

ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ORFORD NESS, SUFFOLK COLD WAR RESEARCH & DEVELOPMENT SITE

SURVEY REPORT

Wayne Cocroft and Magnus Alexander



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ATOMIC WEAPONS RESEARCH ESTABLISHMENT ORFORD NESS, SUFFOLK

COLD WAR RESEARCH & DEVELOPMENT SITE

Wayne D Cocroft and Magnus Alexander

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SUMMARY

The Atomic Weapons Research Establishment, Orford Ness, Suffolk, was operational between 1956 and 1972. Its primary task was environmental testing to simulate the conditions that nuclear weapons and their components might experience during trials and in service use. Here science and high politics merged, with investigations that were crucial to the credibility of the United Kingdom's nuclear deterrent forces, the cornerstone of Cold War defence policy. Prior to the 20th century Orford Ness was a rarely visited place; the main economic activity was animal grazing on reclaimed marsh land. During the First World War the Royal Flying Corps established a flying field on the marshes and associated buildings along 'The Street'. It was principally used for experimental work into aerial machine guns, bombs, navigation, and photography, a role that continued into the inter-war period. In 1935, a small experimental radar team arrived and conducted experiments that were critical in proving the value of this technology. This report is primarily concerned with the development of the post-war Atomic Weapons Research Establishment. To understand these developments a brief summary of the earlier military activity is also provided. Orford Ness is owned by the National Trust.

CONTRIBUTORS

The survey was carried out by Magnus Alexander, Wayne Cocroft, Elaine Jamieson, Sarah Newsome and Jonathan Millward. Professional ground photography was taken by Steve Cole and Roger J C Thomas.

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INTRODUCTION

The Atomic Weapons Research Establishment, Orford Ness, Suffolk, was operational between 1956 and 1972. Its primary task was environmental testing to simulate the conditions that nuclear weapons and their components might experience during trials and in service use. Here science and high politics merged, with investigations that were crucial to the credibility of the United Kingdom's nuclear deterrent forces, the cornerstone of Cold War defence policy. Prior to the 20th century Orford Ness was a rarely visited place; the main economic activity was animal grazing on reclaimed marsh land. During the First World War, 1914-1918, the Royal Flying Corps established a flying field on the marshes and its associated buildings were arranged in along a single road, which became known as 'The Street'. This station was principally used for experimental work into aerial machine guns, bombs, navigation, and photography, a role that continued into the inter-war period. In 1935, a small experimental radar team arrived and conducted experiments that were critical in proving the value of this technology.

The survey was undertaken as part of a national project 'Cold War, People and Place', which was designed to produce four exemplary surveys of Cold War era research and development establishments. The investigation has also contributed to another national project 'England's atomic age', which aims to document some of England's key nuclear installations. The survey of Orford Ness was principally concerned with understanding the post-war use of the spit by the Atomic Weapons Research Establishment (AWRE). This is set against the background of contemporary weapons programmes. To this end a full topographic survey was carried out of the AWRE structures on Orford Beach, and an earlier plan of The Street was digitised, geo-referenced and appended to the present survey. Other peripheral details were derived from Ordnance Survey mapping. Descriptive record sheets were also produced for all the significant AWRE buildings and features on Orford Beach, and selected buildings on The Street. Ground photography was also undertaken.

In addition to its historical interest Orford Ness is a rare and fragile natural environment that is extremely for important bird, plant and insect life. In recognition of this significance, and that of large areas of the adjacent coast, it is protected under a suite of environment designations as an Environmental Sensitive Area, Site of Special Scientific Interest, Special Protection Area, Area of Outstanding Natural Beauty and Ramsar (www.magic.gov.uk).

Orford Ness is owned by the National Trust and during the summer months a regular boat service takes visitors to the spit. Most of the AWRE area may be seen from surfaced tracks, although parts of the former range are closed to assist nature conservation or due to health and safety concerns.

Note

Within the report the buildings are referenced by their latest known numerical designation. Where the earlier number is known this will also be given, for example,

Control Room F4/124/67, where F4 is its current number and 124 and 67 are its previous numbers. More detailed descriptions of the purpose-built AWRE buildings and structures on Orford Beach and selected buildings from 'The Street' are appended at the end of the report. On the accompanying plans features are identified by their latest known designation. All aerial photographs used in the report have been turned so that north is at the top.

TOPOGRAPHY AND LAND USE

Orford Ness (TM 4408 4856) is sited on the Suffolk coast 18km due east of Woodbridge and 8.3km to the south of Aldeburgh (Figure 1). It is the largest vegetated shingle spit in Europe and stretches for about 16 km with a maximum height above sea level of around 4m. At its northern end it is linked to the mainland by a narrow strip of land at Slaughden to the south of Aldeburgh. The remainder of the spit is permanently separated from the mainland by a tidal river, known to the north as the River Alde and to the south as the River Ore. Travelling southwards from Aldeburgh the spit gradually widens out, and opposite to Orford Quay it has a maximum width of about 1.5km. To its rear are a series of salt marshes, to the north Lantern marsh and to the south King's Marsh. Opposite to Orford, the spit is split into two by a tidal watercourse Stony Ditch with King's Marsh to the rear and to its east the shingle known as Orford Beach.

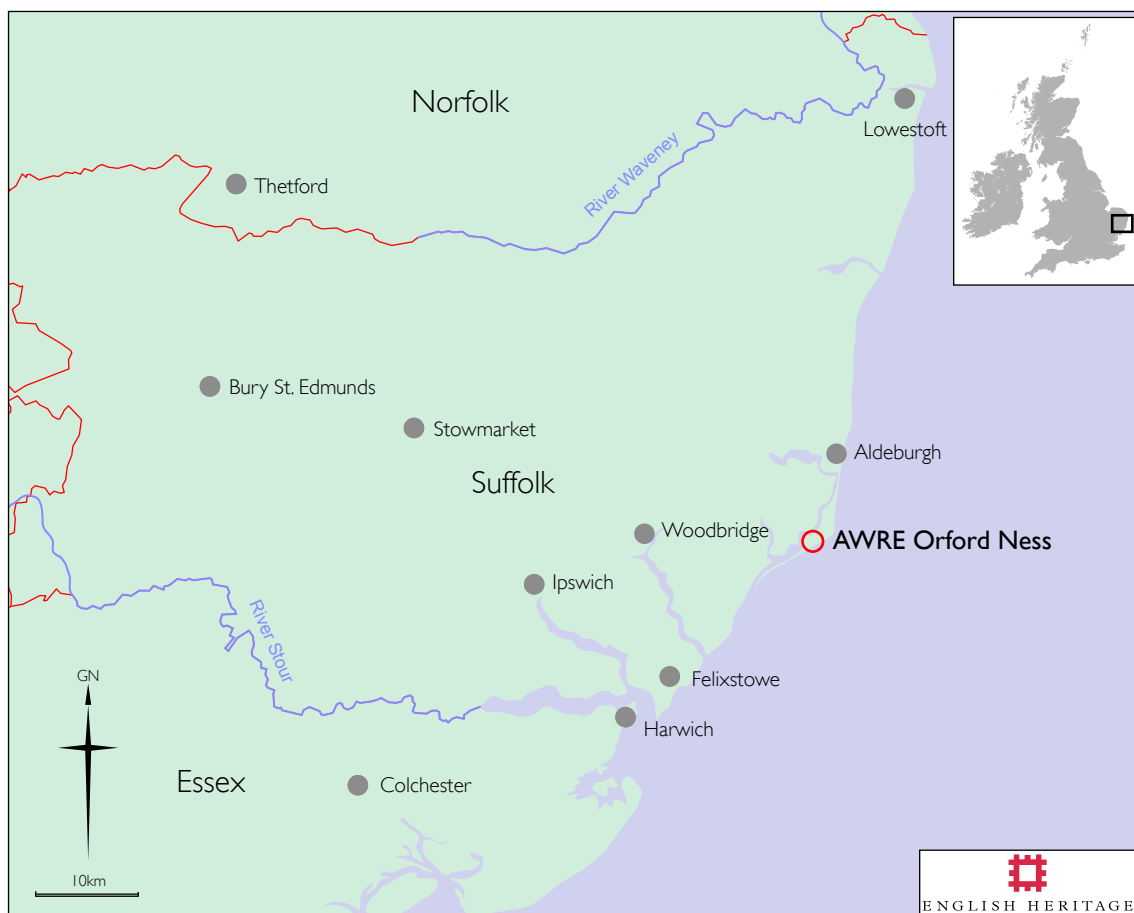


Figure 1: Orford Ness, Suffolk, location diagram (c) English Heritage

Immediately off shore, in Hollesley Bay, there are treacherous swift tides, banks and shoals, which have claimed many ships. In 1627, 32 ships were cast up on Orford Ness (www.trinityhouse.co.uk), later wrecks include three late 18th century ships, five 19th century ships, the remains a stranded 20th century trawler, the *Faithful Star*, which was wrecked in 1957, and two wartime aircraft. Except for the *Faithful Star* none of the

wrecks are precisely located. In addition to the wrecks the seabed is known to be covered by live ordnance from the decades of experimental works. Other remains of wrecks include a large section of an aircraft wing embedded in the south bank of Stony Ditch. Close to the National Trust's Orford jetty is a derelict wooden barge, the *Tuesday*, a late 19th century sailing barge that has been stranded here since the 1930s.

During the First World War, opposite to the town of Orford King's Marsh was acquired by the War Office for the construction of an airfield. To this end the western part of King's Marsh was drained and levelled and a grass flying field constructed. To its south along the line of Stony Ditch were a number of hangars and ancillary buildings. To the south of the ditch are a couple of explosives magazines and Orford beach that was used for bombing practice. The spit remained in government hands until April 1993 when the National Trust purchased 1551 acres (628 hectares) for £292,500. Today, most of the spit, with the exception of the former Cobra Mist wireless station to the north, is managed by the National Trust. Access on to the spit is by boat and then either by land train or on foot. To protect the nesting birds and plant life, and due to the risks posed by unexploded ordnance, visitors are restricted to set routes. To further increase the bio-diversity of the area parts of the former flying field are being allowed to flood.

PREVIOUS ARCHAEOLOGICAL AND HISTORICAL RESEARCH

The occupation of the spit for most of the 20th century by the military effectively restricted access to the area until it was acquired by the National Trust in 1993. Prior to this in 1981, Gordon Kinsey published *Orford Ness – Secret Site* that revealed for the first time its 20th century military history. Shortly after the National Trust acquired the site the Royal Commission on the Historical Monuments of England undertook a topographic survey of the strip of First World War and later buildings, known as 'The Street'. This comprised a ground survey of the buildings and some photography, no detailed report was produced (TM 44 NW 16). Ground and low level oblique air photographs were also taken of the site in the late 1990s and these are deposited in the National Monuments Record, Swindon. Between 2001 and 2004 English Heritage's National Mapping Programme ran a project to plot all the pre-1945 archaeological features along Suffolk's shore, including Orford Ness (Hegarty and Newsome 2007, 32-33, 85-6). The National Trust has also undertaken research on the range, including a summary of its historic importance, which partly contributed to the site guide book (Musson 1993, National Trust 2003). The National Trust has also undertaken taped interviews with a number of former employees. These and other archive material is held on site at Orford Ness and their regional headquarters at Bury St Edmunds. The National Archives also holds a number of files relating to the site.

HISTORY

The earliest known human activity on the spit is marked by a hoard of 4th century Roman coins (TM 44 NE 1) found to the north of the light house. To the rear of Orford Beach the marshland was reclaimed during the medieval period and was held by Sudbourne Hall; the main economic activity was cattle and sheep grazing. Probably by the 19th century oyster beds were also developed on the north side of Stony Ditch. Settlement on the spit was limited to a single small group of buildings to the south of Slaughden known as Marsh House, it or a predecessor was depicted on a map dated 1736 and survived into the 1950s (Musson 1993). To warn seafarers of the dangerous shoals off Orford Ness the first lights were erected in the late 17th century and are shown at approximately the position of the current lighthouse on John Kirby's 1736 map of Suffolk. These were replaced with brick towers in 1720 and the current lighthouse was built in 1792 (www.trinityhouse.co.uk) (Figure 2). Adjacent to the lighthouse is a wooden Coast Guard hut that has stood on this site since the 19th century. To the north at Slaughden between 1808 and 1812, as part of a series of defences to protect the east coast against attack by Napoleonic France, a unique quatrefoil Martello Tower was constructed (Millward 2007, 95-6). It was finally sold by the War Office in 1932 when it became a private house for a short period until it was requisitioned in 1940 for use as a coastal watch tower. In the early 1970s it was acquired by the Landmark Trust who restored it for use as short term holiday accommodation. Another small group of buildings may also have existed at the landing point opposite to Orford Town Quay (Musson 1993).



Figure 2: Orford Ness lighthouse, 1792. (C) English Heritage DP068423

The First World War

In 1915, the Armament and Experimental Flight of the Royal Flying Corps was transferred to Orford Ness, which became formally known as the Aircraft Armament and Gunnery Experimental Establishment. Its main areas of investigation were machine guns and gun sights, bombs and bomb sights, navigation, aerial photography and the development of parachutes. The main construction work at this date included the levelling and draining of the southern end of the King's Marsh to create a flying field. To its south along the northern edge of Stony Ditch supporting buildings were laid out alongside a roughly west to east single track, later to become known as 'The Street'. A tramway also ran alongside



Figure 3: First World War Royal Flying Corps Headquarters building, note the use of cement block construction. This view was taken in the 1990s, it has since been demolished. (c) English Heritage AA99/08438

this route and back to the quay. The largest buildings were two Belfast truss aeroplane sheds, or hangars, the westerly one stood until about 1950 and the easterly one into the 1980s. A contemporary photograph (Wainwright 1995, 75) also shows that there a number of temporary hangars along the southern edge of the flying field. To protect the station from flooding a Chinese labour battalion was drafted in to construct a seawall, which has subsequently been known as the 'Chinese Wall' (Cobb 1998, 12). For some time German prisoners of war were also held on the spit and used in construction work. By the end of the war the station occupied 1022 hectares and comprised about 46 structures, with a complement of 612 personnel (TNA:PRO AIRI/453/15/312/26 Vol.6).

After the signing of the armistice in November 1918 the establishment was closed and placed on a care and maintenance regime.

From 1924 the airfield was re-occupied as a satellite station of the Airplane and Armament Experimental Establishment based at Martlesham Heath and it became the Bombing Experimental Establishment. A 1928 record drawing shows that 36 buildings were retained, although many remained deserted (Hanbury Brown 1991, 9). Due to its remoteness one of main activities at Orford Ness was the investigation of bomb ballistics, the study of the flight of objects moving under their own momentum and the force of gravity. To support this work in the early 1930s the Bomb Ballistics Building was built from which to monitor the fall of test bombs. Some First World War magazines were also probably refurbished at this time and a number of smaller fuze magazines constructed.

