in the path of incoming enemy aircraft. For maximum effectiveness the Bofors operated alongside a predictor, which established the flight path of target aircraft and transmitted the necessary elevation settings to the guns electrically (Price, 2004: 8-9); this instrument is discussed further below.
- 2.4.3.4 Despite acquiring an additional quantity of Bofors guns from Polish sources, supplies of this highly effective, fully mobile gun remained very limited until the second year of the war. The shortfall in modern LAA weapons remained acute throughout this period, necessitating the deployment of large quantities of obsolescent 3" AA guns and 0.303 calibre twin Lewis anti-aircraft LMGs, both of which were of First World War vintage.
- 2.4.3.5 In 1936 a Home Office committee began to prepare a register of factories, public utilities and transport facilities that warranted a degree of LAA protection against attack from low-flying aircraft (Dobinson, 2001: 103-4). Over the years that followed, this list of 'Vital Points' (VPs) was regularly updated, comprising 156 permanent VPs at the beginning of the war, rising to more than 280 five months later (Dobinson, 2001: 177). All of the RO Filling Factories were designated as VPs. Each VP was given a unique three figure reference number: ROF Euxton/Chorley was designated VP.426, the Leyland Motors tank factory at Chorley was VP.426a; ROF Blackburn at Lower Darwen was VP.427, and the De Havilland aircraft factory at Lostock was designated VP.418 (TNA WO 166/2079; TNA WO 199/383).
- 2.4.3.6 Five months before the German invasion of Poland, the AA defences of Great Britain were reorganised in order to place them on a war footing. The existing 1st AA Corps became an independent Army Command with the formation of AA Command on 1st April 1939. Briefly commanded by Lt. General Alan Brooke, AA Command was led by Major General Sir Frederick Pile for the entire duration of the war. Reporting to AA Command were the five (rising to seven) AA Divisions, below which were the AA Brigades. The AA defence of north-west England was provided by 4th AA Division, which was headquartered at Chester under the command of Major-General H.G. Martin (TNA WO 166/2139: 22/08/1939). The division comprised six AA Brigades (33rd, 34th, 44th, 45th, 53rd and 54th), of which the 44th was responsible for the AA defence of Lancashire, Cheshire, much of Staffordshire and a stretch of the Cumbrian coast (TNA WO 166/2139). A contemporary sketch map showing the location of AA defended VPs in 44th Brigade area in November 1939 is reproduced herein (Figure 3).

2.4.4 *The LAA defences of ROF Euxton/Chorley at the beginning of World War Two, August–November 1939*

- 2.4.4.1 44th AA Brigade mobilised on 24 August 1939. Initially the Brigade deployed LAA guns in defence of six VPs, including Kearsley and Barton power stations, the Manchester Ship Canal, Salford Docks, Clayton Aniline Co. Ltd of Manchester and the Metropolitan-Vickers plant at Trafford Park (TNA WO 166/2282: 24/08/1939). At this point, the Brigade had only one Bofors LAA gun, which was deployed alongside a number of obsolescent 3" AA guns by 80th LAA Battery RA in the defence of Kearsley power station near Bolton (TNA WO 166/2826: 22/08/1939). The remaining VPs in the Brigade area assigned LAA protection were defended solely by Lewis LMGs.

2.4.4.2 Mobilisation also saw the deployment of detachments of 62nd Searchlight Regiment to 403 Area, which covered both the ROF at Euxton and Baxter's respirator factory in Leyland (TNA WO 166/3080: 24/08/1939). Responsibility for the defensive arrangements at the ROF Euxton/Chorley was assigned to 435th Battery/62nd Searchlight Regiment, which proceeded to deploy searchlights and Lewis LMGs around the site in accordance with a plan, reproduced herein (Figure 4). At this stage, conditions for the troops at Euxton were rudimentary at best, although an inspection by Major-General Martin on 4 September at least accelerated the supply of hutting and sandbags (TNA WO 166/2282: 04/09/1939). By 7 September men of 62nd Searchlight Regiment manned a total of 36 Lewis LMGs at Euxton, with a further twelve protecting the Leyland VP (TNA WO 166/2282: 30/08/1939; TNA WO 166/3080: 07/09/1939).

2.4.4.3 In early October, 62nd Searchlight Regiment was relieved of the defence of Chorley, ROF Euxton/Chorley and Baxter's of Leyland by 182nd Battery/65th HAA Regiment, which took possession of the 48 (36 plus 12) Lewis LMGs left by the departing unit (TNA WO 166/3080: 01/10/1939; TNA WO 166/2282: 05/10/1939).

2.4.5 *The LAA defence of ROF Euxton/Chorley, November 1939-November 1940*

2.4.5.1 AA Command had entered World War Two with a total of only 72 Bofors guns, the majority of which were deployed to protect the RAF's Chain Home radar stations (Dobinson, 2001: 159). At the start of the second month of the war, AA Command decided to hasten the deployment of Bofors guns to the most important VPs by agreeing to accept a proportion of the guns supplied under the existing order on fixed (static) mountings, as opposed to the mobile mountings originally specified (Dobinson, 2001: 167). The first consignment of these guns was allocated to ten VPs (mainly aircraft factories), which were located at sites that could be effectively defended by fixed LAA installations. A second allocation of static Bofors was distributed to a further 33 VPs the following March (Dobinson, 2001: 179). As Bofors guns became available, training in their use became more widely available across AA Command. At the beginning of November 1939, a training camp was established for LAA troops in 4th AA Division area on Aintree racecourse, at which men could gain experience in the use of Lewis guns, Vickers Mk VIII 2-pdrs and eventually Bofors guns (TNA WO 166/2139, November 1939 Appendix 1c, 06/11/1939; TNA WO 166/2877: 01/09/1939).

2.4.5.2 The beginning of November 1939 also saw a number of changes being made to LAA defence arrangements in north-west England. Following the formation of a number of new AA units in the area, 4th AA Division was reorganised in November. Among the newly created units was 41st LAA Regiment, which was mobilised in Preston at the beginning of the month (TNA WO 166/2139; 01/11/1939; TNA WO 166/2714: 01/11/1939). The new regiment brought together three existing territorial LAA batteries (133rd, 134th and 135th). 135th LAA Battery had been formed in Chester at the beginning of the war under the command of Major G.A. Rickards MC, a highly-decorated veteran of several wars who had first joined the Army as a trumpeter at the age of 14 in 1894 (TNA WO 166/2877: 04/09/1939).

- 2.4.5.3 On 1 November 1939, the battery left the Aintree training camp by rail for Chorley, from which it proceeded to take over the LAA defence of ROF Euxton/Chorley (TNA WO 166/2877: 01/11/1939; TNA WO 166/2282: 03/11/1939; TNA WO 166/2714: 26/11/1939). The incoming unit reorganised the LAA defences of the VP into six sub-areas, each of which was assigned a quantity of the 36 available Lewis guns. Nos. 1 and 2 areas were located closest to Chorley and were the responsibility of 382nd Troop/133rd Battery (OC Lt E. Morton), equipped with twelve Lewis LMGs, no. 3 area was manned by 392nd Troop/135th Battery (OC Lt W.C. Chatterton) with six Lewis LMGs, no. 4 area was manned by part of 391st Troop/135th Battery (OC Lt D.E. Preston) with 6 Lewis LMGs; no. 4 area by the remainder of 390th Troop/135th Battery (OC Lt J.W. Forbes) with five Lewis LMGs and no. 6 area by 390th Troop/135th Battery (OC Lt F.A. Frost) with seven Lewis LMGs, four of which were inside the factory perimeter. 381st Troop/133rd Battery (OC Capt G.P. Young) assumed control of the defences of the Leyland VP, which comprised one 3" gun and twelve Lewis LMGs.
- 2.4.5.4 135th Battery spent the first few weeks of its deployment at Euxton improving the gun-pits, hutting, camouflage and roads. For the remainder of the year, Major Rickards' men settled down to a routine of training and inspections by visiting military dignitaries. A detachment of militia recruits was added to the battery strength in November, before being formed into a separate troop and being dispatched to defend a new VP established in December at the Royal Ordnance Fuse Factory at Lower Darwen (ROF Blackburn) (TNA WO 166/2714:19/12/1939).
- 2.4.5.5 In the first week of January 1940, 44th Anti-Aircraft Brigade received notification that it would receive four static Bofors guns for the AA defence of the Crewe VP (WO 166/2282: 05/01/1940). Despite this promising development, only a handful of Bofors guns were deployed in the Brigade area during the first half of 1940. In fact, the process of delivery was slow across the whole of AA Command, which by the third week of June 1940 had taken delivery of only 227 Bofors guns (Dobinson, 2001: 197).
- 2.4.5.6 The supply of Bofors guns had begun to increase in 4th AA Division area by early June 1940, by which date enough static units had become available to enable 44th AA Brigade to allocate several to the defence of VPs at Lostock, Chadderton and Ringway (TNA WO 166/2282: 06/06/1940, 29/06/1940; TNA WO 166/2826: 17/06/1940). Having been advised that they were to receive the highly prized weapons, battery commanders were instructed to identify suitable locations for fixed gun sites. Instructions concerning the siting of static Bofors guns in defence of VPs had been issued to units in AA Command the previous November (TNA WO 166/2139, November 1939 Appendix 1c, 06/11/1939; Dobinson, 2001: 178). Typically, LAA sites were chosen with due regard being given to line- and density- of fire, and where possible the guns were sited on raised ground in order to command an all-round field-of-fire and to allow the guns to be depressed a few degrees from the horizontal, enabling them to fire both on low-flying aircraft and troops attacking on the ground. Enlarging upon these basic principles, the new instructions stipulated that a 'small' VP could be adequately defended by three LAA emplacements, each of which was to be sited at an approximate distance of 400 yards from the VP that they protected, and at an elevation that allowed an outward field-of-fire of down to 2½° (TNA WO 166/2139, November 1939 Appendix 1c, 06/11/1939).

- 2.4.5.7 The sites chosen by battery commanders for static LAA installations required authorisation from higher authorities. When 80th Battery was ordered in mid-June to select sites suitable for the LAA defence of the strategically important De Havilland aircraft factory at Lostock, it was required to submit details of the proposed site to HQ 21st LAA Regiment for approval (TNA WO 166/2826: 17/06/1940). Having received the proposals, Lt-Col L.F. Poulteney, OC 21st LAA Regiment visited the chosen sites in order to satisfy himself that they were suitable, following which they were subject to inspection and final approval by Brigadier-General Rickards of 44th AA Brigade (TNA WO 166/2826: 23/06/1940, 26/06/1940). Having gained approval for the locations of the gun sites at Lostock, 80th Battery was sent to No. 9 LAA practice camp at Cark near Grange-over-Sands, Morecombe Bay to gain experience in the use of the new weapon.
- 2.4.5.8 In the meantime, the war diary of 135th Battery recorded that members of that unit spent the nine days between 12 and 20 July 1940 *"siting for Bofors positions, and Map Photographing, Enlarging and Platting for transmission to 44th AA Brigade"* (TNA WO 166/2877: 12/07/1940). It is not entirely clear whether this work was carried out around Euxton, Lower Darwen or at another VP awaiting an allocation of Bofors guns, and it was to be several months before the defenders of Euxton were to receive a long-awaited consignment of the guns, as discussed further below.
- 2.4.5.9 135th Battery did not get an opportunity to man any Bofors guns at Euxton/Chorley. Towards the end of July 1940, LAA defences in the 4th AA Division area were reorganised and a number of redeployments took place within the divisional area (WO 166/2139 July 1940 Appendix 8a, 27/07/1940). At the end of July, 184 and 383 Troops of 80th LAA Battery/21st LAA Regiment were ordered to make preparations to leave Cark camp in order to assume control of the LAA defences of the ROF Euxton/Chorley at short notice (WO 166/2139 July 1940 Appendix 8a, 27/07/1940; TNA WO 166/2691: 03/08/1940).
- 2.4.5.10 The move had been completed by 9 August 1940, when men of 80th Battery took over control of the Euxton VP from 135th Battery/41st Regiment, which took up new positions in the Scottish Borders (TNA WO 166/2714: 10/08/1940; TNA WO 166/2826: 09/08/1940). Within four days of its arrival, 80th Battery had deployed troops at six LAA defence sites (all Lewis Gun posts) around the factory (TNA WO 166/2826: 13/08/1940). The 80th Battery War Diary recorded that by the end of the month *"all of the gun pits were lined with one thickness of sandbags"*, in addition to which ammunition recesses and *"elbow rests for ground defence had been constructed"* (TNA WO 166/2826: 27/08/1940). This description suggests that the existing sandbagged Lewis LMG positions were adapted to perform a dual-purpose LAA/ground defence role in the event of ground attack by enemy paratroops. Therefore, it seems unlikely that the DFW3/23 combined pillbox/LAA platform at Lucas Green had been completed by this date, late August 1940.