Increased activity at Orford Ness in the early 1930s is reflected by new construction programmes. The range of experiments also diversified; probably around 1930 a hexagonal building known as the Black Beacon was constructed on the spit to house an experimental rotating radio beacon transmitter. Although, ships had used direction finding by wireless for sometime it required the carrying of special equipment. This new method removed this necessity and the Air Ministry was interested in how it might also be applied to aircraft. The system was later developed for use in airfield homing beacons (Anon 1931, 594). Adjacent to it a brick generator building was constructed to provide power for it and other range infrastructure.

Early radar research

During the First World War attacks on British cities by German Zeppelins and later by large bomber aircraft demonstrated the need to devise methods for predicting the approach of hostile aircraft. One method that was developed from artillery detection methods was sound, or acoustic, ranging. This involved the installation of sound mirrors facing out to sea to detect aircraft engine noise and some research was undertaken at Orford Ness in the 1920s into the development a binaural trumpet. Nevertheless, by the 1930s increasing aircraft speed made it largely obsolete for aircraft finding and in September 1935 work was suspended in favour of Radiolocation and Direction Finding, or radar. In the previous years, a number of radio engineers had noticed the interference created by moving objects, including aircraft, and it was realised that this phenomenon might be used to locate aircraft.

Work on radar was inaugurated in 1935 by the Air Defence Research Subcommittee of the Committee of Imperial Defence under the chairmanship of Henry Tizard. Initial research was started by Robert Watson-Watt's Radio Research Station team at the National Physical Laboratory, Slough (Hanbury Brown 1991, 3-13; Gough 1993, 2-3). On 13 May 1935, a small group, who became known as 'The Islanders', moved to Orford Ness to carry out their practical experiments. They occupied a couple of the former RFC buildings at the south-west end of The Street and also erected a number of masts for their experiments. Here they worked on the design of powerful transmitters, receiving antennae, amplifiers and cathode tubes for displaying the results. On 16 June



Figure 4: Photograph taken during the 1990s of the First World War Royal Flying Corps buildings that were used during the 1930s for radar research, to the left is C13 and to the right C8, most of the buildings in the centre have subsequently been demolished (c) English Heritage BB93/09845

the Tizard Committee visited Orford Ness and saw aircraft followed for more than 40 minutes. The next month, on 24 July, while tracking a Wallace bi-plane other echoes were also detected from a flight of three Hart aircraft, the first time several aircraft were tracked by radar and by January 1936 the team was also able to determine the bearing of approaching aircraft (Crowther & Whiddington 1947, 5-6). The work at Orford Ness had demonstrated the viability of the new technology, but as its development expanded the main focus of the research moved 9 miles (15km) to the south to the more spacious and convivial Bawdsey Manor. After its establishment the main function of the Orford Ness team continued on the development of transmitters, receivers and antennae, as well evaluating the whole system.

The Second World War

During the Second World War the airfield was disused and covered with concrete blocks to deny its use to enemy aircraft. The principal occupant of the spit was the Aeronautical Armament Experimental Establishment, its main activities included the assessment of the vulnerability of aircraft to hostile fire, including captured German aircraft, which were brought to Orford Ness and reassembled. In one incident an enemy aircraft came to them, when after attacking Harwich, an Italian bi-plane developed an overheated engine and landed on Orford Beach. It is now preserved at the RAF Museum, Hendon. One relic of the lethality and vulnerability work is the large aircraft wing embedded in the south bank of Stony Ditch that was probably used to study self-

sealing fuel tanks. During the war a small number of buildings were also added to The Street. On the mainland a 10cm rotating radar was positioned on top of one of Orford Castle's towers, traces of its foundations may still be seen. In summer 1944, to counter the threat from V1 flying bombs seven temporary 'Diver' batteries of 3.7-inch guns were installed around Orford. Four batteries and associated accommodation huts were located close to Raydon Hall, another one to the west of the town on Chantry Marshes and two at the western end of the former Orford Ness airfield.

Post-war bomb ballistics

The association of Orford Ness with the British atomic bomb project began some years before the arrival of the Atomic Weapons Research Establishment in 1955. To produce an operational weapons system required a warhead, bomb casing and a suitable aircraft. The latter two were the responsibility of the Royal Aircraft Establishment (RAE), Farnborough, working in association with private industry. The size of the bomb casing, and hence the aircraft that were to carry it, was dictated by the dimensions of the nuclear device, or physics package, at its centre. The first British device was modelled on the wartime implosion device *Fat Man* that had been dropped on Nagasaki in August 1945. This was relatively large and measured about 5ft (1.5m) in diameter, and was originally encased in relatively crude egg shaped casing. Personnel from the ARL (variously referred to as the 'Airfield Radio Laboratory' or 'Airfield Research Laboratory') section of the RAE Farnborough took the lead in designing the casing (Cocroft and Thomas 2003, 238-9). Working with Vickers Armstrong they developed a casing with far better aerodynamic performance than the wartime *Fat Man* bomb. During the early 1950s flight trials at Orford Ness problems were experienced dropping bombs from high speed aircraft, as it was found that the bomb gained lift and returned back to the bomb bay, this was solved by fitting strakes to the underside of the aircraft to disrupt the air flow (Allen 2005). In flight, once it had left the aircraft a *Blue Danube* might travel on a ballistic flight path for 19-24km.

The casing comprised three sections; a nose cone that contained a series of radars to trigger the bomb at a given height above the ground, and to guard against jamming these were backed up by barometric, impact and graze fuzes (TNA: PRO AIR 2/13689). Other electrical components included batteries and turbo-generators to power the bomb's electrical systems. The central section housed the nuclear device, while the tail contained additional electronics and fins which were designed spring out to their full extent once the bomb had left the bomb bay. Most of the bomb's electronic circuits were designed by the High Explosives Research team at Fort Halstead, Kent, and it was here too that some of the assembly work for the test rounds probably took place (Wynn 1994, 94). At 24ft (7.3m) in length the *Blue Danube* casing was far too large for the RAF's only jet bomber *Canberra*, introduced in 1949, and for the early trials a modified *Lincoln* aircraft with Python turbo-prop engines was used. The trials were designed to understand many aspects of the bomb's performance; each series of trials was prefixed by letter to denote its main purpose, B ballistics, E end point, F fuzes, R release, and T temperature. Most of the casings were fitted with small explosive charges to destroy the telemetry equipment before they hit the water, and in the later trials it is known that the casings were not recovered (Wynn 1994, 96). During these trials numerous of aircraft

sorties were flown from RAF Martlesham Heath, Suffolk. Here most of the airfield has been built over, although its control tower is preserved as a museum (TM 24 NW 74), and other buildings have been adapted to new uses.



Figure 5: Former RAF Martlesham Heath, preserved Air Traffic Control tower (c) English Heritage

The first *Blue Danube* atomic bombs were issued to the RAF's Bomber Command Armament School at RAF Wittering in November 1953 (Wynn 1994, 92). However, there was a considerable lapse of time before the weapons could be regarded as operational. The first *Valiant* V-bomber arrived at RAF Wittering in June 1955 and shortly afterwards a series of trials began to investigate the performance of the bomb's shape at different speeds and altitudes and to monitor internal equipment during flight. Between June and November 1955 a total of 14 trial casings were dropped at Orford Ness for the AWRE and RAE scientists, for economy, in number of instances ballistics and electronics trials were combined (Wynn 1994, 96-97). During 1956 the Orford Ness range was again used by RAF Wittering's *Valiants* in preparation for the autumn *Buffalo* trials at Maralinga, Australia, where one aircraft would make the first operational air drop of a British atomic weapon. The facilities at Orford Ness were particularly important for familiarising the bomber crews and RAE ground controllers with the operating procedures required for the trial. Also in autumn 1956 Orford Ness was used for the initial training flights for the autumn 1957 *Grapple* tests on Christmas Island, in which Britain would detonate her first hydrogen bomb. Training sorties comprised high level visual bombing runs from 25,000ft and 40,000ft using 100lb practice bombs, and

later inert casings similar to the ones that would be used for the live devices; these drops were monitored by AWRE telemetering teams (Hubbard and Simmons 1985, 49; Wynn 1994, 170-171, 226). One of the specially modified *Valiants* that trained over Orford Ness and which saw service in the *Grapple* trials is preserved at the RAF Museum, Cosford.

In addition to the work at Orford Ness on *Blue Danube* ballistics trials, in about 1954 trials also began on the Vickers Armstrong's guided glide bomb, codenamed *Blue Boar*, which was later cancelled (Forbat 2006, 45-64). In the late 1950s there are also accounts of low level bombing trials by *Canberras* and *Scimitars*, both of which were large enough to carry the smaller *Red Beard* tactical atomic weapon (Revett 2004, 86).



Figure 6: The jetty area in May 1952, at the centre is the long rectangular radar building with SCR 584 radar trailers to either end and a third trailer to the left. RAF58/877 5164 21 May 1952 English Heritage (NMR) RAF Photography

To assist the ballistics trials the RAE established a small radar station (Figure 6), whose main functions were to guide the aircraft on to the correct course, to instruct the pilot when to drop the weapon and then to monitor its flight. This station was sited close to the landing stage, its permanent structures included a single rectangular main building, comprising two plotting rooms and a workshop, a detached radar office and store, and a valve store. It operated in conjunction with personnel in the 1930s Bomb

Ballistics Building and was able to communicate with the aircraft from an adjacent radio transmitter mast. For the trials work, three mobile, wartime American gun-laying SCR 584 radar trailers were set up, along with two mobile trackers equipped with cameras (Figure: 7) (TNA: PRO AVIA6/14752).



Figure 7: Early 1950s radar station used during the bomb ballistics trials showing two SCR 584 type radars TNA:PRO AVIA 6/14752

One of the organisations that were sent a copy of the report on the radar station was ARE/HER (Armament Research Establishment/High Explosives Research), the cover name for the atomic bomb team. One drawback of this location was its vulnerability to flooding and the destruction of valuable equipment and records, which was demonstrated by the February 1953 floods that swept the east coast. Air photographs show that this facility was in operation in 1952, but by early 1955 no mobile radar equipment is shown in place, which may indicate that it was redundant by this date or that it was only occupied during trials work (RAF 58/877 (F14) 5163 21 May 52; RAF 58/1674 (F21) 0122 4 Mar 55). The trials were also recorded by cameras and kinetheodolites, a number of whose mounting plinths still survive; they were not visited during this survey (Figure 15).

To further support the bomb ballistics work the RAE also operated a Model Ballistic Firing Range that was built at the southern end of the former RFC area (Figures 8 and 9). Air photographs allow the construction of this facility may be dated to early 1955 (RAF 58/1674 (F21) 0121 4 Mar 55). It comprised a control building with timing and measuring equipment, a platform for a 17-pounder gun and a 50 yard (45.72m) range, covered by a semi-circular corrugated steel sheet roof. In operation models were fired from the gun in a projectile known as a 'sabot' that then fell away to allow the model to travel down the range. Internally, were a series of spark photography stations spaced at 5 ft (1.5m) intervals and for stability mounted on 40 ft (12.2m) piles, which recorded the pitch and



Figure 8: Building C12, was 103, Model ballistics firing range in about 1958. TNA:PRO AVIA6/14752



Figure 9: Building C12, model ballistics firing range interior in about 1958 TNA: PRO AVIA6/14752

yaw of the models as they passed along the tunnel. A contemporary report reveals that bomb and re-entry head models were tested in the range, and one of its illustrations shows a *Yellow Sun* nuclear weapons casing model (PRO:TNA AVIA6/23833).

With the closure of the Ministry of Supply bombing range bomb ballistics work ceased on 1 October 1959 (PRO: TNA ABI6/2975, E4 6 Oct 59). The Model Ballistic Firing Range was later converted into an indoor shooting gallery for the establishment's recreation society.

Atomic Weapons Research Establishment 1956-1972

As discussed above Orford Ness' association with the atomic bomb project began as early as 1951 with the Royal Aircraft Establishment's bomb ballistics trials work on the casing for *Blue Danube*. Responsibility for the design of the warhead initially lay with the Ministry of Supply, but in 1954 passed to the United Kingdom Atomic Energy Authority (UKAEA), and within it to the Weapons Group. Its main headquarters was at Aldermaston, Berkshire, with a smaller explosives and assembly facility at Burghfield, Berkshire. They also developed a specialised test range at Foulness, Essex, and lastly at Orford Ness.

Before a nuclear device is evaluated in trials or a weapon is issued to the services its design and safety in operational use needs to be rigorously tested. In 1954, a requirement was identified for facilities for the environmental testing of warheads, including vibration and temperature trials. Initially, the need was to test the Red Beard tactical atomic bomb, and Mark I atomic bomb, before it was dropped operationally during Buffalo trials planned



Figure 10: Laboratory 1, building F3, this building was completed by summer 1956 to evaluate weapons prior to the autumn 1956 Buffalo trials (c) English Heritage DP070016

for October 1956 (TNA:PRO AVIA 65/1258). It was at first proposed to locate the new facilities on AWRE's existing trials site at Foulness. However, on this already crowded site there was not enough room for the required safety radius of 550 yards (503m) around the proposed test structures. It was also uncertain whether or not the ground at Foulness was strong enough to support the structures (TNA: PRO ESI/269). In March 1955, William Penney, director of AWRE, wrote to Ministry of Supply to impress on them the urgency of having a vibration test building ready for spring 1956 (National Trust Penney 23 March 1955). It was in this context that the first test structures were erected at Orford Ness (Figure 10). The first group of facilities were designed by C W Glover and Partners, Consulting Engineers and Architects, London, and their function appears to have been primarily for the environmental testing of devices prior to overseas trials, their cost was £³/₄ million. A later document characterised the first facilities at Orford Ness as 'adequate to cope with the needs of the Weapons Group to test devices under special handling conditions of overseas nuclear tests' (PRO: TNA ABI6/2975 E4 6 Oct 59).

In 1959, it was proposed to expand the environmental test programme to simulate the conditions weapons would be subject to when they were issued to the services, including transport, storage and operational use. To the planners at AWRE the late 1950s marked a high water mark for potential projects, including warheads for the *Blue Steel* stand-off missile, *Blue Streak* intermediate range ballistic missile, *Blue Water* surface to surface missile, the *Yellow Sun* freefall bomb, and the naval *Seaslug* missile. There was also the prospect of the next generation of weapons represented by the development of WEI77 freefall bomb.

Ideally, AWRE wished to identify a location for a new trials site within a 60 mile (96km) radius of Aldermaston. A number of sites were considered, including Wing airfield, Buckinghamshire, but by January 1960 it had been concluded 'that there was no satisfactory alternative to continuing at the Orford Ness site' (TNA: PRO ABI6/2228 E45 15/1/60). The new facilities and work would be split between Aldermaston and Orford Ness, the former would be responsible for mechanical testing and the latter for assemblies containing high explosives. Work at Orford Ness proceeded under a Special Development Order and represented the westward extension of the establishment including the two **Vibration Test Buildings E2/I36** and **E3/I35** (Figure 12), their **Control Room E4/I39** and the **Magazine E5/I40**, the approved cost of these structures and associated infrastructure was £860,000. The design work for the new facilities was undertaken by UKAEA's Southern Works Organisation, under the supervision of their chief architect G W Dixon, while the design drawings were prepared by C W Glover and Partners (Millington 1971). Dixon's other work for UKAEA also included the Rutherford High Energy Laboratory, Harwell, Oxfordshire (www.chilton-computing.org.uk/gallery/foreign/slide47.htm). Construction of the two **Vibration Test Buildings** at a cost of £120,000 per structure was undertaken by the local builders and contractors Cubbitt and Gotts and was practically complete by June 1960. Work on the **Magazine** probably didn't begin until a year later when approval was given for the expenditure of £29,000 (TNA: PRO ABI6/2975, E139 12 June 1962). At its height Orford Ness was equipped with five laboratories equipped with eight large vibrators, which could be used in association with thermal and altitude simulators, and a radiant thermal heat shock facility. Shock tests were carried out in two laboratories, one was capable of



Figure 11: Vibration Test Buildings E2 and E3, or Pagodas, they were built about 1960 (c) English Heritage DP068510

handling 800lbs (362kg) dropped through 14 ft (4.3m) and the other 100lbs (45.4kg) over 5ft (1.5m) (AWRE nd, 11). Reference was also made to the requirement for an 'R.A. Vibration Facility and Store' (TNA: PRO ABI6/2975, E3). It is uncertain whether or not this referred to a Radiological Assessment Vibration Facility and Store, if it related to another activity, or if the facility was constructed. In common with other industrial test facilities some radioactive isotopes were used for diagnostic purposes, including Cobalt 60 and Iridium 192 sources (AWRE nd, 18). The question about the testing of radioactive weapons components on Orford Ness is still open. In a letter to the Ministry of Housing and Local Government in October 1960 it was stated 'there will be no tests involving the release of radioactive matter'. One former employee, however, recalled test items with either their high explosive contents or their fissile/fusion components, but never both together. He also remembered being present during an overnight test on a system with components made of plutonium (Revett 2004, 85, 95).

The 1958 Mutual Defence Agreement and its consequences

In November 1946, the United States passed the Atomic Energy Act (McMahon Act) that effectively barred the United Kingdom from American nuclear know-how. Subsequently, successive British prime ministers strived to restore the link. The work of the research establishments, and in particular AWRE, was crucial in demonstrating British competence in this field and that the country had something to offer to the United States. Two events in autumn 1957 contributed to the renewed links with the United States. The detonation of Britain's first true hydrogen bomb and the launch of the Soviet

satellite *Sputnik*, that created fears that their missile technology might be more advanced than was envisaged.

The 1958 *Agreement for co-operation on the Uses of Atomic Energy for Mutual Defence Purposes*, or Mutual Defence Agreement, opened up the opportunity for the United Kingdom to gain access to United States warhead designs (Hennessy 2007, 124). Ironically, the great prize of renewed nuclear collaboration with the US, which the research establishments had helped to secure also led to their gradual decline. While this provided information on the most up to date design principles designs the resulting warheads were more than copies. Through a process known as 'Anglicisation' United States' designs were tailored to meet British engineering and safety standards. The scientists and engineers had, for example, to be sure that British manufactured explosives would have exactly the same effects as their American equivalents. This rule also applied to many other materials used in the warheads and the need to study their interaction with one another. It was also vital that the various electronic components were compatible with the aircraft and boats that were to carry them.

The 1960s

From the autumn of 1959, when it appeared that there was the expectation of a multitude of nuclear weapons projects being carried forward Britain's steadily worsening economical situation led to many defence cutbacks, including the reduction in overseas garrisons and the ending of national service. In this climate many high-tech defence projects were cancelled and over the next decades the United Kingdom relied on a small number of standard nuclear warhead types. Projects that were carried forward into the 1960s included the Anglicisation of the United States W28 warhead, in British service known as *Red Snow* that was used in the *Yellow Sun* Mk 2 free fall bomb and the *Blue Steel* stand-off missile, which was designed to be launched from *Vulcan* V-bomber.

Work was also continued on the WE177 family of freefall bombs (Figure: 12). If success in weapons design is judged by longevity in service it might be regarded as one of the United Kingdom's most successful projects. The series remained in service use from 1966 to 1998. The operational requirement for this weapon was established in the late 1950s to provide a tactical weapon to replace the *Red Beard* bomb, and which was small enough to be carried by a variety of aircraft. The design that emerged was a series of bombs that weighed between 600-900 lb (272-431kg) and measured between 9ft 4in and 11ft 1 in (2.84-3.37m) in length and 16½ in (0.42m) diameter, which was determined by the size of the warhead. It was an extremely sophisticated weapon whose yield could be varied; different variants might be dropped in different roles, for example, as a parachute retarded lay down bomb that was designed to hit the ground before detonating, or as a nuclear depth charge. To simulate falling from a great height the **Impact Facility F5/171** was built in late 1963 or early 1964, in which a weapon, minus its fissile core, was propelled by a rocket powered sled against a concrete wall.

Following confirmation in June 1963 that Britain would proceed with the purchase of the United States, A3T Submarine Launched Ballistic Missile system (Polaris) AWRE's principal task was the development of the ET317 warhead for this missile. Work



Figure 12: WE177A freefall tactical nuclear weapon (c) English Heritage DP068440

proceeded quickly and it is thought that an underground test carried out at the Nevada Test Site, USA, in October 1965 was conducted to prove its design (Norris et al 1994, 404). One source claims that the design was finalised by spring 1966 and that production began shortly afterwards (Norris et al 1994, 62). If this was the case, by the time the last test building was completed, the **Centrifuge E1/I76**, it appears that the *Polaris* warhead programme was already at an advanced stage.

Nevertheless, by this date it was noted that nuclear weapons work was 'beginning to tail-off' and that other non-nuclear work was being undertaken for the Ministry of Defence (TNA: PRO AB16/2976 C57 16 Dec 1966; AWRE nd). The WE177 series of weapons were coming into service and in 1969 responsibility for the United Kingdom's nuclear deterrent forces passed from the RAF to the Royal Navy's *Polaris* submarine fleet. It also marked a pause in over 20 years of British nuclear weapons development. The next main task for AWRE was the hardening of the *Polaris* warhead to ensure that it could penetrate Soviet anti-ballistic missile defences. This project, which would eventually result in the *Chevaline* warhead, may have come too late to involve any of Orford Ness' facilities.

During the 1960s, it was also proposed to construct a burning ground to the east of **Laboratory I F3/I27** (SW/S7823/Site/AL/1). Historic air photographs, however, confirm that the proposal was not carried out.

Project 441- L Cobra Mist



Figure 13: Cobra Mist site 23 July 1997. NMR 15704/25 (c) Crown.copyright.NMR

In the late 1960s, and unconnected with AWRE, Orford Ness was selected as the site for an experimental over the horizon radar system (Figure 13). In essence it was designed to extend the range of conventional radar detection techniques by bouncing radio signals off the ionosphere. In theory it should be possible to detect any disturbance to these signals caused, for example, by the launch of a missile or the passage of an aircraft. The northern end of the spit selected for this installation had been one of the main target areas and was heavily disturbed by practice bombing. Unexploded ordnance clearance began in 1967, by July 1971 most building work was completed and fitting out was finished by February 1972. Testing began almost immediately, it was, however, quickly discovered that there were unsolvable problems with background interference and the project was abandoned in June 1973 (Cocroft and Thomas 2003, 135-9). The facility was later adapted for use by the BBC World Service and since 1997 has been managed by VT Merlin Communications Ltd.

Closure of AWRE Orford Ness

With the introduction of the WE177 and the Polaris system, there was relatively little new work in prospect and in April 1969 the decision was announced to close Orford Ness and to move many of its functions to Aldermaston. The last trial took place on 9 June 1971 and the establishment closed on Friday 1 October 1971 (Kinsey 1981, 115). On 24 July 1972

Orford Ness formally passed from AWRE to the RAF, a number of buildings were identified for their use, while the future of the more specialised buildings was yet to be determined (TNA: PRO AIR2/18780, E30 23 May 1972). With the withdrawal of AWRE the local planning authority wished to see the removal of the 'clutter' from the skyline, in 1971 it was estimated that to reduce the laboratories to shingle covered mounds would cost £50,000 (TNA: PRO AB 44/75 E18 1 Nov 71: AIR2/18780, E64 24 July 1972).

With the departure of AWRE, No.2 Explosive Ordnance Disposal Unit (RAF), which had arrived to clear the Cobra Mist site in 1967, assumed charge of the site. In the following decades they worked to clear the range of unexploded munitions and brought other munitions on to the spit for destruction. This work ceased about 1986, although many unexploded munitions still remain on Orford Beach. Around this time the National Trust began negotiations with the Ministry of Defence to acquire Orford Ness, and an agreement was concluded in 1993.

DESCRIPTION

The former AWRE area on Orford Ness may conveniently be divided into two parts to the north and south of the muddy creek of Stony Ditch (Figure 44). To the north is the former flying field of the Royal Flying Corps station and the remains of its buildings 'The Street', which are set along a track to the north of Stony Ditch. To the south of the creek is Orford Beach, until the arrival of AWRE this area was mainly used as bombing range, although close to the southern bank of Stony Ditch were a number of explosives magazines.

In addition to the facilities on Orford Ness, AWRE constructed the present Orford town car park, which was equipped with a **Cycle Shelter 157**. On Orford Quay the National Trust office originated as the establishment's **Clocking Station 156**, AWRE also operated a 7 ton crane on the end of the quay.

The Royal Flying Corps flying field and buildings

Orford Ness is accessed from Orford town quay by boat to a **Jetty A1** at the northern tip of the spit (Figure 45). To its south is a concrete ramp that allows vehicles to be driven off a landing craft (Figure 14). Adjacent to the jetty a submarine cable was laid to supply the establishment's electrical power. At the quay are a small number of buildings, including a concrete framed barn-like structure that was erected by AWRE as a **Bus Shelter 134**. To the south of these buildings was the site of the early 1950s radar station that was used to guide aircraft on their bombing tracks and to monitor the fall of bombs. Its site is marked by an octagonal brick pier on which a **Kinetheodolite 100** was mounted (Figure 15). To their south were two features that were also probably used by the ballistics range to plot the course of test devices, a **Non Metallic Gantry 121/A50** and an **Aerial Measurement Building 122/A7**. From the jetty a track follows the south shore of the River Ore from which two arms head south towards the old Royal Flying Corps station. This track in part follows the line of the First World War tramway that ran up to and along The Street. Close to the jetty one relic of this system is the former **Locomotive Shed 88**. To the west the first road that is encountered was constructed by AWRE in about 1960 and heads for the west end of The Street, while the second arm heads to the establishment's main gate.

About 1960, The Street was surrounded by a cranked concrete post, wire mesh and barbed fence, enclosing just over 12 hectares (29.5 acres). In 1971, at the end of AWRE's occupation this area comprised about 33 roofed buildings, most of which it had inherited from former occupiers. When the National Trust acquired the site in 1993 many of the buildings were in a derelict and dangerous condition and all but 16 were subsequently demolished. Prior to demolition a plan of The Street was made and its buildings were photographically recorded by the Royal Commission on the Historical Monuments of England. The results of this work are held by the National Monuments Record.

The buildings of The Street may be considered as two groups, west and east (Figures 46 and 47). The western group of buildings is laid out on a rectangular grid established by the Royal Flying Corps and may slightly post-date the buildings to the east. At the



Figure 14: RAF Orford Ness in May 1948 showing the grass flying field to the north and the buildings of 'The Street' to the south. RAF 58/25 5047 16 May 1948 English Heritage NMR RAF Photography

western end of The Street is the remains of the **Model Bombing Range C12/103** that was constructed by the Royal Aircraft establishment in about 1954 (Figure 16). This comprises at its eastern end a detached **Control Room I06** and to its west a concrete plinth on which a 17-pounder gun was mounted to fire test models down the range. This was covered by a curved corrugated metal sheet roof, which has been removed, although its profile remains visible in its brick end walls. To its south is the derelict **Canteen C13/3**, which dates from the First World War and is constructed from precast concrete blocks with a pitched timber roof. During the 1950s it was partly refurbished and extended with a brick extension covered by a flat-roofed and was used as a Canteen



Figure 15: Kinetheodolite base (C) NMR AA99/08401

for AWRE staff. To its east photographs show the majority of the buildings were timber sheds and most have been levelled. The plan form of the area may, nevertheless, still be discerned from the remaining floor slabs and paths. To the north of this area, and adjacent to the main west to east track is a Second World War **Static Water Tank 13**. The **Offices/Stores C8/7** building is also of First World War date and is of similar construction to the **Canteen C13/3**. It is believed that this building was used in 1935 by the experimental radar team to prove the effectiveness of this technology in locating approaching aircraft. A number of concrete footings and mast bases between it and the **Canteen C13/3** probably also relate to this work. To its west an embankment leads up to the site of a 5 ton **Bridge C52/159** that was built to assist in the construction of the test structures on Orford Beach. Opposite to the main entrance to The Street are two small buildings, **AEAC/PBX C5/74** (Atomic Energy Authority C/Private Branch Exchange) which is now used as an exhibition space, and the **Garage and Store C4/131**. To their north is a large concrete floor area, which marks the site of a First World War **Hangar**; this was demolished between 1948 and 1957 and replaced by a **Store and Office C6/120** building, which too has subsequently been removed. The largest building demolished in this area was AWRE's brick **Fire Station, Boiler House, First Aid and Offices 119** building, which fronted on to the main track. Its site may also still be traced as a concrete slab. The last building in this area is a First World War, timber-framed **Barracks C1/18** (Figure 18), that was used by AWRE as a **Store**, resulting in the insertion of double doors into its eastern end. To its west the regular layout of concrete paths may mark the position of other now, lost barrack, accommodation.