- 2.4.5.11 While the Battle of Britain raged across southern England in September 1940, Lancashire remained something of a backwater. Two key personnel changes in 80th Battery did take place that month however, with the appointment of Lt W Chatterton³ MC to OC Euxton VP on 18 September, and the promotion of Capt H.K. Wilkes to Battery Commander eight days later (TNA WO 166/2826: 18/09/1940, 26/09/1940). Lt Chatterton was subsequently succeeded by T/Capt P.J. Clancy in early December (TNA WO 166/2826: 04/12/1940).
- 2.4.5.12 ROF Euxton/Chorley received its first recorded visit from the Luftwaffe on 2 October 1940, when an enemy aircraft dropped a flare near the VP, which was extinguished by LMG fire from 80th Battery (TNA WO166/2826: 02/10/1940). A number of bombs were dropped in the vicinity during the nights that followed, with as many as fifty incendiary bombs landing near Euxton on the night of 7-8 October (TNA WO166/2826: 08/10/1940). At 10pm on the evening of 26 October 1940, enemy aircraft dropped four flares directly over the factory, presumably in order to illuminate the target for bombers following in their wake (TNA WO 166/2691, October 1940 Appendix D, 26/10/1940). LAA crews of 80th Battery engaged the flares with LMGs, destroying all four, although they fired nearly 400 rounds of ammunition in the process. It is possible that the same flares were fired upon by defenders of the Leyland VP, who expended a further 132 rounds of their own ammunition attempting to shoot them down (TNA WO 166/2691, October 1940 Appendix D, 26/10/1940).

2.4.6 *The deployment of static Bofors guns at ROF Euxton/Chorley, November 1940-February 1941*

- 2.4.6.1 Despite the sporadic raids that took place over Manchester and Liverpool during October 1940, London continued to bear the brunt of the Luftwaffe bombing campaign throughout the month (Dobinson, 2001: 267). By the beginning of November however, the frequency of attacks against cities north of the capital was increasing, culminating ultimately in the devastating raid against Coventry on the night of 14-15 November. The level of preparedness at VPs was increased in 2nd AA Corps area in early November, when orders were issued that 40mm LAA guns were to be manned by three men continuously from forty minutes before sunrise until forty minutes after sunset, in order to ensure that they could engage enemy aircraft at immediate notice (TNA WO 166/2139 November 1940 Appendix 2a, 06/11/1940).
- 2.4.6.2 When this order was issued it was of little direct relevance to the gunners of 80th Battery at Euxton, who were still equipped only with Lewis LMGs. However this situation changed that November, when the arrival of a number of new weapons transformed the defences of the VP. The battery war diary recorded that two 40mm static mountings arrived at ROF Euxton/Chorley on Monday 11 November 1940 (TNA WO 166/2826: 11/11/1940; TNA WO 166/2282: 11/11/1940). Five days later, a further three static Bofors arrived at the factory, following which the surplus fifth gun was returned to Ordnance stores (WO 166/2826: 16/11/1940).

³ Presumably the same Lt W. Chatterton as the CO of 392nd Troop/135th Battery, who had commanded the Lewis guns defending no. 3 area of the ROF the previous November.

- 2.4.6.3 The first of the four Euxton 40mm guns was described as being *“in action”* (i.e. in an operational state) by Sunday 17 November 1940, followed by the second a day later and the third and fourth guns on Thursday 21 November (WO 166/2826: 17/11/1940, 18/11/1940, 21/11/1940). During the course of the following week, a further eight Bofors guns were deployed by 21st LAA Regiment to defend VPs at Clayton-le-Moors and Leyland (TNA WO 166/2691: 26/11/1940).
- 2.4.6.4 The rapid deployment of the four static Bofors guns at Euxton suggests that their emplacements had been selected and constructed in advance of or soon after their arrival. A reference in the battery war diary to the return of two sets of ‘balk mountings’ to the AA Ordnance Depot on 9 January 1941 suggests that at least two (and possibly all four) of the guns were originally to have been mounted on cruciform balk platforms, rather than concrete-set holdfasts as used at Lucas Green (TNA WO 166/2826: 09/01/1941; Dobinson, 2001: 178). Balk platforms comprised interlocking timber beams, which provided the stability necessary to mount and fire the gun, but also permitted mobility, which was of particular usefulness when there was a possibility that the gun might be moved (Dobinson, 2001: 179). The fact that two of these balk mountings were returned to depot confirms that at least two of the static Bofors defending ROF Euxton/Chorley were deployed at permanent concrete emplacements of the type at Lucas Green, and it is conceivable that all four were mounted on similar concrete-set holdfasts in similar emplacements. It is also possible that the guns were initially deployed on balk mountings awaiting completion of their permanent concrete emplacements. The holdfast assembly at Lucas Green is a variant of a standard DFW design, an illustration of which (Dobinson, 2001: 181, figure 13) is reproduced herein (Figure 5).
- 2.4.6.5 Unfortunately the war diary of 80th LAA Battery provides no detail about the construction of the static emplacements defending Euxton, and neither the name of the Royal Engineer unit that oversaw their construction nor that of the civilian contractor (or the unit that supplied military labour) that built them can be identified from the war diaries of Western Command and East Lancashire Area (TNA WO 166/1218; TNA WO/166/1219; TNA WO 166/98; TNA WO 166/1108; Wills, 1985: 45-6). Other than the sketches made by 62nd Searchlight Regiment in the early days of the war, no contemporary plans of the defences are known to have survived. It is known that the sites where the guns were deployed were numbered 1, 3, 5 and 7, suggesting that the even-numbered positions may have been assigned to Lewis guns. In addition to the known Bofors site at Lucas Green, there was an LAA gun site close to Euxton Lane, though the precise location of the latter is uncertain.
- 2.4.6.6 Although many Bofors guns supplied to AA Command during the early months of the war had to be fired over open sights, owing to a shortage of fire-control instrumentation, by the time that the defenders of ROF Euxton/Chorley received their allocation, a crucial, associated piece of equipment, the predictor, in this case almost certainly the Kerrison Predictor, had become more readily available.

- 2.4.6.7 Predictors could aim a gun at an aircraft based on simple inputs like the observed speed and the angle to the target. The Kerrison Predictor was a relatively simple device compared to slightly earlier high-altitude predictors, such as the Vickers Predictor, which had been intended for larger anti-aircraft guns for use against high-altitude bombers (Routledge, 1994: 52-55). It was designed by Major A.V. Kerrison at the Admiralty Research Laboratory, Teddington, in the late 1930s, with an innovative key component - an electromechanical analog computer - which could deal with very short engagement times and high angular rates of motion and thus function quickly enough to be used in the demanding high-speed, low-altitude role required of it and the 40mm Bofors gun, with which it was designed to work with.
- 2.4.6.8 Predictors undertook all necessary calculations mechanically through a complex system of gears (Price, 2004: 8-9). Inputs to its calculations included wind speed, gravity, ballistics of the gun and the rounds it fired, angle to the target in azimuth and altitude, and a user-input estimated target speed. Some of these inputs were fed in via dials, which turned gearing inside the device to calculate the range (from the change in angle and estimated speed) and direction of motion. The 'output' of the device drove hydraulic servo-motors attached to the traversal and elevation gears of the otherwise unmodified Bofors gun, allowing it to follow the predictor's indications automatically without manual intervention. The gunners simply kept the gun loaded, while the three aimers simply had to point the predictor, mounted on a large tripod, at the target. The Kerrison Predictor did not calculate fuse settings, as the shells fired by the 40mm Bofors gun, were contact fused.
- 2.4.6.9 The Kerrison Predictor proved to be able to hit practically anything that flew in a straight line, and it was particularly effective against dive bombers (Routledge, 1994: 52-55). However, it was also very complex, including over 1,000 precision parts and weighing over 500 lb (230 kg), even though much of it was made of aluminum to reduce weight. The system did, however, require a fairly large electrical generator in order to drive the gun and power the internal mechanism of the predictor (although all the necessary calculating was worked by gyros and gears), increasing the logistics load in supplying the generators with fuel. Setting the system up was also a fairly complex task and in the end they were used almost entirely for static emplacements as at Lucas Green.
- 2.4.6.10 At the end of the third week of November 1940, a single predictor and generator arrived and were set up, providing fire control for at least one of the guns deployed to defend the ROF (TNA WO 166/2826: 22/11/1940). This unit appears to have been replaced by a delivery of four predictors which arrived at Euxton on 11 December 1940; within three days these had been deployed to all four Bofors gun sites (TNA WO 166/2826: 11/12/1940, 14/12/1940). At Lucas Green, a circular brick-built pedestal that stands on the opposite side of the emplacement to the pillbox would have housed the predictor. The separation of the pedestal from the gun holdfast may have helped reduce the vibrations caused by gunfire, which affected the operation of the sensitive instrumentation of the predictor (Osborne, 2004: 174-5). The cables themselves would have run from the gun through the holdfast and along the semi-sunken cable duct in the concrete floor of the emplacement and thence to the predictor, probably via the ceramic cable duct exposed on the predictor pedestal. It is likely that the predictors installed at Euxton were Vickers Mk1 No. 3 models, the standard variant used by AA Command during this period. Three Mk1 No. 3 predictors were deployed by the same Battery at the Leyland VP a few weeks later (TNA WO 166/2691: 24/01/1941).

- 2.4.6.11 While 80th Battery at Euxton was being re-equipped with new weapons, a number of enemy aircraft were reported in the vicinity, including at least one that dropped three bombs in a field near Balshaw Lane Station, approximately half a mile from the VP, and a second that dropped flares nearby on 28 November 1940 (TNA WO 166/2826: 19/11/1940, 28/11/1940). Although neither of these targets was engaged, one round was accidentally discharged from one of the Euxton Bofors shortly before Christmas (TNA WO 166/2826: 23/12/1940).
- 2.4.6.12 At the beginning of January 1941, a further four Lewis AALMGs were deployed at locations around the Euxton VP, bringing the total number of these guns held by the defenders to twelve (TNA WO 166/2826: 01/01/1941). In addition to their LAA role, both the Lewis and Bofors guns were also expected to play a role in the ground defence of the site in the event of an enemy ground attack. In an Operation Order issued at the end of January, gunners were told that in such situations their primary duty was to defend their guns to the last man. Given that each ten-man LAA crew (each Bofors gun was manned by a crew of six) was equipped with only two rifles between them, instructions were issued to use both Lewis (firing short five-round bursts) and Bofors guns (barrels lowered with sights set to 'near') in the ground defence role (TNA WO 166/2826: '80 LAA Bty Operation Order No. 1', 29/01/1941). The limited allocation of small arms to gun crews was a cause of concern amongst senior officers in AA Command, who lobbied unsuccessfully for an increased provision of weapons for their men (TNA WO 166/2096, February 1941 Appendix 21, 12/02/1941). The following month, HQ 2nd AA Corps issued a revised policy for the ground defence of LAA batteries, which suggested that the otherwise unarmed men should be issued hand grenades and even Molotov cocktails, failing which they should withdraw within the nearest Defended Location when the attack alarm sounded (TNA WO 166/2096, February 1941 Appendix 47, 21/02/1941). In these circumstances it seems that if the LAA emplacement at Lucas Green had ever been attacked from the ground, the pillbox element of the defences would have functioned more as a shelter than a fortification. A tactical exercise undertaken in conjunction with local Home Guard at the Euxton Lane LAA site in early February 1941 may have been carried out to put the defences against ground attack to the test (TNA WO 166/2826: 09/02/1941).⁴

2.4.7 *The deployment of mobile Bofors guns at ROF Euxton/Chorley, February-December 1941*

- 2.4.7.1 The first six weeks of 1941 saw a flurry of visits by senior officers to the Euxton LAA gun sites, culminating in an inspection by Major-General C.A.E. Cadell, GOC 4th AA Division on Thursday 13 February (TNA WO 166/2826: 13/02/1941). Three days after this visit, 44th Anti-Aircraft Brigade received an order to replace the static Bofors at Euxton, Accrington and Blackpool (TNA WO 166/2282: 16/02/1941).