Figure 16: The remains of the Model Bombing Range C12/103. (c) English Heritage

The eastern group of buildings is less regularly laid out and is mainly sited to the south of the principal east to west track (Figure 47). Travelling from the west the first building encountered was the **Electrical Workshop B9/77**, which was housed in a now



Figure 17: Building C13/3 First World War Officers' mess to right and 1950s AWRE Canteen extension to left. (c) English Heritage DP070030



Figure 18: First World War barracks C1118. (c) English Heritage DP070023

demolished Second World War Nissen hut, its floor slab remains. To its west is the large wartime brick **Offices and Electrical Workshop B8/78**, which survives in use as a site



Figure 19: Building B5/24, First World War Motor Transport Shed. (c) English Heritage DP070018

hostel. Adjacent to this is the site of the **RFC Headquarters B7/21** that was last used as a **Mess and Locker Rooms**. It too was constructed from pre-cast concrete blocks with a pitched roof and facing the flying field along its northern side is a covered veranda. To its east is another Second World War brick structure, the **Machine Shop B6/22**, this building has been refurbished as the National Trust site office. Opposite it is a small brick **Lavatory B11** that was constructed in 1962 and remains in use. The last large standing building is the First World War **Motor Transport Shed** that was used by AWRE as a **Heavy Workshop B5/24**, and remains in use as a workshop (Figure 19). To its east a number of small huts survive, including the **Air Compressor Room 25**, **Alkaline Battery Charging Room 82**, and the **Battery Charging Shop 69**. To the north of the main track are three large concrete slabs that mark the position of **Hangars**, and to the south concrete floors of smaller buildings. To the north of this area, on the former flying field, is a Second World War building that was last used as the **Radio Laboratory 84/A5**. The buildings **B6/22**, **B8/78** and **B9/77** were all constructed at some time after January 1942 and before the end of the war (RAF/BR289 (VB) 5 7 Jan 1942).

Orford Beach

The main area of AWRE development was to the south of Stony Ditch, where eventually about 80 hectares (198 acres) of Orford Beach was enclosed. Prior to this date most of this area had been part of the bombing range and air photographs show craters caused by exploding bombs, and many of which remain (Figures 41 and 44). Prior to the 1950s there were few buildings in this area, the most prominent was the 18th century lighthouse and its associated cottages.

The magazine area

On the south side of Stony Ditch are a number of structures pre-dating the Second World War associated with the storage and handling of bombs and other aircraft munitions (Figure 44). In keeping with practice elsewhere they are placed remotely from the flying field and its associated buildings, and in this instance also from the town of Orford. Access to this group of buildings was by a trestle bridge that carried a narrow gauge tramway across Stony Ditch, on the south side of the ditch are traces of its low pebbly embankment and occasional wooden sleepers. The earliest buildings dating from the First World War are two **Magazines D1/37** and **D2/36/85**. **Magazine D1** lies to the east, it is rectangular in plan, 11.15m (36ft 7in) by 8.1m (26ft 6in), of cavity wall construction with pre-cast concrete block walls and is covered by a pyramidal wooden roof capped with a central ventilation lantern. The building is entered from the north through a double door opening with windows to either side; the present doors and windows probably date from the 1950s. Internally are raised storage platforms to either side of a central passageway that probably originally allowed stores to be loaded directly onto flatbed tramway wagons. To its west is **Magazine D2/36/85** (Figure 20), this is of a similar form although it is constructed from mass concrete and has undergone more substantial alterations (Figure 21). It too is rectangular in plan, 11.05m (36ft 3in) by 8.2m (26ft 10in) and covered by a wooden pyramidal roof, with a lantern that is now stored within the building. The lower sections of its walls are cast from mass concrete and cast into the rear wall is a concrete plaque that records 'Ches Fld Coy RE' (Cheshire Field



Figure 20: First World War Magazine D2/36/85. (c) English Heritage DP070012

Company Royal Engineers). It too is entered from the north through double doors with windows to either side, which have been blocked. At some point its walls were raised in brick and the whole structure cement rendered to give it a uniform appearance. Internally are two storage platforms and above them a travelling crane by 'Herbert Morris Ltd, Loughborough'. In 1931, the date noted on a concrete plaque, a small brick extension was added to the north east corner of the magazine with a single door to the north and a small 4 light window to the south.

In the 1930s this area was expanded by the construction of three **Fuze Magazines D3/43/88, D4/42, and D5/41/87**. The easternmost is **D3** adjacent to **Magazine D1**, this is a rectangular structure, 4.98m (16ft 4in) by 3.08m (9ft 11in), built in brick cavity wall construction with a flat concrete roof. A concrete plaque on its walls records that it was built in 1931. Originally it was divided into two separate bays, each with wooden outward opening doors facing on to the tramway. By each of the doors is a boot scraper. It was lit by small barred, wooden framed windows set in the south wall and also perhaps a light shining through a small window at the east end of the north wall. In keeping with its function as an explosives store are the remains of external fittings for lightning conductor straps and electrical equipment. Probably during the 1950s the Magazine was converted into a small office by removing the central dividing wall and installing plywood cupboards.

To the west of **Magazine D2/36/85** is another **Fuze Magazine D4**, this is slightly larger than **D3** at 7.28m (23ft 10in) by 3.54m (11ft 8in) and is divided into three bays. Most of the north elevation of this structure has been demolished revealing an inner wall of Fletton bricks laid to English bond with a slate damp proof course and an exterior wall of



Figure 21: First World War Magazine D2 showing storage platforms and later alterations. (c) English Heritage DP070014

fair faced red bricks laid to stretcher bond. At the eastern end of the building is a self-contained bay that was entered from a single wooden outward opening door. At the western end of the building was a similar door that gave access to a shifting lobby, with coat hooks surviving on one wall. From this area it was possible to access the central bay, surviving wooden batons on the dividing wall indicate the position of a toe board dividing the changing area from the clean area, where loose explosives might be present. All the bays were lit by a pair of hinged wooden windows with wired glass. Other features typical of explosives handling buildings, include the use of copper or bronze fittings on the doors, sealed electric light units and external pipes housing electricity cables, and fittings for external lightning straps.

To the west is a third **Fuze Magazine D5**, the use of metal-framed windows in this structure may suggest that it is of a slightly later date. It is also of brick cavity wall construction set on a slate damp proof course and has a T-shape plan. To the northeast is an entrance porch and changing area, entry into the magazine area was over a toe board, whose position is marked by wooden batons fixed to the wall. Internally, the **Magazine** is divided into three separate storage bays to the west, each closed by wooden outward opening doors and accessed from a longitudinal corridor. This was lit by a pair of four light metal-framed windows to either side of the porch, which was lit by a similar window.

Pre-war range buildings

At the eastern end of the AWRE area were a number of structures associated with the bombing range (Figure 44). To the west of the lighthouse is the **Black Beacon G1/40**, constructed in 1928 to house an experimental rotating radio beacon to aid marine navigation. It comprises an octagonal mass concrete base with a wooden superstructure that has recently been reclad in weatherboards. Adjacent to this building, but perhaps built a few years later is the **Generator House G2/46**. This is a well-built brick structure with gable ends lit by wooden ocular windows, and to the north probably retains its original wooden windows. Later modifications include the addition of a porch, and an outshot to the east that has subsequently been removed.

To its north **Bomb Ballistics Building H1/44** was built in 1933 to monitor the fall of bombs on the range to the east. It comprises a substantial mass concrete ground floor storey with a single room and a double door opening to the west. Above is a brick



Figure 22: The Black Beacon G1/40 and to the left the Generator House G2/46. (c) English Heritage DP068424

observation room with a flat roof that could also be used for monitoring purposes. To its east is another unidentified feature **H2**, it was not visited during the course of this survey. Air photographs reveal bomb craters created by this trials work across most of the Orford Ness. The densest concentrations of cratering lie to the south of the Cobra Mist complex, and between it and the sea. To its east is feature H2 that was not visited during this survey.

First phase AWRE buildings

Air photographs reveal that the first group of AWRE buildings were begun sometime after March 1955 and all were complete by July 1958 (Figure 42) (RAF 58/1672 (F21) 0167 3 Mar 55; RAF 58/2519 (F21) 0001 18 Jul 58). Building record drawings in the possession of the National Trust dated June 1956 probably indicate that construction work was underway by this date. For access across Stony Ditch a new bridge on the site of the existing bridging point at the northern end of The Street was used and a new concrete road constructed in the direction of the Black Beacon G1, which was chosen as the headquarters area (Figure 48). About 900m to the southwest of the existing bridge and close to the First World War Barracks C1/18, a new bridge rated at 5 tons, was constructed across Stony Ditch. On the south side of the ditch the concrete track split into two, one arm headed for Laboratory 2 F1/125 and the other towards Control Room F4/124. This track is less well finished, and is prone to subsidence and cracking.

The original airfield magazine area was retained and some of its buildings were refurbished. In **Magazine D1/37** new soft wood windows and doors were added, internally it is lit by post-war magazine type lighting. To replace the old tramway a new track of wooden railway sleepers was laid from the eastern Bailey bridge. Access to the other **Magazine D2/36/85** was perhaps still possible across the old bridge across Stony Ditch and a short spur from the new track from the 5 ton bridge also gave access to this magazine. Internally, it was lit by post-war style pendant lights and heated by electrical wall heaters. A sign records 'Man Limit 4', which indicates that it remained in use for storing explosives. Close to **Magazine D1/37**, the former **Fuze Magazine D3/43/88** was



Figure 23: The headquarters area in the 1990s, to the left is the headquarters building G3 and to its right the Office Annexe G6. (c) NMR AA99/08477

converted into a small office. The other two **Fuze Magazines D4/42** and **D5/41/87** were either retained in their unaltered form or abandoned.

Adjacent to the **Black Beacon G1/40**, the **Headquarters G3/47** has been demolished but may be traced as a large U-shaped floor slab (Figures 23 and 48). It was built in two phases; originally, around 1956, it comprised a single-storey, L-shaped prefabricated concrete panel building to the north, whose primary function as telemetry recording. Perhaps as part of the 1960 expansion scheme a rectangular brick wing was added to the south. Scars on its slab reveal the internal layout of the building, with offices in the north wing and a probable stores area to the east and south. To the rear are the concrete bases for a metal-framed covered area, possibly a stores area or bicycle shelter. Air photographs show that the building was complete by 1964, but the chronological sequence of air photographs is insufficient to confirm the date of the extension. To its north was a detached brick boiler house finished in Burwell whites, surviving details on its slab mark the position of former walls, door thresholds and plant bases. To its southeast is the concrete floor slab of a timber hut which was the **Office Annexe G6/50**, again scars on its surface reveals its internal layout.

It is believed that the **Black Beacon G1** was adapted by AWRE for telemetry recording and to its west is a concrete mast base and three concrete cable anchors, probably used to support a mast. Adjacent to the **Black Beacon** is a concrete slab EH5, which measures 3.05m (9ft 10ins) square and probably represents a small fenced storage compound. The 1920s **Generator House G2/46** was reused as a **Workshop** and it is probably at this time that the porch and the brick out-shot to the east were added. To the east of **G1** is the **Small Vibration Laboratory G5/48**, this is a rectangular building, 6.95m (24ft 10in) by 6.05m (19ft 10in), faced in Burwell White bricks that contrasts with its red brick west wall. The porch is a later addition and partly overlies an original metal door strip, which indicates that the use of this building as a **Small Vibration Laboratory** is a secondary function. To the west of the building is a 0.92m (3ft) circular concrete track with an external diameter of 6.98m (22ft 11in), faint grooves on its surface, with a gauge of 0.4m (1ft 4ins), mark the track of a test vehicle designed to subject components to sustained gentle vibration. A narrow filled channel between the track and the building probably marks the position of a control and monitoring cable. The late date of this feature is confirmed by a 1965 air photograph on which it is absent (OS/65054 (V) V-028 20457 30 Apr 65).

In about 1964 a series of radio experiments began around the **Bomb Ballistics Building H1/44**. The purpose of these experiments is unknown, but they were probably not part of AWRE's activities (Figure 24). To the southeast of the **Bomb Ballistics Building H1/44** are the remains of an **Antenna H50** base, which comprises at its centre a large 0.42m (1ft 4in) square post that sits within a circular concrete ring 25.37m (83ft 3in) in diameter; this is 1.07m (3ft 6ins) wide and on its surface are fixing bolts. To the northwest of this feature is a rectangular slab that marks the position of associated huts. The circular feature and its hut was in place by August 1964 and by the following April had been joined by two long linear arrays to the south and north, the one to the south causing the road to the lighthouse to be diverted (RAF/58/6492 (F41) 0079 27 Aug 64; OS/65054 V-029 20457 30 Apr 1965).



Figure 24: View of the area to the east of the AWRE boundary fence, showing to the top the circular Antenna base H50 and linear arrays to its north and south. The dark section of track marks where it has been diverted around one of the arrays. OS/65054 V029 30 April 1965 (c) Crown Copyright. Ordnance Survey

Laboratories 1, 2 and 3

To the west, the first development phase comprised three main structures, **Laboratory 1 F3/I23**, **Laboratory 2 F1/I25**, and **Laboratory 3 F2/I26/I28**, also associated with **Laboratory 1** was the **Control Room F4/I27/67**. To move heavy construction plant across Stony Ditch it appears that a shingle causeway was created to the southeast of the First World War **Barracks C1/I18**. From this point a concrete road was laid towards the **Control Room F4/I24** and another toward **Laboratory 2 F1/I25**. As discussed above a new road was also laid from the existing bridging point at the north eastern end of The Street towards the **Black Beacon G1/40**. This is a well constructed road with kerbs to either side and is surfaced in asphalt and it was probably along this road that the test devices were brought. From the headquarters area the road heads southwest towards the **Control Room F4** after which point it splits, a southerly branch heading towards **Laboratory 2 F1/I25** and a northerly arm towards **Laboratories 1 F3/I23** and **3 F2/I26**.

At the time these laboratories were designed the standard casing for large air dropped nuclear devices was the one used for the first generation of operational nuclear weapons known as *Blue Danube*. It was large and measured 24ft (7.3m) in length with a maximum diameter of 5ft (1.52m) and weighed 10,000lb (4636kg), its size determined by the dimensions of its warhead. Britain's first operational warhead, the Mark I, also contained around 2.50 tons of conventional high explosives (Cocroft and Thomas 2003, 30). As discussed above this casing had been extensively proven by trial drops over Orford Ness, and there was probably also an element of expediency and economy to use casings that were already held in stock for a number of later warheads. Given its large size, for trials work it was able to accommodate newer models of warheads, such as the interim megaton device *Orange Herald*. Combined with a *Blue Danube* casing it was known as *Violet Club* or *Knobkerry* and was issued briefly to the RAF between 1958 and 1959. The size of the *Blue Danube* casing, the relatively large amounts of conventional high explosives used within 1950s nuclear warheads, the proposed trial routines and safety all contributed to the form of the test buildings.

Travelling from the headquarters area the first major structure of this period encountered is **Laboratory 1**, or the **Large Vibration Laboratory F3/I23** (Figures 10 and 49). As its name suggests the function of this laboratory was to gently vibrate a fully assembled weapon, minus its fissile core, to simulate the types of stresses it might undergo while being transported by road or in the air. **Laboratory 1** is a massive reinforced concrete structure with a large central bay measuring 30.69m (100ft) by 9.13m (30ft) and was designed to mitigate against the effects of an accidental explosion. Its concrete walls were given extra mass by the shingle traverse placed around them, which would tend to force blast vertically rather than laterally. The roof was also a relatively weak structure comprising nine steel W-shaped trusses and clad in aluminium sheeting, insulated with cork and covered in weather proof felt. The original requirement for this building was to test the Mark I atomic bomb and the *Red Beard* tactical weapon. It was envisaged that two chambers would be required, one for the assembly of the weapon and drop-tests with an impact loading of up to 200 tons. As its name implies in a drop-test a weapon would be released from given height to simulate a ground handling mishap. A second chamber would be required for vibration tests (TNA: PRO AVIA 65/I258).



Figure 25: Laboratory I F3/I23 showing the large vibration laboratory to the southeast of the main dividing wall. (c) English Heritage DP068442

Internally, the main bay is separated into two unequal portions by a substantial concrete dividing wall, and running along its northern side is a pit 3.18m (5ft 5in) wide and 2.74m (9ft) deep (Figure 25). On the dividing wall are traces of a screen mechanism to ensure that activities either side of the divide remained confidential. The larger Vibration Laboratory to the southeast measures 17.32m (57ft) and the smaller Drop Test Laboratory to the northwest 12.15m (40ft). Each of the bays was served by its own entrance with wooden doors to either end, creating air locks measuring 10.1m (33ft) and 9.2m (30ft). Although the original specification only called for the testing of the bomb's central section, the air locks were long enough to accommodate a fully assembled *Blue Danube* and its carrying trolley. Although manoeuvring such a large item through the southwest entrance and into the Drop Test bay would have been extremely tight.. A contemporary photograph (Cocroft and Thomas 2003, 30) shows a *Blue Danube* bomb in **Laboratory FI**. It is not known if this taken in summer 1956, or if it relates to later trials, as the *Blue Danube* casing was also used for a number of other warheads and the photograph may relate to work on later boosted fission and thermonuclear weapons. A ledge below the top of the longitudinal walls of the central bay marks the position of a travelling crane that was used to position the bomb on the test equipment. Each of the of the entrance passages was later protected by crude steel doors fashioned from welded reinforcing rods, the presence of electric locks on the doors indicating they were added during AWRE occupancy. Attached to the wall of the main bay are many small bore pipes that carried various services, including electric wires, hydraulic fluids, and carbon dioxide fire

suppressant, and within the roof structure are the remains of large air conditioning ducts.

On the northern side of the south eastern entrance passage are two rooms that probably accommodated switch and monitoring equipment, and on the south side of the south west entrance passage was a staff room and toilet cubicles. Testing required the building to be temperature and humidity controlled and on the northwest side of the mound is a large self-contained reinforced concrete, two bay plant room measuring 21m (69ft) by 3.89m (12ft 8in). This sits within the main shingle traverse and is insulated from it by a surrounding brick wall that acts a damp course. Air conditioning ducts from the main chamber enter this building and surviving plant within it indicates that it housed air conditioning plant. On the north side of the traverse is a similar self-contained structure; surviving fittings show that it mainly housed electrical switch gear, controls for the vibrating machines and carbon-dioxide supplies for the fire suppressant system. To the northwest of **Laboratory I F3/I23** is a detached rectangular reinforced concrete building, 10.92m (35ft 10in) by 6.1m (20ft). It was formerly numbered **I27** and its last function was described as a **Laboratory Store**. Later alterations to this building, include the bricking up of the entrance on its southwest side and the replacement of wide opening with a single door, at this time a window was probably also blocked on the northwest side. Internally, a breeze block wall was inserted. These alterations may point to a change in the building's function.



Figure 26: Control Room F4 127/67, showing the later brick porch and blast wall. (c) English Heritage

The operations within **Laboratory I** were considered to be so hazardous that it was provided with a detached **Control Room F4/127/67** 130m (142yds) to its northeast. This is an L-shaped reinforced concrete structure, originally with an open sided porch

on its northeast side that gave access to the control and monitoring room to the southwest. This comprised two elements; a taller section to the northeast that housed air conditioning plant, some of which survives, an entrance passage; toilet cubicles and to its southwest a large open room with a suspended floor that housed the monitoring equipment, of which a few metal cabinets survive. To protect the building from any accidental explosions in **Laboratory I** its southwest side was protected by a shingle traverse – a protective mound. In late 1963, or early 1964, the **Control Room** was modified to serve the new **Impact Facility F5/171** (see below) that was being constructed to its northeast, it also suggests that experiments in **Laboratory I** may have ceased by this date (RAF 58/6492 (F41) 0079 27 Aug 64). Alterations to the **Control Room** included the bricking up of the open porch and the insertion of double doors protected by a small projecting brick porch. Due to the change in direction for flying debris a protective brick wall and concrete roof were built to protect the toilet cubicles. Immediately to the northeast is a small brick **Mess Room F8/130**. This was probably originally designed as a **Store** with a set of double doors facing the **Control Room F4** and windows on its northeast and southeast sides. Later the double door opening was infilled in breeze block and the window opening on the southeast side was used to create a single door. Internally, a white tile splashback survives on its northern wall. Unlike the **Control Room F4** no attempt was made to protect the building from flying debris from **Impact Facility F5**. Similarly, to the south of the **Messroom F8** was an unprotected **Camera Store 172** housed in a timber and asbestos caravan, no trace of which remains.



Figure 27: Laboratory 3, F2 126/128, this laboratory was primarily used for the climatic testing of nuclear weapons. (c) English Heritage

To the west of **Laboratory 1** is **Laboratory 3 F2 126/128**, which was used for climatic testing (Figure 50). Its function was to either warm or chill a weapon to simulate the variations of temperature that it might face in service. This building is also of reinforced concrete construction with a barrel vaulted roof and is entered from its south end through a concrete canopy, the southern wall of which was revetted with shingle. To manoeuvre the heavy test objects into position there was a hoist mounted on a beam secured to the underside of the canopy and roof of the main chamber; traces of its fittings may still be seen. Entry into the chamber was originally through double wooden doors, but in common with the other earlier **Laboratories** security was strengthened by the addition of crude welded steel doors. At the top of these doors is a slot for the overhead lifting beam indicating that the doors were added while the building was operational. Internally, it comprised a large central chamber, 24.5m (80ft 5ins) by 6m (19ft 6in), which is divided into two sections. To the south was the preparation area and on its walls are the remains of electric conduits and small bore pipes for electric cabling. To the rear was an insulated chamber 13.5m (44ft 4in) in length, which was separated from the preparation area by a cement covered expandomesh wall and a metal clad sliding door carried on an overhead rail. This slid into a corridor to the west that also gives access to a small switch room. The working area of the rear chamber measured 9.14m (30 ft) by 3m (10ft) by 3m (10ft) and its floor, set on four dwarf concrete walls, was capable of supporting 6 tons. The temperature range that could be achieved varied between plus 60° to minus 60° centigrade, and while undergoing thermal tests an object might also be subject to vibration (AWRE nd, 10).



Figure 28: Laboratory 3, interior showing the rear climatic chamber and dismantled sliding door that sealed the chamber. (c) English Heritage DP068471

To support the functions of this building it was equipped with large plant rooms. Set into the western side of the shingle traverse is the **Condense Pump House 128** a large reinforced concrete building 16.98m (55ft 8in) by 6.3m (20ft 8in). It is divided into two rooms. To the south is a small switch room, which may be entered through double external doors as well as from the main chamber along the corridor for the sliding door. The other chamber is larger and housed air conditioning and plant, it too could be entered through external doors or from the main chamber. Outside of its entrance is a support for four gas cylinders that probably held carbon dioxide bottles as part of the building's fire suppressant system. On the northwest corner of the building are a series of small rooms that held various pieces of plant and toilet cubicles.



Figure 29: Laboratory 1, F3/123, to the left is the rear plant room and to the right the main entrance passage. (c) English Heritage

The third and western most laboratory built during the first construction phase was **Laboratory 1 F3/123** (Figures 29 and 51). It is constructed from reinforced concrete with a large central bay 30.67m (99ft 9in) by 9.05m (29ft 9in) oriented roughly east to west. To increase the available height in the chamber, its A-frame, angle iron roof trusses are raised 0.6m (2ft) above the tops of the walls. The roof was originally clad with cork insulation board covered in aluminium sheets and protected by an outer asphalt coat. Within the roof structure was an internal catwalk to give access to the lighting and large central cork clad, metal air conditioning duct. Internally, below the tops of the walls are projecting ledges that supported the rails for an overhead crane. This was used to manoeuvre test pieces within the building, and for the installation and maintenance of the centrifuge (see below). To the north and south of the main chamber are side aisles running the full length of the central chamber. These too have concrete walls but are roofed with horizontal beams with curved breeze blocks between them; above they are covered by the shingle mound. Each of the side aisles had an emergency escape exit,

both again later secured by crude steel doors. The main entrance to the central bay was from the east where a T-shaped road layout provided enough space for a vehicle and trailer to reverse into the building. The concrete entry porch was originally closed by wooden doors, but in common with the other earlier laboratories it was later secured by crude steel doors with an electrical alarm or catch. In common with **Laboratory I** the distance between the wooden doors would have probably been large enough to accommodate a fully assembled *Blue Danube* casing and its trolley. The building can also be entered from the west through another large entrance, also with an entrance passage secured by double wooden doors, and later crude steel gates. Entry from this aisle into the main chamber was through two openings in the main side wall, which would have restricted the size of items that could be taken through. Adjacent to this entrance are two staff amenity rooms.



Figure 30: Laboratory I in June 2000, interior showing the centrifuge pit and above it a section of air conditioning conduit. Below the tops of the walls are projecting ledges that carried rails for a travelling crane. (c) English Heritage

At the northern end of the chamber was a Napier centrifuge, this was housed in a ground level, circular brick built feature 30ft (9.14m) in diameter, which could be entered by doorways to the east and west. The centrifuge was supported on a central base plate and above by two rolled steel joists to the north and south, which have subsequently been removed for scrap, leaving only their end sections embedded in the side walls.

The centrifuge arm was 16ft (4.88m) in diameter, was capable of supporting a test piece weighing up to 1,000 lbs (453.6 kg), and was rated at 100,000 'g' lb (AWRE nd, 13). In the south bay adjacent to the centrifuge is a large red concrete mounting block that probably held some of the control equipment for the centrifuge. At the western end of the central bay is a raised control room, accessed from a flight of concrete steps on the north wall.

At the western end of the building is a large reinforced concrete plant room, which is divided into two bays. To the north is a small control room and to the south was a large air conditioning plant. Surviving drawings indicate that the plant room was modified in 1963, alterations include the insertion of a single door to give access to the control room and the addition of a brick outshot to house a transformer and rectifier.

A number of features and documentary sources suggest that the centrifuge is a secondary feature. In contrast to the remainder of the structure the circular feature surrounding the centrifuge was brick built rather than concrete. Unfortunately, the wall surfaces are painted and also in part covered by grime and vegetation growth, which makes any assessment of the relationship of this feature to the original structure difficult. The entrances to either end are also large enough to accommodate a large trailer and potentially a full size *Blue Danube* casing. Within the main chamber the working area to the east of the centrifuge also appears disproportionately large. In addition amongst the surviving drawings is a record plan of the centrifuge installation dated June 1962 and plans for the extension of the plant room dated September 1963 (UKAEA Lab No.2 Centrifuge Details of plant room extension SW/S7851/Lab2/ADI8339 24 9 63).

Also built during the first construction phase were two structures described as **Plinth F F6/I13** and **Plinth G F7/I12**, which housed electrical transformers. They are both simple reinforced concrete structures comprising an open rectangular bay with wing walls to either side to retain a shingle traverse. **F6** is located to the northeast of **Laboratory 2 F1** and **F7** is positioned to the south of **Laboratory 3 F2**.

Second Phase AWRE Buildings

As discussed above, in autumn 1959 proposals were put forward for the expansion of Orford Ness' facilities marking the beginning of the next main development phase (Figure 52). This included the construction of the distinctive 'Pagodas', or more formally, the **Vibration Test Buildings E2/I36** and **E3/I35**, **Control Room E4/I39**, **Magazine E5/I40** and associated infrastructure. The new structures were built to the west of the previously developed area. To simplify access to this area a new single track road with passing places was constructed from the quay track to the western end of The Street. At this point a new **Bridge C53**, rated at 12 tons, was constructed across Stony Ditch (Figure 53). On the southern side one branch of the road continued southwards splitting shortly afterwards, with one track heading for the new **Magazine E5/I40**, while the main track continued southwards. The other branch of this track headed westwards and parallel to Stony Ditch for just over 200m before turning southwards. On the northern side of this track between it and Stony Ditch the land may have been used as a builders' yard. In this area are the concrete footings for a temporary hut, a **Toilet E6** and the concrete supports for a static water tank.



Figure 31: The Control Room E4/I39. (c) English Heritage

At the southern end of the access road is the **Control Room E4/I39**, an **Electrical Sub Station E7/I66**, and the **Pump House E8/I68**. The **Control Room** (Figure 31) was constructed for the remote operation and monitoring of the **Vibration Test Buildings E2/I36** and **E3/I35**, which lie 136m (446ft) to the south. It is constructed in a simple, functional and contemporary style in Burwell White bricks that contrast with the red asphalt covered lower sections of the metal framed bay panels. Littering the ground in front of this building are fragments of yellow Perspex, which was probably used to glaze this building. Although, it has been suggested that the yellow Perspex may have been inserted by a film company. It is divided into two sections, to the west the slightly taller portion housed control and monitoring equipment, and to the east were staff facilities. The building is entered at the eastern end through an inset covered porch, which is surfaced in red and yellow flag stones arranged in a chequer board design. Entry into the building was past the messengers' room, located on the west side of the entrance and to its rear is a windowless switch room. On the opposite side of the entrance was the cloak room. Along the rear wall is a ladies lavatory, cleaners' room and a gents' locker room and lavatory. At the eastern end of the corridor is a small tea room and to its south a large mess room. The taller western section of the building is split into two by a longitudinal east to west corridor. At its eastern end to the south is a store room and on the opposite side of the corridor a dark room. To their west and to either side of the corridor were six almost identical bays, although the two in the southwest corner form a single large room (Figure 32). These rooms were used for housing control and monitoring equipment, which was supported on a raised floor, the under floor void probably accommodated air conditioning pipes and cabling. To reduce noise the upper sections of these rooms and their ceilings are lined with square pierced, plaster-board panels.