⁴ This LAA emplacement was probably located to the south-west of Lucas Green - it does not appear on the Defence of Britain database.

- 2.4.7.2 On the morning of 18 February 1941, a Royal Army Service Corps (RASC) truck was sent to Chorley to collect two Bofors static (BOSP)⁵ guns deployed at Euxton no. 1 and no. 5 sites for delivery to the Boat House Inn at Irlam Lock, where they were to be exchanged with two Bofors mobile (BOMP)⁶ guns then in the possession of 69th LAA Battery (TNA WO 166/2691: February 1941 Appendix A: S/O/1962, 16/02/1941; TNA WO 166/2826:18/02/1941). The replacements for these guns arrived at Euxton no. 1 and no. 5 sites over the course of the following two days (TNA WO 166/2691: 20/02/1941; TNA WO 166/2826: 18/02/1941; TNA WO 166/2282:19/02/1941).
- 2.4.7.3 Two days after the arrival of the second mobile Bofors from Irlam, the remaining two static Bofors guns were removed from Euxton nos. 3 and 7 sites and were sent to AA Command at Stanmore, where they were allocated to 208th Battery (TNA WO 166/2691: 22/02/1941; WO 166/2826; WO 166/2282). These guns were exchanged for two further mobile Bofors, which arrived at Euxton from Stanmore on 24 February 1941 (TNA WO 166/2691: 24/02/1941; TNA WO 166/2826: 24/02/1941).
- 2.4.7.4 In the event, the men of 80th Battery had little opportunity to familiarise themselves with their new guns. On 26 February 1941, Major Shaw and Capt B.M. Schofield of 51st Battery/38th LAA Regiment reconnoitred the defences of the VP in advance of the forthcoming deployment of the battery at Euxton (TNA WO 166/2826: 26/02/1941). At the beginning of March, 80th Battery handed over the new 40mm guns at Euxton to 51st Battery, although they remained responsible for the Lewis guns defending the site (TNA WO 166/2826:01/03/1941; TNA WO 166/2282). Eight days later, four of the latter guns were withdrawn from Euxton and sent to the AA Ordnance Depot at Holmes Chapel as part of the scheduled replacement of .303 calibre Lewis LMGs with .300 calibre equivalents (TNA WO 166/2691: 08/03/1941; TNA WO 166/2096: 04/03/1941).
- 2.4.7.5 On 10 March 1941, 21st LAA Regiment was formally relieved of its commitment to defend VPs at Euxton and Leyland (80th Battery), Accrington and Darwen (69th Battery) and Barrow and Distington, Cumbria (136th Battery) (TNA WO 166/2691: 10/03/1941). All three batteries were redeployed to defend VPs elsewhere in the divisional area, 80th Battery assuming responsibility for the defences at the Woodford Aerodrome and Chadderton VPs (TNA WO 166/2826: 10/03/1941).
- 2.4.7.6 The same day the 51st Battery took over the four mobile Bofors guns and the four remaining Lewis guns at Euxton (TNA WO 166/2282 March 1941 Appendix A, 11/03/1941). Although the battery was nominally part of the strength of 38th LAA Regiment, it was attached to 65th LAA Regiment, which assumed overall responsibility for the LAA defence of both the Euxton and Accrington VPs (TNA WO 166/2282: 17/03/1941).

⁵ Otherwise known as Bofors Static, Power Controlled (SPC).

⁶ Otherwise known as Bofors Mobile, Power Controlled (MPC).

- 2.4.7.7 During the spring of 1941, efforts were made to improve the alertness of LAA guns defending VPs within 44th Brigade area by ensuring that all were connected to AA Command via the nearest Gun Operation Room (GOR) to the site, which would provide up-to-date information on enemy air activity in the vicinity. The guns at Euxton were henceforth to be connected by field telephone to the nearest LAA Troop HQ (at BHQ in Chorley), which would feed information from the GORs at Preston and subsequently Blackburn, on completion of the latter (TNA WO 166/2282: 20/03/1941). The number of Lewis guns defending ROF Euxton/Chorley had risen to seventeen by late June, although the complement of four Bofors MPCs remained the same (TNA WO 166/2079, June 1941 Appendix 56, 20/06/1941). A plan and sections of DFW-approved designs of standard emplacements for mobile Bofors guns are reproduced herein (Figure 6).
- 2.4.7.8 Although 51st Battery was still manning the four Euxton Bofors guns in July 1941, a Brigade location statement issued at the beginning of April indicated that they had been temporarily relieved by a Troop of 196th Battery/65th LAA Regiment commanded by Lt J.A.C. Burcher (TNA WO 166/2282: 03/04/1941; July 1941 Appendix B). Responsibility for the remaining Lewis LMGs at the Euxton and Leyland VPs was again split, with 236th Battery/76th LAA Regiment taking control of the Lewis guns at both sites in early July (TNA WO 166/2282: 08/07/1941). A divisional 'equipment situation' report issued on 13 July 1941 indicated that the Euxton ROF was protected by four 40mm Bofors guns, two of which were the BOA variant and the other two the BOM version (TNA WO 166/2141: 13/07/1941). Exactly a week later all four guns deployed at Euxton were of the BOA variant, suggesting that two of the existing guns may have been replaced at this time (TNA WO 166/2141: 20/07/1941). This change appears to have coincided with the arrival of 48th Battery/42nd LAA Regiment, which took over the 40mm LAA defences at VPs Accrington and Euxton from 51st Battery/38th LAA Regiment, which left the Brigade area (TNA WO 166/2282: 15/07/1941). Responsibility for the Lewis guns at Euxton and Leyland remained in the hands of 236th Battery/76th Regiment until the end of July, when it passed into the hands of A and B Troops of 80th Battery/21st LAA Regiment (TNA WO 166/2691: 31/07/1941; TNA WO 166/2282: 02/08/1941). At the beginning of August 1941, the latter Battery also took possession of the four 40mm guns at Euxton from 48th Battery/42nd LAA Regiment, which was posted to Cark practice camp (TNA WO 166/2282: 02/08/1941).
- 2.4.7.9 On 19 September 1941, 178th Battery/76th LAA Regiment relieved 80th Battery/21st LAA Regiment at Euxton VP, shortly after which 21st LAA Regiment left 4th AA Division area altogether for Blandford Camp in Dorset (TNA WO 166/2282: September 1941 Appendix C, 14/09/1941; TNA WO 166/2691: 20/09/1941; TNA WO 166/2282: 21/09/1941). A detachment of 178th Battery/76th LAA Regiment commanded by 2/Lt A.S. Binning continued to man the 40mm guns at Euxton VP throughout October 1941, and much of November, although the arrival early the following month of a Troop of 178th Battery/88th LAA Regiment at Euxton appears to have coincided with a significant change in the strength of the LAA defences of the VP (TNA WO 166/2282 October 1941 Appendix H, 30/10/1941; TNA WO 166/2282: 19/11/1941). Commanded by Major F.T. Sobey MC, who was also responsible for the defence of the Leyland VP, at first the new arrivals took over the LMGs at Euxton. Soon afterwards a new Battery HQ was established at Croston Hall, from which the defence of both VPs was co-ordinated (TNA WO 166/7401, February 1942 Appendix N, 27/02/1942).

2.4.8 *Drawing-down the LAA defences of ROF Euxton/Chorley, December 1941-January 1943*

- 2.4.8.1 On 17 December 1941, vehicles arrived at Euxton with orders from HQ 4th AA Division to collect all the 40mm guns from the VP and deliver them to the AA Ordnance Depot at Donnington (TNA WO 166/2282 December 1941 Appendix D, 17/12/1941; Appendix E, 18/12/1941). Orders for the movement of the guns stipulated that all guns dispatched to Donnington were to be on Mark III mountings, and accompanied by four boxes of ammunition (c216 Mk I) and 24 charges per gun (WO 166/2141, December 1941 Appendix 4C). All of the Bofors removed from Euxton were replaced by LMGs.
- 2.4.8.2 The withdrawal of the 40mm LAA guns from the Euxton VP took place only a couple of weeks after Japan entered the war in early December 1941. The attack on Pearl Harbor had exposed a shortage of modern LAA weapons in America's arsenal, and AA Command was called upon to supply guns for the defence of Allied interests in the Far East. During the months of December 1941 and January 1942 the Command gave up a total of 214 LAA guns and 66 HAA guns for service in South-East Asia (Dobinson, 2001: 352).
- 2.4.8.3 The decision to withdraw the Bofors LAA cover from ROF Euxton/Chorley appears to have been temporarily rescinded in early 1942, when it was reported that a single mobile 40mm gun was deployed in defence of the factory (WO 166/7328: January 1942 Appendix 1a, 04/01/1942). This gun was on loan from Accrington, and remained in service at Euxton throughout January and February (TNA WO 166/7328: February 1942 Appendix 1d, 22/02/1942). On 22 February an order was given to remove the gun, its predictor, generator, gun stores and ammunition, on the morning of the 25 February, for deployment outside the Brigade area (TNA WO 166/7401, February 1942 Appendix M, S/571/G, 22/02/1942; TNA WO 166/7328: March 1942 Appendix 1a, 08/03/1942). The gun was finally withdrawn from the Euxton VP on 3rd March, when it was sent to the 3rd AA Division in Scotland (TNA WO 166/7401: 03/03/1942).
- 2.4.8.4 Fortunately, the depletion of AA Command's stock of modern LAA guns coincided with the lull in large-scale Luftwaffe offensive operations against Britain that had followed the German invasion of the Soviet Union in June 1941. However, in March 1942 the Luftwaffe launched a new campaign, comprising 'tip-and-run' attacks by agile fighter-bombers against largely unprotected targets on the south coast of England. As the frequency of these raids increased throughout the spring, on the night of 24 April 1942, the city of Exeter was bombed during what turned out to be the first in a campaign of attacks by the Luftwaffe against historic cities, known as the 'Baedeker' raids. The impact upon morale of 'tip-and-run' (aka 'Fringe Target') raids by day and 'Baedeker' raids on historic cities by night began to be felt by the end of April, by which date Norwich, Peterborough, York, Lincoln, Chelmsford, Ipswich and Cambridge had all been attacked, while both Exeter and Bath had each been bombed twice (Dobinson, 2001: 353).