Figure 32: The Control Room E4, showing the large southwestern control room, with subfloor cable ducts and sound proofing boards. (c) English Heritage DP070006

To the east of the **Control Room**, is a simple rectangular brick **Electrical Sub Station E7/166**, comprising to the south a large room that housed the transformers and to its north a smaller switch room. The building was protected by a carbon dioxide fire suppressant system, with a three cylinder holder in the larger room feeding into red painted pipes; the system could also be activated by a red switch on the building's exterior. To its east is the brick **Pump House E8/167**, in plan this building is a truncated T-shape with a large central plant room and two small self-contained bays to either side. The full description for this building noted it contained the combined pump house for fire mains, condensate and appliance room. In the large central room was an electric and diesel pump, the western bay was described as the **Condensate Building**, which presumably handled condensed water from a steam heating system. To the rear of this building were two large Braithwaite water tanks supported on low concrete walls with a total capacity of 72,000 gallons (372, 312 litres). Only the tank to the west remains.

Vibration test buildings – The Pagodas

The most distinctive structures built during this phase were the **Vibration Test Buildings**, commonly referred to as 'The Pagodas'. The specification for the **Vibration Test Buildings** included the ability to withstand the accidental detonation of 400lbs (181.4kg) of high explosives. The report on their design noted that 'the design of such a building is beyond normal architectural or structural practice' (Millington 1971). Responsibility for the design of the structure lay with the Southern Works Organisation of UKAEA and G W Dixon ARIBA was identified as the architect. Interestingly, a similar design had been used in the early 1950s at the Explosives Research and Development Establishment,

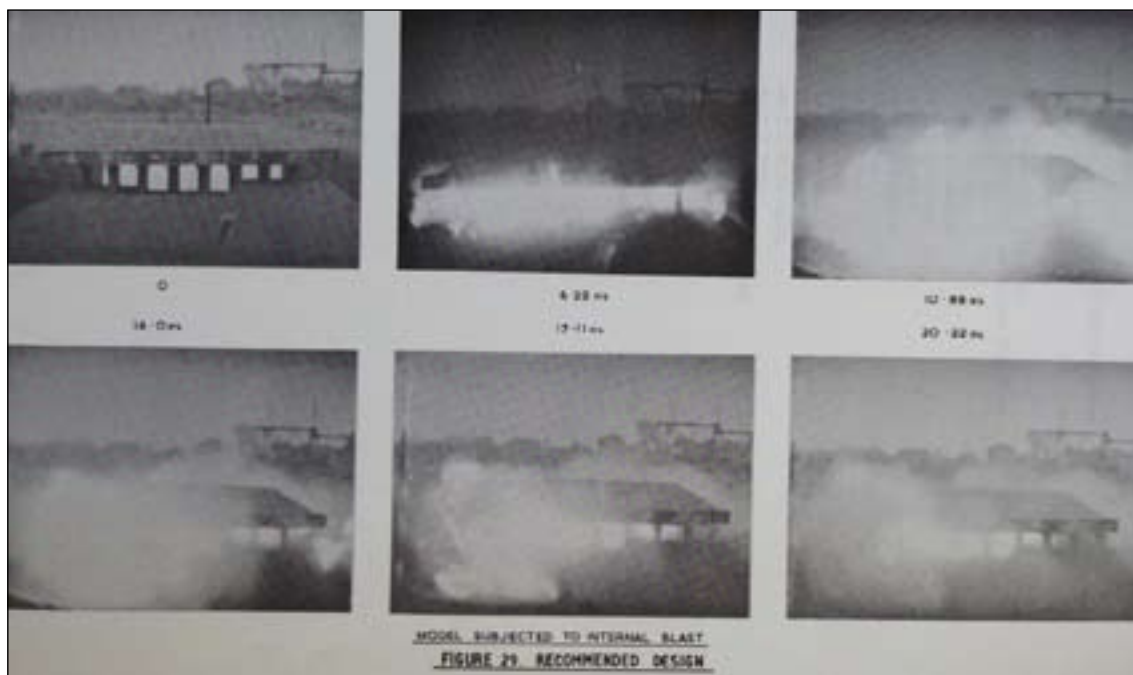


Figure 33: Film stills from experiments carried out at AWRE Foulness, Essex, to prove the design for the Orford Ness Vibration Test Buildings. TNA: PRO ES4/1282

Waltham Abbey, Essex, for the design of firing points with heavily armoured central chambers and control rooms and camera positions to either side. No reference was apparently made to these structures and in order to determine the best design for the new buildings experiments were carried out at AWRE Foulness using small amounts of explosives and 1/10 scale models (Figure 33). The initial design was for a monolithic structure with a single entrance; a detonation in this structure completely destroyed the model and produced large fragments. This was modified by replacing the roof with laminated strawboard over the test cell and mounding its walls with gravel to add to the mass of the structure. The design was further refined by supporting the roof on columns and also by adding to its mass by placing gravel on its top. The roof also overhung the test cell to contain the danger of lying debris being ejected from the building. When a model of this design was tested the roof and mound rose up, with part of the force of being vented through the gap between the top of the cell and the roof, the columns then gave way allowing the roof to fall back into the cell.

The **Vibration Test Buildings E2/I36** and **E3/I35** are identical in design and the following description of **E2/I36** is largely applicable to both structures (Figure 34). It comprises a large reinforced concrete central cell 16.47m (54ft) by 7.30m (24ft) covered by a massive reinforced concrete roof supported on sixteen reinforced concrete columns. To the south and east of the main chambers are self-contained plant rooms. The main access to the building is from the south through an entrance passage which was originally sealed by a pair of outward opening metal covered wooden doors. On its western side, adjacent to the main entrance passage is a blocked doorway that led to a small staff room and toilet. Inside the building, on the eastern side of the passageway one set of stairs gives access down to the main test cell and another up to a walkway around the top of the chamber. At the end of the passageway is a lift pit, which allowed test pieces to be



Figure 34: Vibration Laboratory E2, to the right are plant rooms. To the rear is the Control Room E4. (c) English Heritage DP0685509

lowered on to the floor of the main test cell. To assist in manoeuvring heavy objects there are a number of substantial steel eyelets screwed into the underside of the roof. A travelling crane also ran on rails mounted on a ledge beneath the windows, a loose plate on the floor recorded 'Becker twin Lift Maximum Working Load 40 tons serial A-2647-2'.

The floor of the main cell is formed of parallel and narrowly spaced steel I beams for test rigs to be firmly secured to the structure (Figure 35). To either side are cable ducts now filled with shingle. At the same time as being vibrated objects might also be placed in jackets to simulate extremes of heat and cold, or in a portable altitude chamber to mimic the effects of altitudinal changes (AWRE nd, 6-7, 9). Set into the north wall are seven steel plates with vertical cruciform slots that were also used for securing tests rigs or monitoring equipment. Below these are eight pipe opening from the service passageway to the north. In the south wall are three steel plates with horizontal slots, above the top plate is stencilled the figures 1ft to 27ft and below it 1m to 7.5m. The walkway around three sides of the cell was originally protected by a handrail and there is another handrail fixed to the main wall. Running around the wall is a cable conduit and attached to the wall are various pipes for carrying electrical wires, switches, junction boxes and pressure gauges. Signs on the wall above the lift pit record 'Telephone Instrument Room', 'Vac Pump Running, Vac Pump Stopped' with associated light fittings.

At the northeast corner of the cell is a doorway to the rear service passage running east to west along the north side of the building. To the east a flight of stairs gives access to the eastern plant room. To the west another set of stairs provides access to the



Figure 35: Vibration Laboratory E2 showing the main test chamber with slots for mounting test equipment. (c) English Heritage DP068518

northern side of the lift pit, the upper walkway and to an emergency escape passage through the north side of the traverse.

To the south of the main cell is a freestanding Burwell brick-built plant room. The main plant room is entered through two sets of double doors on its south side, internally are four machinery mounting plinths. Attached to its west wall is a metal cabinet that probably housed equipment to operate the hydraulic compressor for the internal lift. At the eastern end of the building is a store room with a blocked doorway to the south.

To the east of the main cell is another large freestanding Burwell brick plant room running along the eastern side of the **Vibration Test Building**. At its southern end is a large, now open, bay that housed water coolers, this comprises a flat concrete roof with roof vents, that was supported on two steel girder portal frames and a brick wall to the south with a door opening. To aid ventilation its side walls were infilled with wooden louvered vents and probably for decorative effect the vertical steel columns were originally covered with copper sheeting. Internally, there is a central walkway and cable conduits, now filled with shingle. A now blocked door in its north wall gave access to the main plant room. At the southern end of the main plant block was an electrical transformer in a self-contained room bay and to its north three large openings closed by metal concertina doors. Internally, the eastern section of the main plant room, which housed amplifiers, a solid concrete floor remains, while to the west the floor

was supported on concrete piers. This was probably to allow the use of under floor cabling and ventilation pipes. At the northern end of the plant room is a bricked up door opening that formerly gave access to the passage way running along the north side of the main building. One difference between the two **Vibration Test Buildings**, is that in the northeast angle of **E3**, is a concrete vehicle ramp. A historic photograph (Kinsey 1981, 108) shows a mobile air conditioning van on this ramp, with two large diameter pipes connecting back to the building, as well as electrical leads plugged into fittings on its north wall.

Magazine

As described above one branch of the new access road across Stony Ditch headed southwards and a loop road gave access to the new **Magazine E5/I40** (Figures 32 and 53). This is a reinforced concrete structure with a barrel vaulted roof and is revetted on all sides by shingle traverses. The main drive through entrance passage is oriented roughly north to south and surfaced in smooth concrete. To either end it was closed by wooden doors that were set back from the ends of the passageway. These comprised a set of double doors and a separate single pedestrian entrance door to one side. At eaves height above the passage way are a series of mounting plates that supported an overhead monorail. On the western side of the passage are two self-contained storage magazines, each of which was formerly closed by outward opening wooden doors. At the entrance to each of the rooms wooden batons on the walls indicate the presence



Figure 36: The Magazine E5, to the left is the door to the plant room. (c) English Heritage DP068522

of toeboards, separating an inner clean magazine area from the outer dirty area. The two bays differ slightly in size, the south bay measures 7.45m (24ft 6ins) by 4.55m (15ft), and the north bay measures 9.15m (30ft) by 7.45m (24ft 6in), both are 5.12m (16ft) high. Each was ventilated through a roof vent with a tall vertical stack projecting through the roof, and by a pair of vents leading into a rear air conditioning plant room, which was entered through a single door to the south.

Final AWRE phases

The final structural phases of AWRE Orford Ness are represented by two discrete building programmes. The first was probably begun in late 1962 for the evaluation of the WE177 series of tactical freefall nuclear weapons and resulted in the construction of the **Impact Facility F5** to the east of **Laboratory I F3** (Figures 37 and 49). In one operational mode it was designed to be dropped by parachute and to skid along the ground before detonation, to provide enough time for attacking aircraft to make its recovery. To simulate the forces the weapon would be subject to on impact fully assembled weapons, minus their fissile cores, were propelled on a rocket sled at up to 150 mph (241kph) against a solid concrete wall (Figure 38). This measures 15.27m (50ft) by 3.67m (12ft) and stands to a maximum height of 3.05m (10ft). Set on top of the wall was a wooden

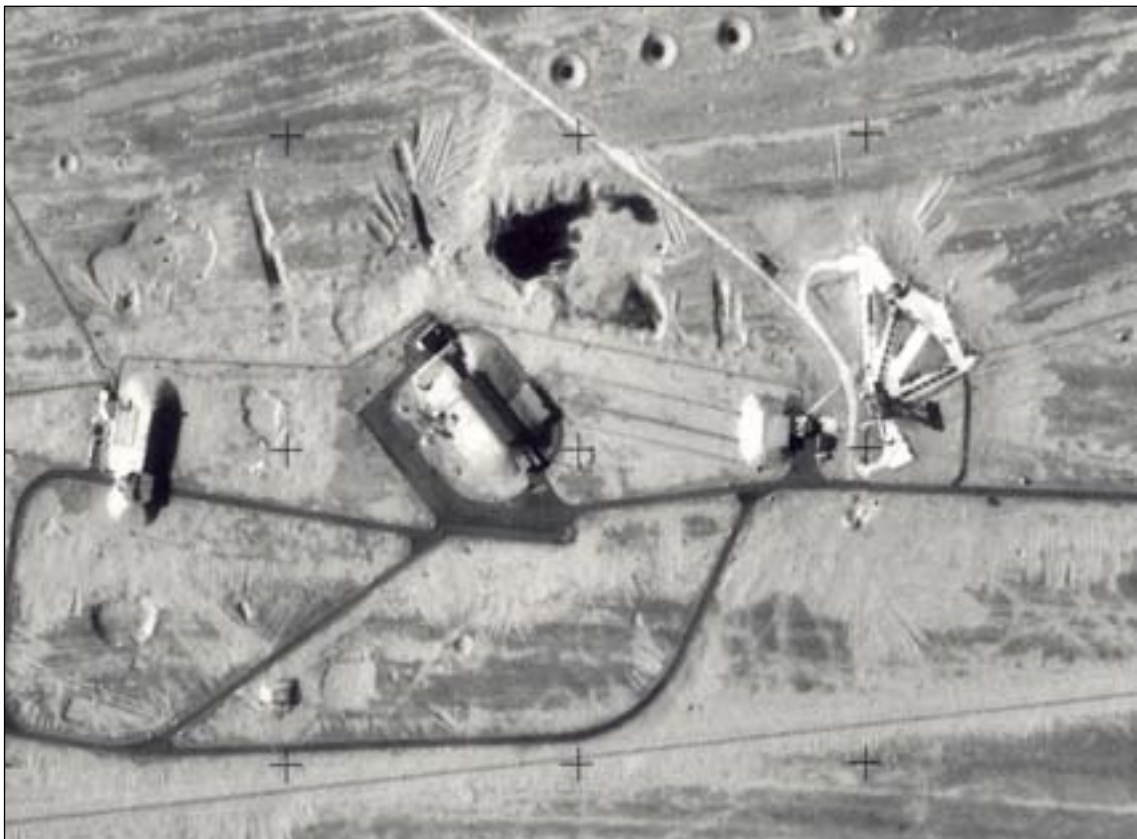


Figure 37: An aerial photograph taken in 1965 showing to the left Laboratories 1 and 3 and to the right the Impact Facility F5, note the rocket sled tracks and the shadow of the timber photographic tower. OS/65054 V108 30 April 1965 (c) Crown copyright. Ordnance Survey



Figure 38: The Impact Facility F5, visible on the wall are the impact spots from firing bomb casings against its surface. To the right is the Control Room F4. (c) English Heritage DP068431



Figure 39: Centrifuge E1 to the right is one of the shingle revetted sides facing the occupied section of the site, also in view is an emergency escape way through the traverse. (C) English Heritage DP068500



Figure 40: Centrifuge E1, interior showing the main entrance to the right and steps down into the pit. Also visible in this view are three of the four concrete piers that supported the centrifuge's frame. The rear door led to the emergency escape way. (c) English Heritage DP068497

gantry that supported a series of high speed cameras that recorded the impact of the weapon against the wall. During the dismantling of the establishment the wooden gantry was cut down and sections remain where they fell. On the northeast side of the wall are a number of spalled areas that mark the positions of impact. To its south historic photographs show torpedo netting supported on scaffold poles that were designed to catch the weapon, traces of these poles are evident at the side of the concrete surface. To the northeast of the wall is an area of largely featureless concrete on which the tracks for the rocket sleds were placed. These appear to have been semi-movable and were secured to fixing points along the edge of the concrete area. Also on this slab are a number of metal grid covers that probably gave access to control and monitoring cables, and two electrical switch boxes.

Air photographs reveal that the programme to construct a second **Centrifuge E1/176** (Figure 39) was begun sometime after 1965, and a typescript Property Services Agency building list dates it to 1966 (PSA 1973). It was constructed at the western extremity of the site to the west of the **Vibration Test Building E2/136** and within the existing site boundary (Figure 52). To provide access to the new building a single track concrete roadway was constructed westwards from the **Control Room E4/139**. The design of the **Centrifuge** building suggests that it too was designed to handle devices containing explosives. It is a single rectangular concrete structure with gable ends and is covered by a light, pressed-metal roof sheeting with insulation board beneath supported on three rolled steel joists with angle-iron purlins. Its north and east sides, which face other

buildings, are covered by a shingle traverse. To the north is a metal flag pole, which may have also functioned as a lightning conductor. The building was entered from its west side, to the south a double door opening and the north a single door. Both have subsequently been sealed with breeze blocks, and more recently the National Trust has inserted a steel-framed door into the blocked southern opening.

Internally, is a sunken brick-lined centrifuge pit, which is 8.06m (26ft 6in) in diameter and 2.68m (8ft 9in) deep (Figure 40). To the south the base of the pit is accessed from a flight of concrete steps. At its centre is a metal plate that supported the central metal spindle of the centrifuge, a cable duct passes from the centre to a self-contained basement equipment room to the northeast. Equally spaced around the wall of the brick lined pit are four concrete piers columns on top of which are metal mounting plates, which are set below the main floor level. These were probably used for mounting a cruciform framework to support the top of the central spindle. In operation the top of the centrifuge was floored over (AWRE nd, 14), also confirmed by a row of now inaccessible coat hangers set high on the north wall. Along the top of each of the long walls is a ledge that supported the rails of a travelling crane, which was used to install and service the crane and lift test pieces into place. At the northern end of the building are two self-contained equipment rooms, the one to the west, which could also be entered from the outside. In the east wall is a blocked doorway that led to an emergency escape passage through the shingle traverse. Adjacent to the main south door is a small wash and toilet room.

Site infrastructure

Initially, AWRE Orford Ness relied on geographic remoteness to ensure secrecy and security; it was separated from the mainland by a tidal creek and the further obstacle of Stony Ditch. To the north the narrow strip that joined it to Aldeburgh was easily observed. Around 1960 the security of the establishment was increased when a wire mesh and barbed wire fence was erected. This was put up along the north side of The Street and around the buildings on Orford Beach and comprised cranked concrete posts, topped with barbed wire supporting a wire mesh fence. Along the line of the fence were a number of V-shaped projections and at the corners larger rectangular bastions that allowed the line of the fence to be monitored. On the Orford Beach side there were also a number of gates to allow access to the beach. Most of the fence around The Street remains in place, while the fence on Orford Beach has been removed and in number of areas are piles of solid concrete blocks into which the posts were set. A former employee (pers comm G Lohar) recollected that the impetus for the fence came from United States' security advisors. On the beach are the remains of the wooden **Police Lookout Tower G7/38**, it is 3.66m (12ft) square) and stands 9.6m (31ft 6ins) to the top of its eaves. On its top platform was a wooden cabin that allowed the police to observe any movement on the beach or offshore.

To further ensure secrecy, in common with other defence research establishments, the site's activities were compartmentalised and access to and around the range was tightly controlled. This was reflected by the presence of wooden barriers to block the access roads to the various trials facilities. For safety reasons they would be closed prior to



Figure 41: Fire hydrant. (c) English Heritage DP070008

trials and were also lowered while test items were being moved. Some of these may be traced as concrete blocks with a central square hole from where the timber has been removed or rotted. In any area handling explosives fire is a serious hazard. In two of the earliest **Laboratories F2** and **F3** traces of a carbon dioxide fire suppressant system was found, including stands for gas cylinders and red painted pipes. A similar system was found in the later **Electrical Sub Station E7/166**, although no trace of a carbon dioxide system was in found **Laboratory F1/125**. Carbon dioxide was probably chosen where there was risk of electrical fires. During the early 1960s development a **Pump House E8/167** was installed along with storage tanks capable of holding 72,000 gallons (372312 litres). This was connected to a system of pipes and hydrants usually placed close to the test structures (Figure 41). Probably due to the difficulty of digging trenches in the shingle, and for ease of maintenance, water was carried between the buildings in overhead pipes. The metal water pipes have been removed have largely been removed, but their lines may be traced by rows of displaced concrete pipe bases and conduits where they passed beneath the roads.

Power to the site was supplied along an 11kv overhead power line and stepped down by eight transformers. As described above the electrical transformers **F6/113** and **F7/112** were housed in protected concrete shelters, in addition to these were another six transformers mounted on open concrete plinths.

Conclusions

Throughout its history Orford Ness has been a remote and seldom visited place, except

for solitary sheep and cattle grazers on its coastal marshes, wild fowlers, the tenders of the oyster beds, and the beacon and lighthouse keepers. Occasionally, this quiet life was dramatically punctuated by a shipwreck or a vessel stranding offshore. The acquisition of the spit by the War Office during the First World War effectively closed it to public access for nearly 80 years. During this time it was used by various defence research establishments and by their very nature little was known about the significance of their work. Its possession by the government transformed the history of Orford Ness from one of local interest to one of national and international significance.

Aviation heritage

During the First World War military aviation underwent an extraordinary revolution and at Orford Ness the technology of aerial machine guns, bombing and emergency parachutes were developed as well as air combat tactics. This work continued during the interwar period particularly into aerial bombing techniques. Of particular significance during the late 1930s was the investigation of radio waves, or radar, to locate hostile aircraft. Critically, the work carried out at Orford Ness confirmed the viability of this technology and led to the setting up of a larger research station at Bawdsey Manor and the development of the Chain Home network of radar stations. In the Second World War, the establishment was primarily engaged in studying the vulnerability of different types of aircraft and their components to hostile attack.

Nuclear weapons research

Two historians of Britain's nuclear programme have commented that Cold War 'defence policy was dependent on the work of hundreds of scientists, engineers and technicians engaged in research, producing fissile material and other special materials, and designing, fabricating and testing nuclear devices and weapons' (Arnold and Smith 2006, 13). The structures at Orford Ness embody this link between science and high politics.

The facilities at Orford Ness were one part of a complex scientific and industrial infrastructure that had been built up to equip the United Kingdom's armed forces with nuclear warheads and to maintain its policy of nuclear deterrence. The remoteness of the site and the robustness of its laboratories were specifically designed to test components and assembled weapons containing conventional high explosives. No detailed accounts are available on the research programmes that were carried out at Orford Ness. Nevertheless, the development phases may be set against known weapons projects, which may give an indication of the variety of activities the range was concerned with.

Prior to the arrival of AWRE in 1955 the existing bomb ballistics range played an important role in the development of the casing for Britain's first atomic bomb *Blue Danube*. During these trials numerous casings were dropped off Orford Ness and their flight paths monitored by telemetry teams housed on the spit. The origin of the AWRE Orfordness lies in the feverish activities of the mid to late 1950s, when the establishment was engaged in a succession of warhead programmes and associated trials. This work would not only secure Britain's nuclear deterrent forces through the provision of new

weapons, but through demonstrated expertise led to renewed nuclear co-operation with the United States. In spring 1955, the immediate concern of the planners was for an installation to test the tactical *Red Beard* bomb and the Mark I atomic bomb, or *Blue Danube*, before the autumn 1956 *Buffalo* trials to be held in Australia (TNA: PRO AVIA 65/1258, E28). AWRE's development of the Orford Ness range may be broken down into four main construction phases. The first began in 1956 with the construction of **Laboratories F1, F2 and F3**. Construction work for the second phase began in 1960 when the range's most distinctive structures, the **Vibration Test Buildings E2 and E3**, or pagodas, were built along with their associated infrastructure. The last two phases comprised the construction of two single structures; the **Impact Facility F5** in late 1963, or early 1964, and a second **Centrifuge E1** around 1966.

Initial construction work probably began in summer 1955 and building record drawings completed in June 1956 suggest that the challenging task of building **Laboratory I** was complete by this date (Figure 43). By summer 1956 preparations were already well advanced for the autumn *Buffalo* trials at Maralinga, Australia, which would include an operational air drop of a *Blue Danube* atomic bomb by the RAF (Arnold and Smith 2006, 138-171). By August Bank Holiday of that year, **Laboratory I F3** was ready for its first trial, a live *Blue Danube* round, minus its fissile core (Kinsey 1981, 109). This work was essential to verify that the Bomb's complex systems could withstand the rigours of transport and then operate as intended. The results of these tests would determine whether or not the air drop trial was included in the *Buffalo* programme.

Cabinet approval for the development of a much more powerful thermonuclear, or hydrogen, bomb had been given in July 1954, and became the main emphasis of AWRE's activities. By summer 1956, when Orford Ness' facilities became operational, many important design questions still needed to be answered, which led to the pursuit of a number of different design options. After the completion of the *Buffalo* trials in autumn 1956, the focus quickly moved to the far more ambitious *Grapple* series planned for autumn 1957 on Christmas Island in the Pacific Ocean. In these tests Britain would detonate her first thermonuclear weapon.

During the late 1950s AWRE was running a bewildering number of programmes. Based on differing detonation techniques two designs of thermonuclear weapons were proposed *Green Bamboo* and *Green Granite*. Two derivatives of the latter *Short Granite* and *Purple Granite* were tested during the *Grapple* series. Work was also proceeding on a device known as the interim weapon; an early design was called *Orange Herald*. Such a device, although technically not a thermonuclear weapon would allow the government to claim that the country had a weapon with a yield in the megaton range - defined as more than 400 kilotons. Later a version codenamed *Violet Club*, or *Knobkerry*, was issued to the RAF for a short time. AWRE was also developing a smaller tactical weapon that could be carried by a greater variety of aircraft. This was designated *Red Beard*, it measured 12ft (3.66m) in length and weighed 2,000lb (907kg). In June and July 1957 ground vibration trials on a ballistic version of the weapon, attached to a Canberra bomber carrier and fitted with all components and a HE warhead were carried out at Orford Ness (TNA: PRO AIR 2/13683 22 Oct 57, 3 page 11). Consideration was also being given to two even smaller warheads *Blue Fox* and *Pixie* that might be mounted on surface to air missiles (Arnold and Smith 2006, 180-8). The picture that emerges from



Figure 42: AWRE in July 1958, by this date the first development phase was complete. To the right is Laboratory 1 and to the left Laboratory 2, between the mound covering Laboratory 3 has blended with the disturbed shingle. RAF 58/2519 0001 18 July 1958 English Heritage (NMR) RAF Photography

the late 1950s is a period of intense activity, where many competing designs were being brought forward for testing, some of which required returning for modifications, while other proceeded to overseas trials.

The successful detonation of a thermonuclear warhead off Christmas Island during the 1957 *Grapple* tests marked an important technological milestone. It proved the proficiency of the country in this technology and was one of the factors that led to the signing of the 1958 Mutual Defence Agreement, which gave Britain access to United States nuclear expertise. One of the results of this was acquisition of knowledge about the United States W28 warhead, which in its Anglicised form became known as *Red Snow*, which was used in the *Yellow Sun MKII* gravity bomb and *Blue Steel* stand-off missile.

The second main construction phase is linked to a requirement to expand the test programme to simulate the conditions weapons might be subject to during service use, including temperature variation and vibration. It was during this phase that the **Vibration Test Buildings**, or pagodas, were constructed. These structures probably came into operation in late 1960 at a time when renewed access to American nuclear know-how was beginning to reduce the need for some research work, although important work continued to Anglicise United States' designs. Fiscal pressures, as well as questions about the utility of certain types of nuclear weapons also started to reduce the number



Figure 43: An aerial photograph showing the development of the AWRE area to April 1965. OS/65054 VI08 30 April 1965 (c) Crown Copyright. Ordnance Survey

of defence research programmes. Furthermore, as warhead technology matured, compared to the multitude of experimental types it was possible to standardise on a small number of warhead variants, some of which remained in service for a number of decades. Another consequence of renewed nuclear co-operation between Britain and the United States, and the presence of American derived technology on the site was increased security measures within the establishment. These included the erection of a fence around The Street and the fitting of crude steel doors to some of the test structures.

The scaling back in the number of projects, coupled with a reduction in the size of weapons may have resulted in the mothballing of **Laboratory 1 F3**, which allowed its **Control Room F4** to be modified for use with the new **Impact Facility F5**. In 1962, alterations were carried out to the plant room of **Laboratory 2 F1** and it was probably at this date that the centrifuge was installed.

Uniquely, the **Impact Facility F5** may be confidently associated with a specific weapons

programme, the development of the WE177 series of freefall bombs. It was specially designed to test their resilience to hitting the ground before detonation. This facility was constructed in late 1963 or early 1964 and was active until the late 1960s. The first two variants were deployed for service use in 1966 and the final type for the Royal Navy became operational in about 1971.

The technological context for the second **Centrifuge EI** is more difficult to ascertain. It was constructed in 1966, by this date the main design work on WE177 was complete, and the focus of AWRE's attention was the development of the ET317 warhead for the first generation of Polaris missiles. One source, however, claims that the ET317 warhead design was sufficiently advanced for an underground firing at the Nevada Test Site in October 1965, and that production began in 1966 (Norris et al 1994, 62, 404). As discussed above the **Centrifuge EI** was designed to handle components containing explosives charges, and may have been used to refine the design of explosive triggers, or to verify the effectiveness of existing systems.