- 2.4.8.5 The following month, 40mm LAA guns were withdrawn from a further seven VPs within 4th AA Division area, all of which were dispatched to “*destinations in southern England*”; these formed part of a redeployment of 38 Bofors guns taken from factory VPs in May 1942 (TNA WO 166/7328, May 1942 Appendix 4a; TNA WO 166/7401: 04/05/1942; Dobinson, 2001: 356). By the end of June 1942, the only VPs in the 4th AA Division area equipped with Bofors LAA guns were Ellesmere Port (one gun), Mersey Docks (four guns), West Derby (three guns), the De Havilland aircraft factory at Lostock (one gun) and Barrow (one Bofors, one Vickers Mk II and two 75mm guns (TNA WO 166/7401, June 1942 Appendix 1c, 28/06/1942).
- 2.4.8.6 In the third week of May 1942, AA Command gave permission for Euxton/Chorley and Lower Darwen VPs to be permanently relieved by a single LAA troop, which would provide mobile cover for both sites when required (TNA WO 166/7401, May 1942 Appendix H, S/3310/G, 22/05/1942). The move would entail the withdrawal of the remaining Lewis guns from both VPs, leaving both unarmed. The following day, 477th/88th LAA Battery vacated the VP at Euxton/Chorley (TNA WO 166/7401: 23/05/1942).
- 2.4.8.7 Location Statements issued throughout the remainder of May, June and July 1942 indicated that the Euxton defences remained unmanned throughout the entire period. Small numbers of Bofors guns were redeployed at VPs in the north during the summer, with Lostock, Woodford, Chadderton and Clifton all receiving up to four mobile Bofors guns apiece in early August (TNA WO 166/7401: 01/08/1942 – 05/08/1942). As the frequency of German raids against fringe targets in southern England intensified during the early autumn of 1942, AA Command withdrew a further 110 Bofors guns from VPs across the country (Dobinson, 2001: 366-8). By December 1942, as many as 400 Bofors guns had been deployed around towns on the south coast, supplemented by large quantities of Lewis guns, Hispano-Suiza 20mm cannons and Vickers ‘K’ MMGs drawn from across the three armed services (Dobinson, 2001: 370-1). With such an extensive redeployment of LAA arms taking place, it is scarcely surprising that ROF Euxton/Chorley remained an undefended backwater throughout the remainder of the year.

2.4.9 *The Home Guard LAA defence of ROF Euxton/Chorley, 1943-1944*

- 2.4.9.1 The question of whether members of the Home Guard could be profitably employed in the AA defence of factories and other locations, thereby relieving regular soldiers for active service elsewhere, had been debated in the higher echelons of the Army as early as May 1941 (TNA WO 199/359, December 1941 Appendix 2a). In August of that year, AA Command permitted certain factories, including the ROFs at Blackburn and Chorley (Euxton) as well as Leyland Motors in Leyland, to man LAA weapons of no greater than 20mm calibre with Home Guard personnel recruited from their workforces (TNA WO 166/2079: August 1941 Appendix 85, 23/08/1941). The success of the scheme depended upon the willingness of workers to defend their workplace outside working hours. While the workforce of Leyland Motors raised sufficient manpower to operate two Lewis LMGs by December of that year, the LAA defences of ROF Euxton/Chorley continued to be defended by regular units operating under the orders of AA Command until the guns were withdrawn altogether in May 1942 (TNA WO 199/359, December 1941 Appendix 2a).

- 2.4.9.2 The conditions under which Home Guard might be usefully employed in AA defence were reconsidered the following January (1943), when AA Command found itself under increasing pressure to release personnel for service elsewhere in the Army. This coincided with the decision by the Chiefs of Staff that the LAA defence of factory VPs was to be made the responsibility of GHQ Home Forces, which commanded the Home Guard as well as regular forces in the United Kingdom (TNA WO 199/378: 13/01/1943). In order to offset these reductions in regular personnel, AA Command reconsidered the possibility of manning LAA guns with Home Guard on a permanent basis (TNA WO 199/378, 'Notes on HG and AA', 06/01/1943). The principal obstacle to the deployment of Home Guard in this role was the fact that the guns had to be manned by day as well as night, which was problematic for those engaged in full-time war work.
- 2.4.9.3 A solution was found by restricting Home Guard assistance to the LAA defence of factory VPs, thereby allowing the number of LAA batteries allotted to the ADGB to be reduced from 125 to 112 as demanded by the Chiefs of Staff (TNA WO 199/378: Appendix 11a, 03/02/1943). The proposed new Home Guard LAA detachments would assume control of 40mm or 20mm guns *"as required by tactical considerations"* defending factory VPs across the country. Amongst those VPs considered for Home Guard LAA defence in the north-west was ROF Euxton/Chorley, which it was proposed to defend with eight 20mm LAA guns manned by two Troops of Home Guard (TNA WO 199/378, Appendix 17a:12/02/1943). The War Office approved the scheme in early March 1943 and by the beginning of April a sufficient number of employees at ROF Euxton/Chorley were available to form the two Troops necessary to man its LAA defences (TNA WO 199/378, Appendix 31a, 12/03/1943; 03/04/1943).
- 2.4.9.4 Although it had originally been intended to defend ROF Euxton/Chorley with eight 20mm LAA guns, by early April 1943 the number considered necessary had risen to nine (TNA WO 199/378, Appendix 39a: 07/04/1943). The following month, when the order to form the factory defence Home Guard LAA Troops was issued, it had been decided to upgrade the LAA defences of ROF Chorley to four Bofors 40mm LAA guns and nine 20mm guns (TNA WO 199/378, Appendix 66a: 31/05/1943). By the middle of September 1943, all thirteen guns had been deployed to defend the factory (TNA WO 199/378, Appendix 119a: 15/09/1943). The guns were manned by A and B Troops of 131st Lancashire Home Guard LAA Battery, which was drawn from 12th Battalion Lancashire Home Guard. The battery received its orders from 44th AA Brigade, which remained responsible for the AA defence of the north-west until it was relieved by 33rd AA Brigade in 1944.
- 2.4.9.5 Despite changes made to the operational role of the Home Guard in early 1944, which saw it relegated from its role as a fighting organisation, Home Guard AA units remained responsible for the defence of factory VPs. The Home Guard 'order of battle' of that year listed four Bofors and nine 20mm guns in the LAA defences of ROF Euxton/Chorley, manned by members of A and B LAA Troops of 12th Battalion Lancashire Home Guard (TNA WO 199/383: 12).

2.4.9.6 Towards the end of August 1944, GHQ Home Forces informed all regional Army Commands that compulsory attendance at Home Guard parades was to end in mid-September, although it was intended that the force would continue to operate on a voluntary basis (TNA WO 199/872A, HF 656/G(O), 29/08/1944). However as it became increasingly apparent that the Allied invasion of Western Europe was heading towards a successful outcome, preparations were made to stand down the Home Guard altogether. In October 1944, GHQ ordered all battalions to stand-down with effect from 1 November 1944, bringing to an end the Home Guard LAA defence of ROF Euxton/Chorley.

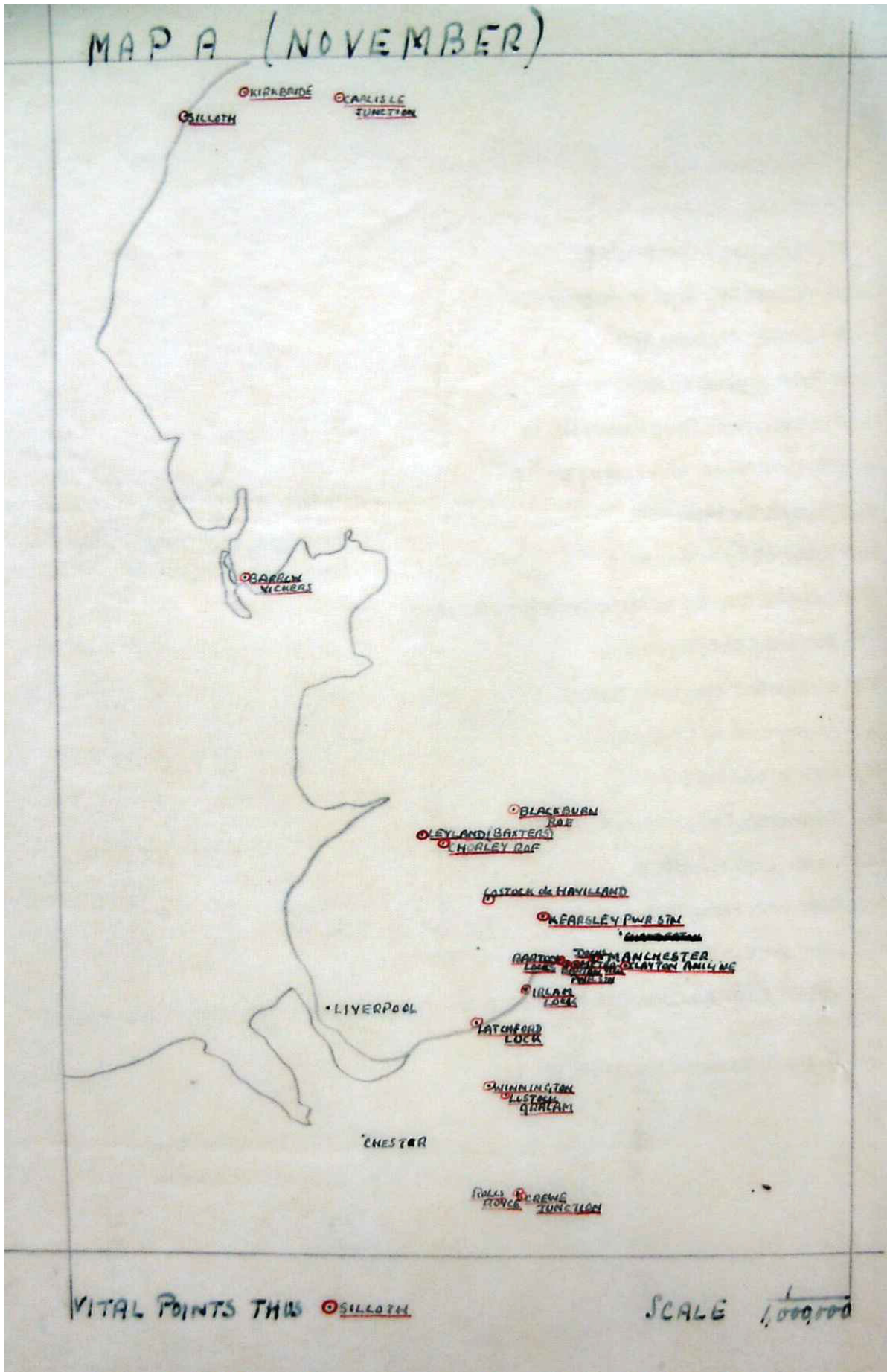


Figure 3
Vital Points (VPs) in 44th AA Bde Area, November 1939 (from TNA WO 166/2282)
1:20,000 at A4



Figure 4
 Euxton VP LAA defence scheme, September 1939 (from TNA WO 166/3080)
 (not to scale)

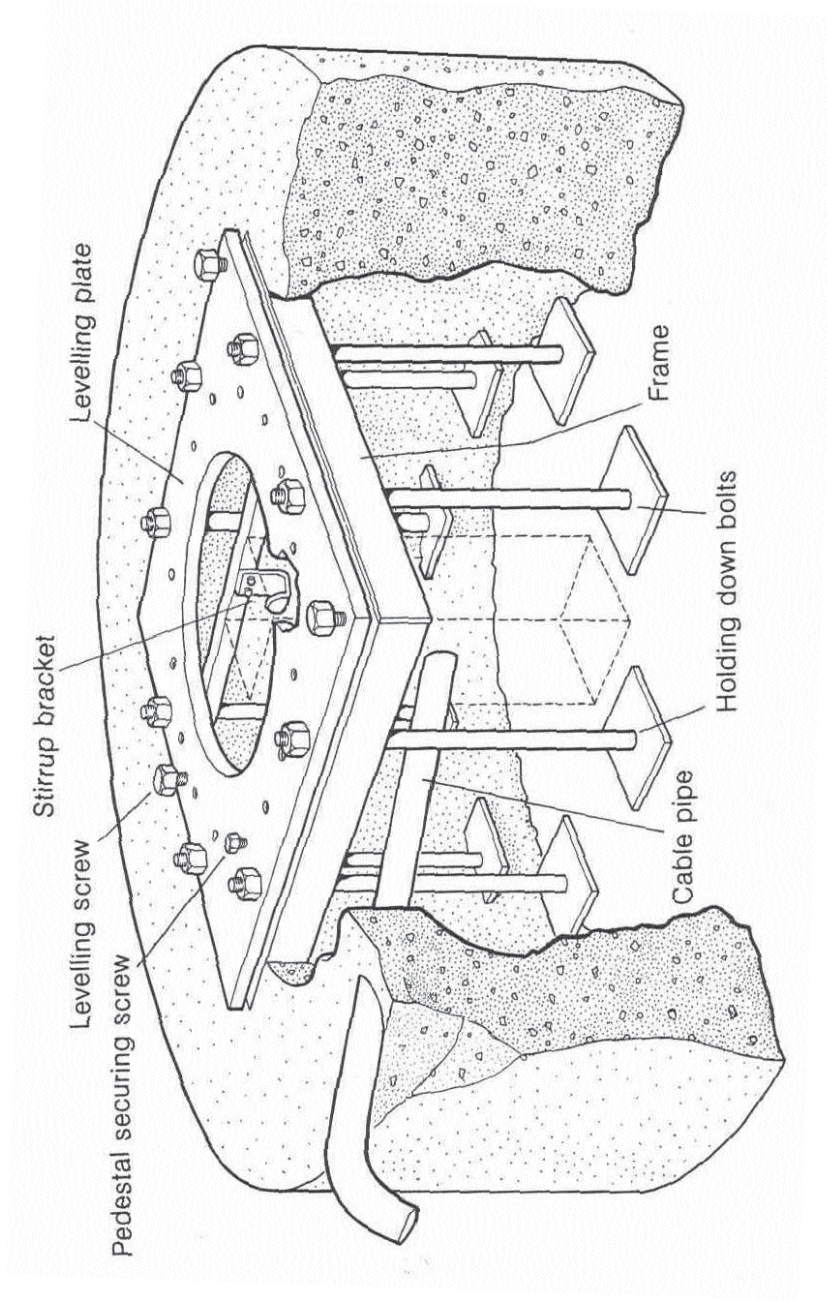


Figure 5
 DFW3 design of holdfast assembly for static Bofors LAA gun (©Dobinson, 2001: 181)
 (not to scale)

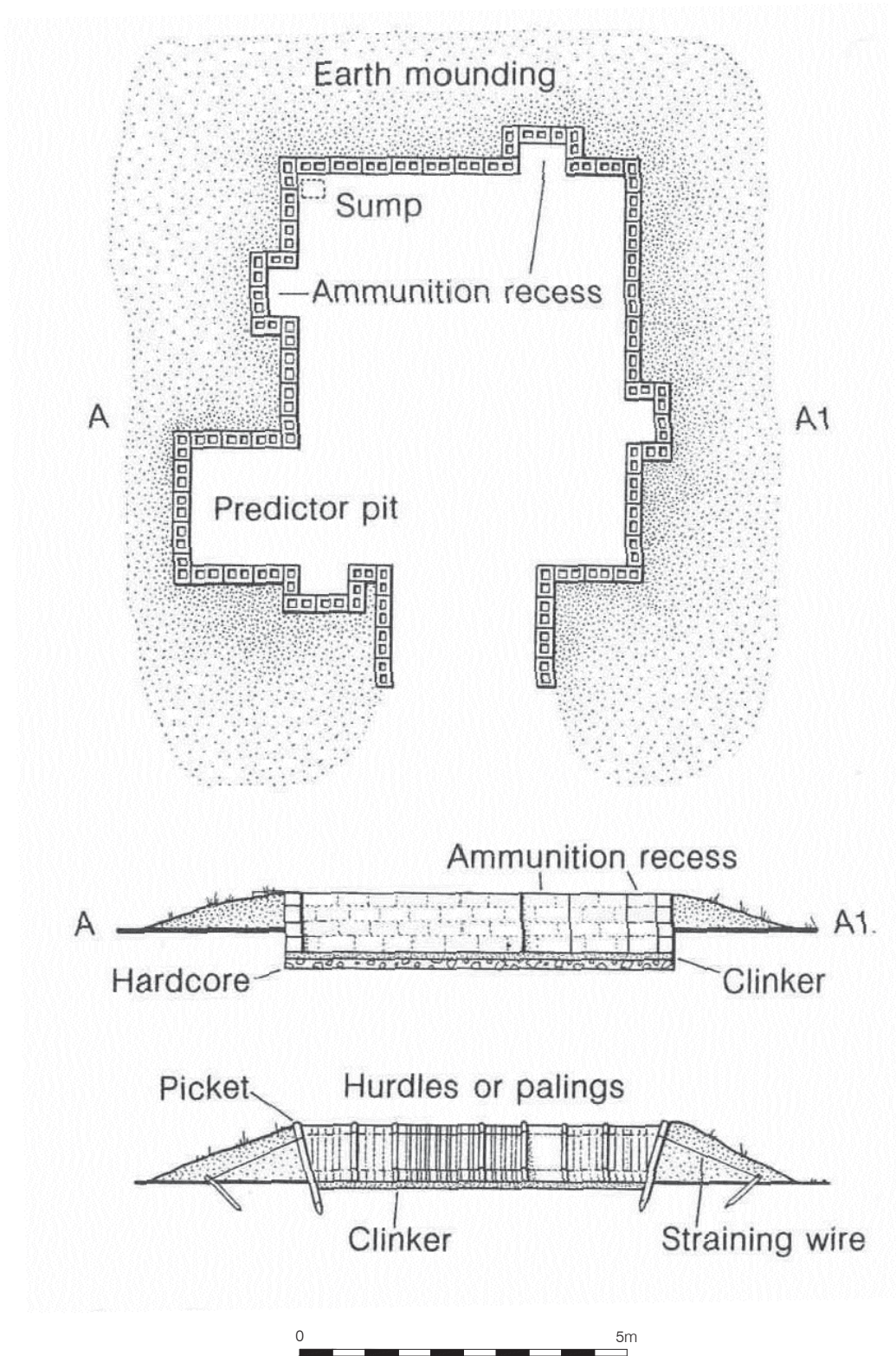


Figure 6
DFW3 designs of semi-sunken (top) and surface (bottom) emplacements for
mobile Bofors LAA gun (©Dobinson, 2001: 180)
1:100 at A4

3. AIMS AND OBJECTIVES

- 3.1 The planning condition required a full record of the World War Two defensive installation at the site – initially thought to comprise a brick and concrete pillbox, with anti-aircraft gun mounting close by. At the time of the planning application, the aim of implementing such a strategy was to result in replacement of the physical structures with an appropriately detailed record and level of analysis, supported by documentary research to place the installation in a wider historical context. The record was to be to the ‘Level 2’ standard defined by English Heritage (2006a).
- 3.2 Initial investigation of the installation established that the pillbox was backed to the south-west by an anti-aircraft LMG platform, which itself abutted a LAA gun emplacement, a far more extensive complex of defensive works than had been anticipated. The scope of work was therefore extended to fully expose and record the entire installation.
- 3.3 Although the development layout was re-designed to allow the structure to be retained *in situ*, the overarching aim of the project remained to provide a record of the installation.
- 3.4 The specific research objectives of the project remained:
- to provide a permanent record of the entire defensive installation at the site;
 - to provide an appropriate level of analysis of the installation, supported by an appropriate level of background research to place the installation in a wider historical context.

4. METHODOLOGY

4.1 Fieldwork

- 4.1.1 The building recording was conducted with regard to standards set out by English Heritage in *Understanding Historic Buildings; a guide to good recording practice* (2006a). A 'Level 2' record was required, in this instance comprising photographic recording of the building, interior and exterior, compilation of drawn ground plan, horizontal cross-section of the pillbox and selected elevations, with written descriptions of structural elements.
- 4.1.2 All work was undertaken in accordance with Institute for Archaeologists (IfA) standards set out in *Standard and Guidance for the archaeological investigation and recording of standing buildings or structures* (IfA 2008).
- 4.1.3 The initial investigation of the structures was undertaken 23-25 January 2013. Exposure and recording of the entire installation was then undertaken 18 February-1 March 2013. All work was undertaken by archaeologists from PCA.
- 4.1.4 The structures were cleared of overburden by hand and cleaned to an appropriate standard. A 'test-pit' was excavated against the north-west facing elevation of the pillbox to establish the full depth of the structure below ground level and determine the method of construction of its foundation. The test-pit was backfilled on completion of the recording.
- 4.1.5 A photographic record was compiled of the installation using 35mm film for black and white negative and colour transparencies. Standard-sized prints were generated from the black and white negatives and the transparencies were mounted. The photographic record was supplemented by digital photography, using the high resolution JPEG setting. The overall installation was photographed, along with external elevations, key features and interior spaces of the pillbox. All photographs included a graduated metric scale and a register of photographs was compiled. A selection of the photographs is included in this report to illustrate the text.
- 4.1.6 The installation was planned to scale, externally and internally. GPS instrumentation was used to locate the overall installation relative to the Ordnance Survey grid and install a Temporary Bench Mark on the installation. Heights relative to Ordnance datum were recorded on key elements of the installation using a 'dumpy' level. The north-west facing elevation of the pillbox was drawn to scale. A detailed written record was compiled, using pro forma recording sheets. This record was used as the basis of the description of the installation which forms Section 5 of this report.

4.2 Documentary Research

- 4.2.1 The main source of material for the documentary research was The National Archives (TNA), Kew, Richmond, Surrey, which were visited (by Guy Thompson). TNA houses a vast collection of World War Two material including British Army unit war diaries, government and military records, including War Office (WO), Admiralty and Air Force documents.
- 4.2.2 The Local Studies Collection held by Chorley Library, Union Street, Chorley, was visited (by Robin Taylor-Wilson) and the collection of maps and local history publications was examined in an attempt to locate any relevant documentary material.

4.2.3 Chorley Historical and Archaeological Society was contacted to determine whether any of the members of this locally-based organisation held any relevant documentary material.

4.2.4 A summary of the historical background of ROF Euxton/Chorley and its defensive outworks and a detailed account of the historical background of the Lucas Green installation is set out in Section 2.4; the vast majority of the information used to compile this was located at TNA.

4.3 Project Archive

4.3.1 The undertaking of fieldwork, including historic building recording, results in the establishment of a project archive. In preparing the project archive for deposition all relevant standards and guidelines documents referenced in the Archaeological Archives Forum guidelines document (Brown, 2007) would be adhered to, in particular the IfA guidance document on archaeological archives (IfA, 2008b).

4.3.2 The project archive will include all written, drawn, and photographic records generated by the fieldwork element of the project. The archive will be quantified, ordered, indexed, and internally consistent before transfer to the recipient museum.

4.3.3 The project archive is currently held at the Northern Office of Pre-Construct Archaeology Durham, under the site code LWC 13. The archive will ultimately be deposited with Museum of Lancashire, Stanley Street, Preston, PR1 4YP. The archive will be organised as to be compatible with the other archaeological archives produced in the county. A completed transfer of title deed will accompany the archive on deposition.

5. RESULTS OF THE BUILDING RECORDING

5.1 Introduction

5.1.1 During the fieldwork, separate structural elements and stratigraphic entities were assigned unique and individual 'context' numbers, which are indicated in the following text as, for example [1]. The majority of the contexts allocated were for structural elements of the pillbox and LAA gun emplacement. The test-pit excavated adjacent to the elevation of the north-west wall of the pillbox north-west also resulted in the allocation of a small number of context number for exposed deposits.

5.2 Pre- World War Two Deposits

5.2.1 Natural geological deposits, [24] and [23], were exposed at the base of the test-pit excavation undertaken adjacent to the external elevation of the north-west wall of the pillbox. These comprised firm, mid reddish brown silty clay and firm, mid reddish brown silty sand, respectively, with no inclusions. This material represents the glacially-derived drift geology of the area. The natural sub-stratum was recorded at a maximum height of 92.76m OD, c. 1.15m below existing ground level (Figures 9 and 20). The material is likely to have been horizontally truncated as a result of the construction of the pillbox.

5.2.2 A naturally formed sub-soil, [18], comprising friable mid greyish brown clayey silt, was encountered in a small sample excavation undertaken within the internal area of the predictor pit platform. At least 0.45m thick, but not bottomed, it was recorded at a maximum height of 93.46m OD. No sub-soil was recorded within the test-pit excavation undertaken adjacent to the north-west wall of the pillbox, as mentioned above, this likely being the result of ground reduction in the footprint of the pillbox at the time of its construction.

5.2.3 Although no artefactual material was recovered from the sub-soil, its period of origin is likely to be medieval or earlier. Cartographic evidence indicates that the site has essentially remained undeveloped agricultural land since the 19th century; therefore the sub-soil probably accumulated over a substantial period of time with possible episodic reworking associated with agricultural use.

5.3 The Pillbox and LAA Gun Emplacement

5.3.1 The defensive installation at Lucas Green comprises a pillbox and associated LAA gun emplacement sited along the line of an established field boundary, presumably to facilitate camouflage. The overall installation, including the predictor platform, measured up to 13.40m NE-SW by up to 6m NW-SE (Figure 7)

5.3.2 The pillbox element is built to the Department of Fortifications and Works (DFW) design known as 'Type DFW3/23' (hereafter Type 23). The pillbox comprises two principal elements (Figures 7 and 8): an enclosed infantry chamber, [3], incorporating a simple internal anti-ricochet (AR) wall and with loopholes for light machine guns or rifles on three elevations, the exception being the rear (south-west) elevation, and an open platform, [21], to the rear (south-west) with a centrally-located square socket, [19], designed to accommodate the mounting for a Lewis anti-aircraft LMG.

- 5.3.3 In a standard Type 23 pillbox, the LMG platform was typically enclosed by a wall built as high the pillbox with access provided either by a door or by iron rungs/ladder set into the wall. In this Type 23 variant, with associated LAA emplacement, there was limited evidence of iron rungs/ladder, provided by small cut-off iron fixtures within one interior wall elevation near the south-west corner entrance to the platform, this created to allow access from the LAA emplacement, as described further below.
- 5.3.4 The enclosed element of the pillbox survives in very good condition with loss of only the uppermost course of brickwork of the wall of the north-east external elevation and up to three courses of brickwork of the wall of the north-west external elevation (Figures 17 and 18). The LMG platform survives less well, with its three walls (its fourth side is formed by the south-west wall of the pillbox) demolished to ground level, thus resulting in the loss of the upper c.1m of the structure (Figure 14). The stubs of the demolished north-west and south-east walls are evident in the south-west facing elevation of the pillbox (Figure 15).
- 5.3.5 The LAA gun emplacement is broadly circular in shape and comprises four principal elements (Figures 7, 11 and 12): the external brick walls, incorporating four ammunition recesses or bays; an internal concrete floor incorporating drainage; a centrally located holdfast assembly comprising a cylindrical concrete pedestal with metal frame attached for a LAA gun, and; at its south-west end, a raised, circular brick-walled platform for the predictor. The LAA emplacement connected with the LMG platform element of the pillbox via a narrow chamfered access, this the aforementioned corner entrance created in the south-west corner of the wall enclosing the LMG platform.
- 5.3.6 As with the LMG platform, the LAA emplacement has been demolished to ground level, although the below ground structural remains are very well preserved. It is estimated that perhaps c. 1m of the above ground structure has been demolished; the lost portions of the enclosing walls and ammunition bays would probably have been incorporated into an enclosing earth-bank. It is uncertain when demolition of the upper parts of the LMG platform and LAA emplacement was undertaken, it may have occurred shortly after the installation was decommissioned.

5.4 Pillbox: External Construction

- 5.4.1 The pillbox element of the Lucas Green installation is rectangular in plan, constructed of brick and reinforced concrete measuring 5.9m NE-SW by 3.47m NW-SE (Figures 7 and 8). The pillbox comprises three main structural elements: floor, walls and blast roof, collectively forming the enclosed infantry chamber. The construction cut for the enclosed chamber was exposed within the test-pit excavation adjacent to the north-west wall; it comprised a presumably square-cut construction trench, [4], c. 0.40m deep, backfilled with brick rubble and concrete mortar in a firm silty clay matrix, [2].

- 5.4.2 The wall foundation, [25], as exposed in the test-pit, comprised a c. 0.12m thick concrete slab (Figures 9, 19 and 20). The walls were c. 0.60m thick, with the exception of the rear (south-west) wall which was c. 0.50m thick, and were constructed using unfrogged bricks (220mm x 110mm x 70mm) bonded by light grey concrete mortar. The final element was the blast roof, which had three separate elements: the lowermost comprising a series of NW-SE aligned pre-cast steel reinforced concrete lintels (Figures 18 and 22); these were overlain by a single course of unbonded bricks (220mm x 110mm x 70mm) and these in turn were overlain by the uppermost element, a c. 0.10m thick concrete slab (Figure 18).
- 5.4.3 The pillbox was constructed with three loopholes, one each located slightly off-centre in the north-west, north-east and south-east walls (Figures 8, 9, 16, 17 and 18), through which light machine guns or rifles could be fired. The embrasures are constructed using separate pre-cast concrete elements with each loophole comprising four chamfered broadly rectangular blocks (250mm x 200mm x 330mm) situated between two lintels (up to 920mm x 300mm x 150mm) forming a sub-square aperture measuring c. 0.25m wide and 0.33m high.
- 5.4.4 A narrow aperture measuring 0.60m wide by 0.10m high had been constructed in the south-eastern extent of the rear (south-west) wall (Figure 15); it continued through the wall at an angle and narrowing, appearing in the internal elevation as a sub-square hole measuring 80mm by 70mm. The function of this feature is uncertain; the extent to which the internal and external apertures are offset from one another suggests that it is unlikely to have been designed as a pistol loophole for last-ditch defence, therefore it probably represent a means of communication between the enclosed chamber and the open LMG platform – it may even have been created to feed cabling in to the enclosed chamber.
- 5.4.5 Three levelling deposits, [5], [6] and [7], comprising variously coloured clayey silts were recorded within the test-pit excavation adjacent to the north-west wall of the pillbox. Their combined thickness was 0.70m, recorded at a maximum height of 93.46m OD. The deposits sealed the construction cut for the pillbox and had been used to elevate the adjacent ground level, effectively burying the pillbox to the required depth on its north-western side. The material was presumably derived during the excavation of the construction cut into the natural sub-stratum.

5.5 Pillbox: Internal Construction

- 5.5.1 As mentioned above, access to the LMG platform of Type 23 pillbox was typically provided either by a door or iron rungs/ladder set into the enclosure wall. In this variant design, access to the LMG Platform and pillbox elements of the Lucas Green installation was via a narrow chamfered entrance incorporated into the south-west wall, [21], of the LMG platform (Figures 8 and 14). The floor of the platform comprises a concrete slab, [20], at a height of c. 93.18m OD.

- 5.5.2 Located centrally within the concrete floor is a sub-square, 'socket', [19], that would have housed a mounting for a Lewis anti-aircraft LMG. Bricks laid in the base of the socket, presumably provided support for the weapon mounting. An aperture in the north-west corner of the platform floor (Figures 8 and 14), provides access to the enclosed pillbox chamber. A concrete 'pin kerb', c. 1.0m long, 0.10m high and 80mm wide, skirts the south-east side of the aperture. This may have been a safety feature, to make the occupants of the platform aware of the drop, as described below, into the entrance of the enclosed pillbox chamber and would also have prevented rainwater from getting into the pillbox chamber along the side of the aperture.
- 5.5.3 The enclosed pillbox chamber is accessed from the LMG platform by a c. 0.71m high step-down to a short narrow, c. 0.45m wide, entrance 'corridor' (Figures 14 and 21). The concrete slab forming the floor surface of the enclosed chamber was recorded at a height of 92.47m OD and it is probable that the slab extended to form the foundation for the walls. The pre-cast concrete lintels forming the primary construction element of the roof are evident within the enclosed chamber and the concrete is degraded by minor spalling in places, primarily in the narrow gaps between each lintel (Figure 22).
- 5.5.4 Internal to the enclosed chamber of the pillbox and located centrally to the rear (south-west) wall, extending north-eastwards for 1.40m is a 0.35m thick, full height anti-ricochet wall (Figures 21 and 24). Each of the three loopholes has a narrow pre-cast concrete shelf (920mm 150mm x at least 320mm) situated c. 0.25m below the embrasure in a shallow recess within the walls (Figures 22, 23 and 25) The shelf presumably allowed the occupants to operate a LMG or rifle whilst in a standing position with elbows resting on the shelf. The interior brickwork of the pillbox chamber is covered with the remains of a coat of light greenish yellow paint, which was not applied to the concrete ceiling (Figures 21-25).

5.6 LAA Emplacement

- 5.6.1 The LAA gun emplacement element of the Lucas Green installation is roughly circular in shape and measures c. 5.60m in diameter from the curvilinear external walls, [12] and [13], with four ammunition bays projecting up to 0.70m beyond the wall line (Figures 7, 10 and 11). The emplacement comprises four main elements: external brick walls, incorporating four ammunition bays with concrete floors; circular concrete floor, incorporating a drainage system; centrally located holdfast assembly comprising a cylindrical concrete pedestal with metal frame attached, upon which a static Bofors 40mm anti-aircraft gun would have been mounted; to the south-west, a raised circular platform for the predictor.
- 5.6.2 The concrete pedestal, [14], for the Bofors gun is cylindrical, c. 1.80m diameter by 0.70m high, with a centrally located square aperture, through which the cabling connecting the gun to the predictor would have passed (Figures 31, 33 and 34). A rectangular aperture at floor level in the south-west side of the pedestal would have allowed the cable into the pedestal, as described further below.

- 5.6.3 The pedestal lies centrally within a larger circular concrete footing, also structure [14], c. 2.50m in diameter and at least 0.20m thick. Affixed to the upper surface of the pedestal are the remains of a square steel-bar frame (Figures 33 and 34), the innermost element of which is a stirrup bracket for the gun mounting, set vertically on the north-east side of the central square aperture (Figure 35). Each side of the square steel-bar frame is affixed to the pedestal with two evenly-spaced bolts and until recently a levelling plate remained *in situ* on the surviving element (local resident pers. comm.). In overall terms, this holdfast assembly represents a variant of a standard DFW design (Figure 5).
- 5.6.4 The external walls of the LAA gun emplacement comprise two curvilinear lengths of brick wall, [12] and [13], measuring c. 2.32m and 2.51m in length, respectively, by 0.22m wide (Figures 7, 10 and 11). Abutting the walls are four brick-built ammunition bays, [8]-[11] (Figures 7, 26-30). Two of these, [8] and [9], are located to the north-east, these having a single compartment, while the other two, [10] and [11], are located to the south-west, these larger, with two compartments. All the ammunition bays were similarly constructed, on a concrete slab footing, continuing as the floor, with double-skin brick wall c. 0.30m wide with rubble and concrete mortar core. The single compartment bays measure c. 1.70m by 0.90m, with the compartment itself measuring c. 1.10m by 0.60m, while in total the double compartment bays measure c. 2.50m by 0.90m, with the smaller compartments measuring c. 0.60m by 0.60m and the larger compartments c. 1.16m x 0.60m.
- 5.6.5 Projecting brick courses in the surviving brickwork of the north-west side wall of bay [9] and in the north-east side wall of the larger compartment of bay [10] probably represent ledges for shelving. The brickwork of the sidewalls of the other bays did not survive sufficiently to ascertain whether or not these also had shelving, although a lack of projecting brick courses in the walls of the smaller compartment of bay [10], where the walls did survive as high as might be expected, indicates that the smaller compartments of the double bays did not have shelving. Broken concrete slabs within the rubble backfill of the LAA gun emplacement likely represent the remains ammunition bay capping slabs.
- 5.6.6 The north-east side of the LAA gun emplacement was formed by the rear (south-west) wall, [21], of the LMG platform element of the pillbox. The north-west side wall of bay [9] had been neatly integrated into the south-east corner of the platform enclosure wall and the north-east side wall of bay [8] similarly integrated at its south-west corner, with the aforementioned entrance to the LMG platform created there (Figures 7 and 14). Given that the Bofors gun and Lewis LMGs could not have operated simultaneously, it is assumed that the LAA gun emplacement was built sometime after the pillbox and LMG platform, although it is also possible that the two structures were essentially built contemporaneously; the pillbox may have been almost complete when the decision to construct the LAA gun emplacement was made, so that the LMG platform was simply adapted to incorporate the emplacement to the south-west.

- 5.6.7 The LAA gun emplacement floor comprises a roughly circular concrete slab, [15], 5.32m north-south by 5.10m east-west and up to 50mm thick, encircling the aforementioned smaller foundation slab of the gun pedestal (Figures 7 and 11). Incorporated into the surface of slab [15] is a c. 4.50m diameter drainage circuit, [26], comprising a shallow U-shaped gully, 100mm wide by 40mm deep, with the downpipes of two wide bore ceramic drains surviving *in situ* on the south-east and north-west sides of the circuit (Figure 7).
- 5.6.8 The south-westernmost element of the LAA gun emplacement is the pedestal for the fire-control predictor. Located c. 1.50m south-west of the LAA gun holdfast this comprises a raised circular platform formed by a semi-circular brick retaining wall to the north-east, abutting a semi-circular concrete slab to the south-west (Figures 7, 10 and 26). Overall it is c. 2.70m in diameter and was recorded at a maximum height of 93.62m OD. Both structural elements occupy a narrow construction cut, [29]. The brick element, [16], is constructed using unfrosted bricks (220mm x 110mm x 70mm) laid in header courses and bonded with concrete mortar. Located centrally to wall [16], on its north-east side, is a brick 'buttress' measuring c. 0.90m by 0.32m and presumably representing the means of access to the predictor pedestal from the emplacement. The c. 90mm thick concrete slab element, [17], of the pedestal is broken into numerous fragments, although all remain in place. The internal edge of the concrete is slightly raised possibly indicating that the pedestal was covered by a temporary shelter.
- 5.6.9 The interior of the predictor pedestal was backfilled by a sandy silt deposit, [30]. c. 0.15m thick. A SW-NE aligned salt-glazed ceramic pipe, [27], was embedded within deposit [30] at its uppermost surface (Figures 7 and 26) and it is postulated that this would have formed an improvised conduit for the cable connecting the predictor to the LAA gun. The pipe was stamped 'METALLIC STONEWARE RAINFORD LANCASHIRE'.⁷ After leaving the predictor pedestal, the cable would then have run along a 0.12m wide north-south conduit, [22], deliberately cut through the concrete surface, [15], of the emplacement floor (Figures 7 and 32). This channel abutted a gap in the concrete foundation slab for the LAA gun pedestal, which would have also housed the cable, which would then have passed through the aforementioned rectangular aperture in the side of the concrete pedestal, [14], and fed upwards through its square central aperture to connect to the Bofors gun (Figures 7 and 33).

5.7 Partial Demolition of the Installation

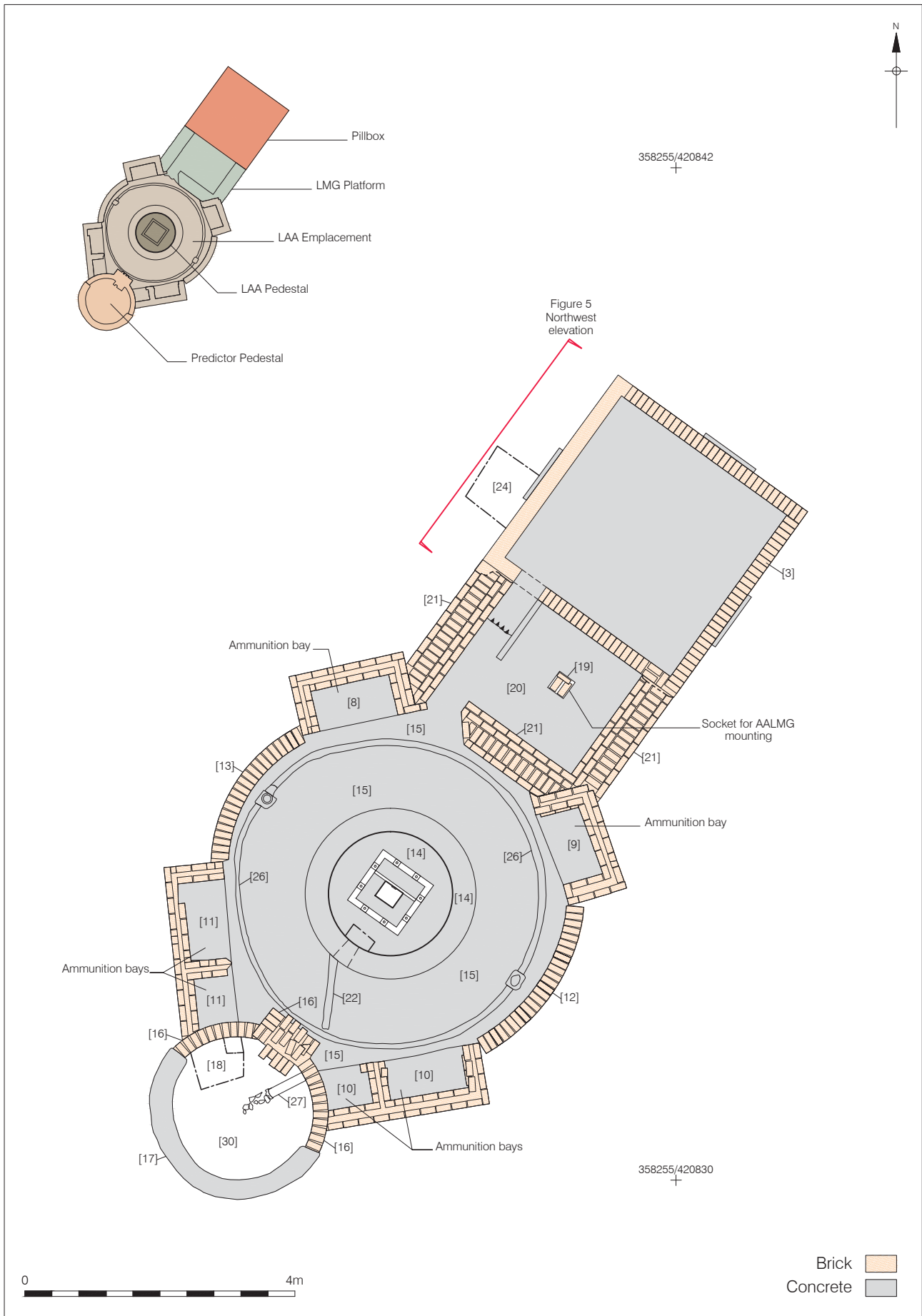
- 5.7.1 The LAA emplacement and the LMG platform element of the pillbox had been backfilled with a rubble deposit, [28], up to c. 0.45m thick. This deposit comprised primarily brick and concrete rubble, including sections of mortared brickwork (wall), within a silty matrix. The rubble was almost certainly derived from demolition of the enclosure wall of the LMG platform element of the pillbox and the upper parts of the LAA gun emplacement walls. Within the rubble were fragments of c. 0.13m thick concrete slab, postulated as being the remains of capping slabs for the ammunition bays.

⁷ Lancashire County Record Office has a catalogue, dated 1937, of Rainford Potteries Ltd., listing all varieties of stoneware pipes, gulleys, and chimney pots the company produced.

- 5.7.2 Although it is unclear when partial demolition of the structures was undertaken, it presumably took place after February 1941, when the static Bofors guns defending the ROF Euxton/Chorley were replaced by mobile variants, although it probably more likely occurred after the LAA defences of the VP were permanently stood down in 1944.

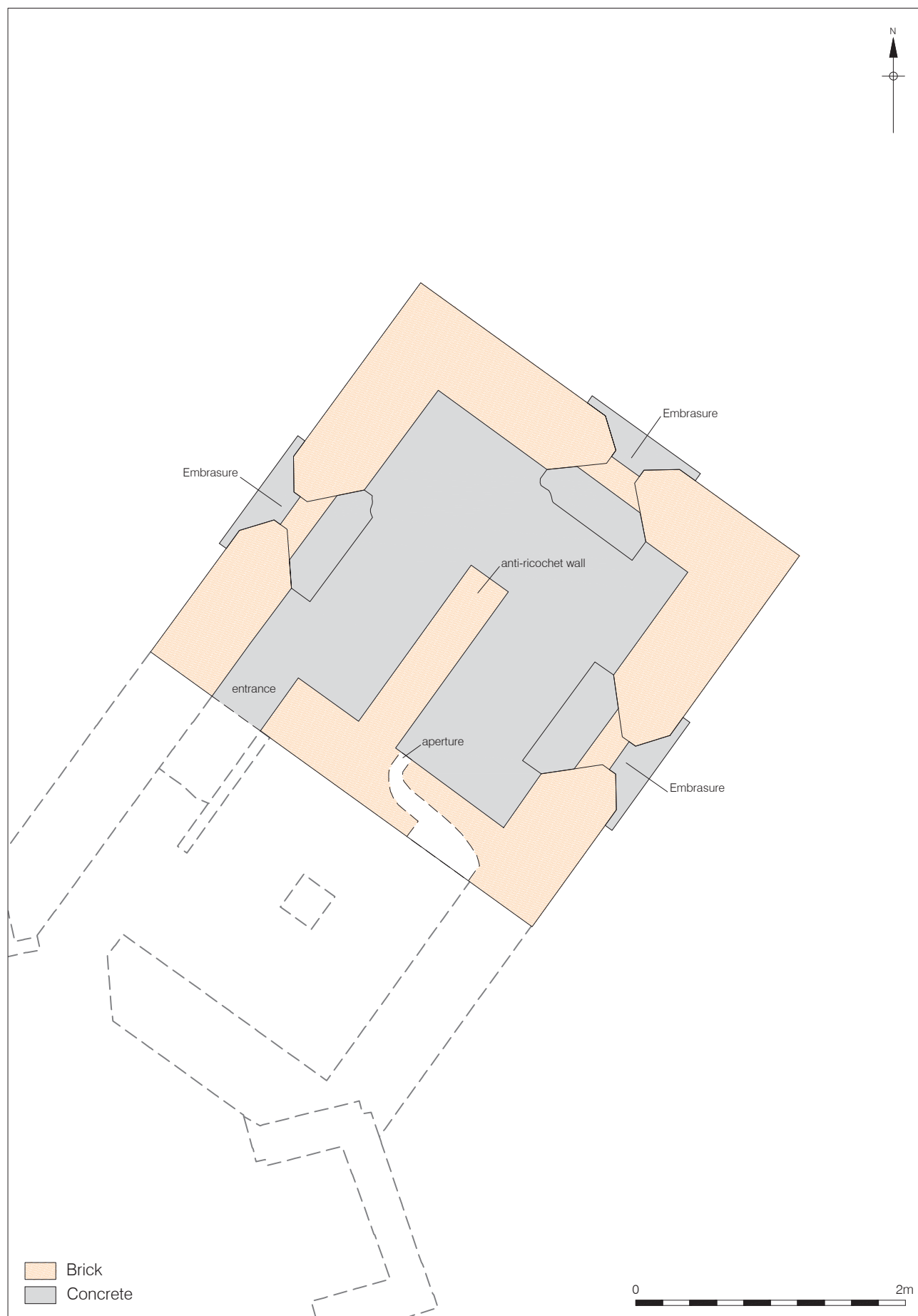
5.8 Existing Ground Surface

- 5.8.1 Topsoil, [1], comprising firm mid brown clayey silt, formed the existing ground surface overlying the infilled remains of the LMG platform element of the pillbox and the LAA gun emplacement, apart from the upper surface of the LAA gun pedestal, which remained visible at ground level at the time of the work. Its maximum recorded thickness was 70mm, recorded within the test-pit excavation adjacent to the north-west wall of the pillbox.



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Figure 7
Plan of pillbox and gun emplacement
1:80 at A4



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Figure 8
Horizontal cross-section of pillbox
1:40 at A4

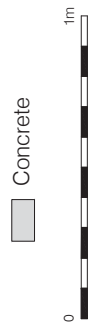
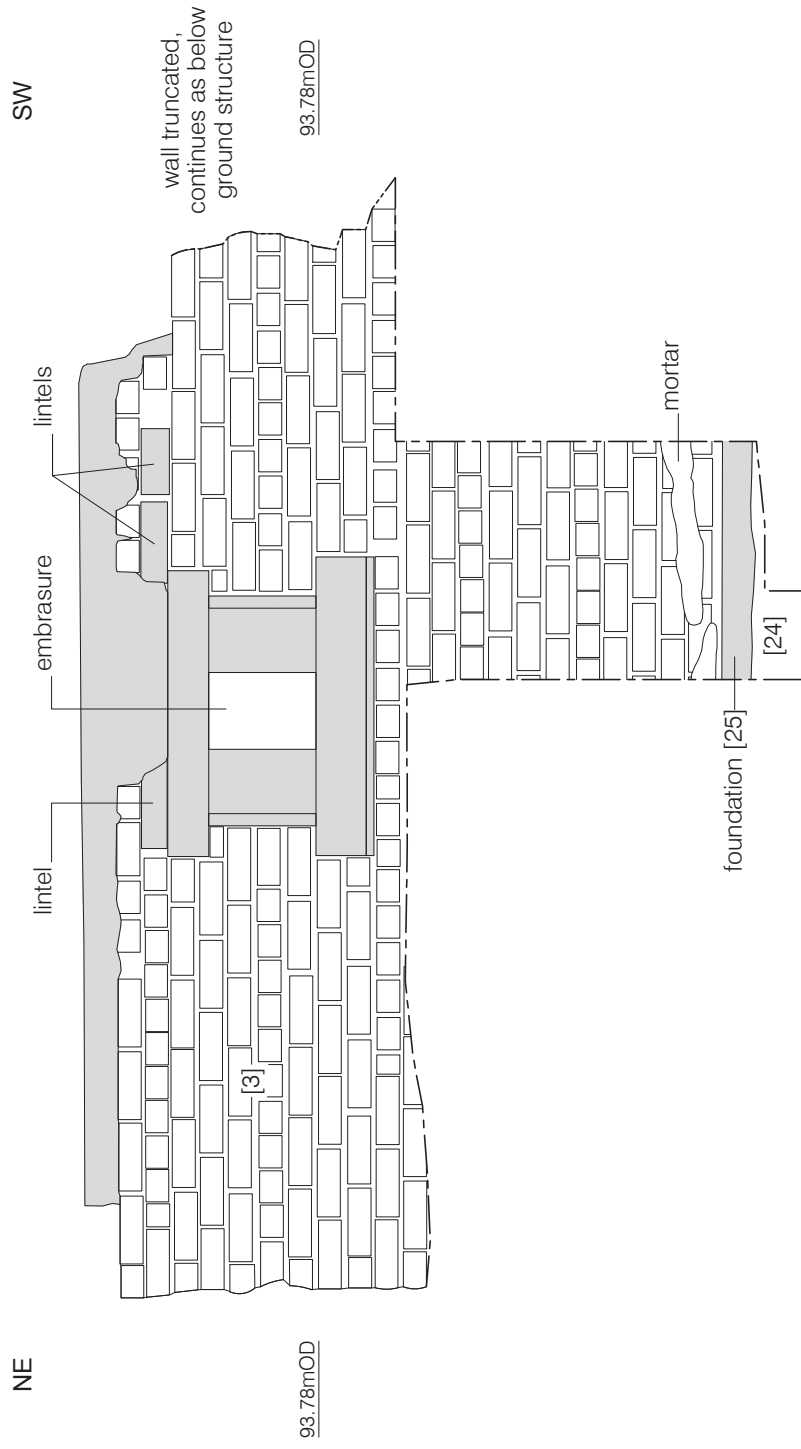


Figure 9
Northwest facing elevation of pillbox
1:25 at A4



Figure 10. Overall installation, looking north-east (2m scale)



Figure 11. LAA gun emplacement, from pillbox roof, looking south-west (2m scale).



Figure 12. LAA gun emplacement, looking south-east (2m scale)



Figure 13. LAA emplacement and LMG platform, working shot, looking south-west



Figure 14. Pillbox and LMG platform, looking north-east (*1m scale*)



Figure 15. Pillbox, south-west facing elevation, into LMG platform (*1m scale*)



Figure 16. Pillbox, south-east facing elevation (1m scale)



Figure 17. Pillbox, north-east facing elevation (1m scale)



Figure 18. Pillbox, north-west facing elevation (1m scale)



Figure 19. Pillbox, test-pit against north-west elevation (1m scale)



Figure 20. Pillbox, foundation in test-pit against north-west elevation (0.5m scale)



Figure 21. Pillbox, interior, entrance, with anti-ricochet wall to left, looking south-west (1m scale)



Figure 22. Pillbox, interior, embrasure in north-west wall, looking north (0.5m scale)



Figure 23. Pillbox, interior, embrasure in south-east wall, looking south-east (1m scale)



Figure 24. Pillbox, interior, south-west and anti-cochet walls, looking south-west (1m scale)



Figure 25. Pillbox, interior, north-east corner, looking north-west (1m scale)



Figure 26. LAA emplacement, predictor pit, looking south-west (1m scale)



Figure 27. LAA emplacement, south-east ammunition bay, [10], looking SSE (1m scale)



Figure 28. LAA emplacement, south-west ammunition bay, [11], looking WSW (1m scale)



Figure 29. LAA emplacement, north-west ammunition bay, [8], looking NNW (1m scale)



Figure 30. LAA emplacement, north-east ammunition bay, [9], looking north-east (1m scale)



Figure 31. LAA gun pedestal, looking south-west (*1m scale*)



Figure 32. LAA gun pedestal and cabling conduit, looking north (*0.5m scale*)



Figure 33. LAA gun pedestal with cabling aperture, looking north-east (0.5m scale)



Figure 34. LAA gun pedestal, metal frame, looking north-east (0.5m scale)



Figure 35. LAA gun pedestal, metal frame, stirrup bracket detail, looking north (*0.5m scale*)

6. DISCUSSION AND CONCLUSION

6.1 Discussion

- 6.1.1 The Royal Ordnance factory (ROF) (Filling Factory No. 1) at Euxton/Chorley was built in 1937-38 as the threat of war with Nazi Germany loomed large. It was one of three major such works commissioned in 1936, the others located at Bridgend, Glamorgan (Filling Factory No. 2) and Glascoed, Monmouthshire (Filling Factory No. 3). The ROFs were amongst a select group of industrial establishments, including aircraft factories and fuel plants, which were considered to be of such importance to the war effort as to warrant the provision of permanent fixed defences. ROF Euxton/Chorley was designated Vital Point (VP) 426.
- 6.1.2 The Lucas Green defensive installation described in this report was built to defend Euxton/Chorley ROF against enemy attack, both from the ground and the air. The topography of the site, a 'platform' lying at c. 93m OD, with clear views to the north-east, east and south-east, would have been a significant factor in its choice as the location for a defensive installation to defend the VP, which lay c. 1 km to the west and south-west at Euxton, on the northern edge of Chorley.
- 6.1.3 Four static Bofors guns were deployed by 80th LAA Battery of the 21st LAA Regiment in defence of Euxton/Chorley ROF in mid-November 1940 and the Lucas Green installation was probably built in the late summer or autumn of that year. The static guns at Euxton/Chorley ROF were replaced by mobile Bofors guns in February 1941 and it is likely that the LAA gun emplacement element of the Lucas Green installation went out of use after that date, although the pillbox element likely remained manned.
- 6.1.4 By September 1943, 20mm LAA guns were deployed to defend ROF Euxton/Chorley, manned by A and B Troops of 131st Lancashire Home Guard LAA Battery, drawn from 12th Battalion Lancashire Home Guard. Home Guard AA units remained responsible for the defence of factory VPs in 1944, when the defences of ROF Euxton/Chorley included both 20mm and mobile Bofors guns manned by members of A and B LAA Troops of 12th Battalion Lancashire Home Guard.
- 6.1.5 The installation comprises a Type DFW3/23 pillbox, backed with an open platform for a Lewis LMG, attached to a LAA gun emplacement designed to accommodate a static Bofors 40mm LAA gun. It is assumed that the LAA gun emplacement was built sometime after the pillbox and LMG platform, although it is also possible that the two structures were essentially built contemporaneously. It may have been the case that construction of the pillbox was almost complete when the decision to construct the LAA gun emplacement was made, with the LMG platform element of the pillbox adapted to incorporate the emplacement to the south-west.

6.1.6 The walls of the installation and four ammunition bays in the LAA emplacement are brick-built, while the floors are concrete slabs throughout and the substantial three-element roof of the pillbox is concrete-brick-concrete. The ammunition bays were likely capped with concrete slabs, the remains of which were found within the demolition infill of the LAA emplacement. Centrally-located in the LAA emplacement is a cylindrical concrete pedestal forming the holdfast assembly for the Bofors gun and the final element of the installation is the raised circular platform at the south-west end of the LAA emplacement on which an anti-aircraft fire-control predictor would have been sited. Conduits and apertures for the electrical cabling connecting the Bofors gun to the predictor were recorded.

6.2 Conclusion

6.2.1 Surviving World War Two LAA installations are relatively rare, with approximately only 40, out of the total of approximately 1,250 that were originally built in Britain, surviving to any coherent extent. Ground emplacements for static Bofors guns are particularly rare and the Lucas Green example is notable amongst this very small sub-group for its exceptional degree of preservation. Only the uppermost brickwork of the LAA gun emplacement is missing, along with the upper part of the enclosure wall of the LMG platform element of the pillbox. With regards to its association with the pillbox, the Lucas Green LAA emplacement may well be unique, certainly in terms of surviving examples.

6.2.2 The original intention had been to remove the installation as part of the development. However, the building recording work undertaken, which has exposed the extent and nature of the overall installation and allowed its degree of preservation and significance to be fully appreciated has led to re-design of the development layout to allow the heritage asset to be preserved *in situ*. The developer, Redrow Homes, was instrumental in this decision-making.

7. ACKNOWLEDGEMENTS AND CREDITS

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APPENDIX 1
CONTEXT INDEX

LWC 13: CONTEXT INDEX

Context	Phase	Type 1	Type 2	Interpretation
1	5	Deposit	Layer	Topsoil
2	3	Deposit	Fill	Backfill of construction cut [4]
3	3	Masonry	Structure	Pillbox
4	3	Cut	Discrete	Construction cut for Pillbox [3]; filled by [2], [25]
5	3	Deposit	Layer	Levelling deposit
6	3	Deposit	Layer	Levelling deposit
7	3	Deposit	Layer	Levelling deposit
8	3	Masonry	Structure	Ammunition bay to north-west
9	3	Masonry	Structure	Ammunition bay to north-east
10	3	Masonry	Structure	Ammunition bay to south-east
11	3	Masonry	Structure	Ammunition bay to south-west
12	3	Masonry	Structure	Curvilinear brick wall of LAA emplacement
13	3	Masonry	Structure	Curvilinear brick wall of LAA emplacement
14	3	Deposit	Structure	Concrete-set holdfast and slab foundation for LAA gun
15	3	Deposit	Surface	Concrete floor of LAA gun emplacement
16	3	Masonry	Structure	Brick element of predictor pedestal
17	3	Deposit	Structure	Concrete element of predictor pedestal
18	2	Deposit	Layer	Sub-soil
19	3	Masonry	Structure	Socket for LMG mounting
20	3	Deposit	Surface	Concrete floor of LMG platform
21	3	Masonry	Structure	Brick enclosure wall of LMG platform
22	3	Deposit	Structure	Cable conduit in floor [15]
23	1	Deposit	Layer	Natural sub-stratum
24	1	Deposit	Layer	Natural sub-stratum
25	3	Deposit	Structure	Concrete footing for Pillbox [3], within construction cut [4]
26	3	Deposit	Structure	Drainage system in floor [15]
27	3	Deposit	Structure	Ceramic pipe, used as cable conduit
28	4	Deposit	Fill	Rubble backfill of LAA emplacement and LMG platform
29	3	Cut	Discrete	Construction cut for predictor pedestal elements [16] and [17]
30	3	Deposit	Fill	Backfill of predictor pedestal

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