International connections

From the beginning AWRE Orford Ness was part of an international network of nuclear testing sites. By August Bank Holiday 1956 **Laboratory I F3** was operational and ready to simulate the conditions a *Blue Danube* atomic weapon would be subject to during transport and flight. This work was critical to the success of the autumn 1956 *Buffalo* trials at Maralinga, South Australia. After the completion of the *Buffalo* series AWRE's attention quickly shifted to the *Grapple* test series on Christmas Island, which ran from May 1957 to September 1958, in which Britain exploded her first megaton weapon. Smaller trials continued until 1963 at Maralinga, and from the early 1960s the United Kingdom also had access to the United States' Nevada Test Site. None of these sites have facilities comparable to Orford Ness, at Maralinga and Christmas Island, temporary infrastructure was erected for the trials work, and that which wasn't destroyed was either removed or abandoned. Further clearance work has also taken place in the last few years to remove the last traces of these activities. The Nevada Test Site is a vast area, roughly equivalent to the area of Cambridgeshire. It comprises a small township to support the range's activities and remote firing areas, again with temporary infrastructure constructed for each trials series. If comparable facilities to those at Orford Ness exist overseas they are likely to be within nuclear weapons laboratories, which due to their character are highly secretive.

Throughout this period the Orford Ness bombing range continued to play a vital role in investigation of the aerodynamic properties of nuclear bomb casings. It was also used for practice by the RAF *Valiant* aircraft crews, based at RAF Wittering, who made the first live air drops of British atomic and thermonuclear weapons (Hubbard and Simmons 1985, 33).

Internationally, Orford Ness has the distinction of being the only former atomic weapons testing site that may be freely visited. At the Nevada Test Site, due to its large size, security and safety concerns access is restricted to guided bus tours. Accompanied tours of the former Soviet test range at Semipalatinsk, Kazakhstan, may also be arranged

(Hodge and Weinberger 2008, 226-48). At Maralinga, South Australia, the local community is considering how it might develop a tourist economy using the area's defence heritage as one attraction.

Orford Ness' cultural significance lies not only in its recent military heritage and the landscape it has created, but also in its intrinsic remoteness, strange desert-like shingle terrain and its dramatic weather patterns. It is this combination of qualities with the striking 20th century ruins set against an apparently barren natural environment that has formed a source of inspiration for many visual and sound artists, including Denis Creffield, Dan Dubowitz, Matthew Roberts, John Wonnacott, and Louise K Wilson (Wilson 2005).

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BUILDING LIST

This list was compiled from a 1973 Property Services Agency list, notes by the National Trust and other sources.

PSA	NT	Date	Earlier function, latest function
1		1954	Electricity substation 1
3	C13	1914-18/1958	Canteen (disused)
7	C8	1914-18/1953	Offices & store (disused)
9	C10	1953/1957	Dogs compound (disused)
11		1939	Static water 18,000 gallons
12	C9	1914-18	Rec Soc (disused)
13		1939	Static water 18,000 gallons
14	C8	1914-18	Rec Soc (disused)
15		1914-18	Oil & paint store
17	C3	1914-18/1953	Electronic services workshop (disused)
18	C1	1914-18	Barracks, Stores
19		1914-18	Garage apron (120)
20	B12	1914-18	Hangar & plate shop
21	B7	1914-18/1961	Mess & locker rooms (disused)
22	B6	1945	Machine shop (disused)
24	B5	1914-18/1961	Heavy workshop
25		1914-18	Air compressor room (disused)
26	B4	1914-18/1961	Heavy machine shop (disused)
27	B3	1914-18	Contractors' workshop
28			Contractors' stores

30	B18		1914-18/1956	Storehouse
32			1914-18	Surface water pump house
33	A4		1914-18	Hut near jetty
34	A52		1955	Surface water pump house (jetty)
36	D2	85	1916	Explosives building (disused)
37	D1		1916	Explosives building (disused)
38				Police lookout tower (disused)
39	J3			Old Coastguard watch house (disused)
40	G1		1928	Navigation beacon, Black Beacon (near 47 disused)
41	D5	87	1936	Explosives building (disused)
42	D4		1936	Explosives building (disused)
43	D3	88	1936	Explosives building (disused)
44	H1		1933	Old Ballistics Building (disused)
45				Water storage towers 56,000 gallons drinking
46	G2		1933	Engine room for 40, Workshop (disused)
47	G3		1956	Telemetry, HQ offices
48	G5		1956	Small vibration lab garage (disused)
49	G4		1956	Boiler house
50	G6		1959	Set office annexe (disused)
53			1935	Boatmen's hut at jetty
57			1952	Latrine at jetty
58				Plinth G (LHouse Road)
59			1958	Police post at ramp

62			7 ton crane – quay
63			7 ton crane – jetty
64			Static water 18,000 gallons EWS
67	A1		Jetty and dolphins
68	A9	1940	Range post disused
69		1940	Battery charging shop (disused)
70		1941	Oil store (near hangar)
72	A10	1941	Range post (disused)
73A		1941	Store house (not explosive disused)
73B		1941	Storehouse (Derelict)
74	C5	1956	HQ Offices, AEAC & PBX (Day)
75		1959	Standby diesel house (disused)
77	B9	1945	Canteen, Electrical workshop (disused)
78	B8	1945	Offices and elec workshop
81	B2	1954	Storehouse (disused)
82		1941	Alkaline battery charging room
83		1941	Box store
84	A5	1941	Radio lab (disused)
85			Workshop at jetty (disused)
86			Store
87			Farm store
88		1941	Implement garage (disused)
89			Plinth B (near bldg 78)
90	A6		Plinth C (jetty area disused)

91			Plinth A (near 5/51)
92			Plinth D (near 47)
94		1949	Metal store (near 22)
95		1935/1954	Marine maintenance workshop
98		1950	Survey trig point old kine 2
100		1950	Old kine at jetty (Kine 4)
101			Rec Soc hut on beach (disused)
103	C12	1954	Rec Soc rifle range (disused)
104			Sand shed at jetty
105			Police post at barrier (disused)
106	C17	1954	Old range control (disused)
110			B/H attendants' mess room (disused)
112	F7		Plinth E (near 123)
113	F6		Plinth F (near 125)
116		1958	Sewage pumping house
117		1958	Dog kennels and runs
118		1958	Electronics workshop
119		1957	Offices and first aid, boiler house, fire station (Lab 7)
120	C6	1957	Garage and store
121	A50	1955	Non metallic gantry (disused, dismantled 1966)
122	A7	1955	Aerial measurements building (disused)
123	F3	1956	Lab I (disused)
124	F4	1956	Control room (disused)

125	F1	1956	Lab II & control room (disused)
126	F2	1956	Lab III & control room (disused)
127	F3	1956	Lab I store (disused)
128	F2	1956	Lab III condense pump house (disused)
129		1955	Ammunition store (disused)
130	F8	1956	Control mess room (near 124)
131	C4	1956	Garage & store (disused)
132		1956	First aid & offices
134		1958	Bus shelter at jetty
135	E3	1961	Lab (disused)
136	E2	1961	Lab (disused)
139	E4	1961	New control room (disused) (for Labs 4 & 5 incl. thermal recording)
140	E5	1962	Magazine (disused)
142		1961	Burning ground (disused)
147		1961/1969	Petrol tank & pump & diesel fuel tank (Diesel 800 gallons, petrol 2,000 gallons)
150		1962	Police post at Gate 3
156		1961	Clocking station – mainland
157		1961	Cycle shelter – mainland
158		1961	18 ton Bailey bridge

Additions

159	C52		5 ton bridge
166	E7		Sub Station 2

167			Fire pump house
168	E8	1961	Condense & fire pump house & tanks
171	F5	1963	Impact Facility
174	C2		Oil store
176	E1	1966	Centrifuge
177			Police
178		1968	Workshop at jetty

Magazine

AREA/LOCATION:

STRUCTURE No. D1 was 37

DATE: 1916

NGR:TM 44020 48918



ORIGINAL FUNCTION: Magazine

LATEST FUNCTION: Store

CONSTRUCTIONAL TYPE: Concrete block

DIMENSIONS: 11.15m (36ft 7ins) x
8.10m (26ft 6ins) Height: 2.30m (7ft 6ins) at eaves

DOCUMENTARY REFERENCE: AWRE 1971 37; PSA 1973 37 Explosives bdg (disused)

PHOTOGRAPHS:AA99/08467, DP070035

RELATIONSHIPS WITH OTHER FEATURES: Similar to D2

DESCRIPTION:

The Magazine is a rectangular single storey building constructed from standard concrete blocks (0.75m (2ft 6ins) x 0.24m (10ins) x 0.10m (4ins)) laid to cavity wall construction. It is covered by a shallow pitch pyramidal timber framed roof, weather boarded with felt over with a central ventilation lantern. The Magazine is entered from the north through double wooden outward opening doors each leaf is covered by a steel sheet. To either side the entrance is flanked by window openings and small metal vents, and to its west a REVO electrical fuse box. The doors and windows appear to date from the 1950s or 1960s. Externally there are a number of bronze fastenings, which were used to fix copper lightning straps. In the rear, south, wall is a single metal 1930s style vent. To the side of the doors is another cast iron vent. Internally is a central walkway with later raised concrete storage platforms to either side, it was latterly lit by enclosed magazine type lighting.

Magazine

AREA/LOCATION:

STRUCTURE No. D2 was 36 & 85

DATE: 1916 reconstructed 1931

NGR: TM 43882 48818



ORIGINAL FUNCTION: Magazine

LATEST FUNCTION: Magazine

CONSTRUCTIONAL TYPE: Mass Concrete

DIMENSIONS: 11.05m (36ft 3ins)
x 8.2m (26ft 10ins)

DOCUMENTARY REFERENCE: AWRE 1971 36; PSA 1973 36 Explosives bdg (disused)

PHOTOGRAPHS: AA99/08468, DP070012-15

RELATIONSHIPS WITH OTHER FEATURES: Associated with D4, similar to D1

DESCRIPTION:

The lower section of the magazine is of mass concrete construction, this was subsequently raised by the addition of a brick upper section, its outer surface was then cement rendered to give a uniform appearance. It is covered by a timber framed pyramidal roof with wooden boards covered by felt, there was originally a central ventilation lantern. The Magazine is entered from the north through a double door; this was originally flanked by windows to either side, which have subsequently been blocked. To the east of the door is the remains of wooden box protecting electrical switch gear. Internally is a longitudinal walkway, 1.34m (4ft 5ins) with raised storage areas to either side. At the rear of the Magazine a concrete plaque records 'Ches Fld Coy RE' (Cheshire Field Company Royal Engineers). Above is a travelling crane by 'Herbert Morris Ltd Loughborough 1 ton'. The building is lit by 1950s style pendant lights and is heated by electrical wall heaters, a sign records 'Man Limit 4'. Attached to the north east corner of the building is a small brick addition, constructed of red brick cavity wall construction in stretcher bond with a flat concrete roof. A concrete plaque on its north wall records '1931'. Terracotta ventilation blocks at floor level and eaves height vent the cavity and metal vents the interior. It is entered from the north through a single wooden door. It is lit to the south by a small hinged wooden 4 light window with opaque wired glass, with concrete cills and lintels. Internally, the floor is covered in asphalt, there is a single electrical socket and inclined pipe that connects back to the main magazine.

A number 85 is sprayed on its north wall.

Fuze Magazine

AREA/LOCATION:

STRUCTURE No. D3 was 43 & 88

DATE: 1931

NGR: TM 43963 48922



ORIGINAL FUNCTION: Fuze magazine

LATEST FUNCTION: Office

CONSTRUCTIONAL TYPE: Brick
(16ft 4ins) x

DIMENSIONS: 4.98m
3.08m (9ft
11ins) Height: 2.55m (8ft 5ins)

DOCUMENTARY REFERENCE: AWRE 1971 43; PSA 1973 Explosives bdg (disused)

PHOTOGRAPHS: AA99/08469

RELATIONSHIPS WITH OTHER FEATURES: Adjacent to D1

DESCRIPTION:

The Fuze Magazine is a small, rectangular, single storey building of cavity wall construction finished in red fair faced brick laid to stretcher bond. It has a flat concrete asphalt covered roof. Earthenware airbricks vent the cavity and the building's interior is ventilated by metal vents. Internally the building was originally divided into two bays accessed through two single wooden outward opening doors on the north side. Adjacent to each of the doors is an inset boot scraper and a concrete slab, presumably to stand on while boot scraping. At the eastern end of the north side is a small window that probably contained an external electric light. A concrete plaque records the building was constructed in 1931 and below this is a faded painted number 43. On the south side the eastern bay is lit by a small wooden four light window with wired glass. The western bay is lit by a pair of similar windows. Both windows have concrete sills and windows and are protected by metal bars. Externally are traces of copper lightning conductor straps and electrical fittings. During the 1950s the magazine was converted into a small office when the central partition wall was removed and ply-wood cupboards and an electrical heater were installed. The east and west walls are blank except for vents.

On the south side of the building is a sprayed number 88.

Fuze Magazine

AREA/LOCATION:

STRUCTURE No. D4 was 42

DATE: 1931

NGR:TM 438835 48845



ORIGINAL FUNCTION: Fuze Magazine

LATEST FUNCTION: Fuze Magazine

CONSTRUCTIONAL TYPE: Brick
10ins) x 3.54m

DIMENSIONS: 7.28m (23ft
(11ft 8ins)
Height: 2.85m (9ft 4ins)

DOCUMENTARY REFERENCE: AWRE 1971 42; PSA 1973 42 explosives building disused

PHOTOGRAPHS:AA99/08470

RELATIONSHIPS WITH OTHER FEATURES: Associated with D5

DESCRIPTION:

The Fuze Magazine is a single storey brick built structure comprising an inner Fletton brick wall laid to English bond, a cavity and an outer red brick cladding wall laid to stretcher bond. The Magazine is set on a foundation course laid to English bond with a double layer Welsh slate damp proof course. The cavity is ventilated by earthenware ventilation bricks, while the bays are ventilated by metal vents set at floor and eaves level. At the east end of the building is self-contained bay formerly accessed from a single outward opening wooden door to the north. To the west are two further bays formerly accessed from a single wooden outward opening door with bronze door furniture, adjacent to the door is a metal boot scraper. This door gave access to a shifting lobby with coat hooks remaining on the east wall and on the west wall is a blackboard. Access to the central bay clean area was over a toeboard, whose position is marked by wooden batons. All the bays were lit by enclosed magazine type lights with wires sealed in metal small bore metal pipes, at the east end of the building is a metal electrical switch box. To the south each bay is lit by a pair of hinged wooden 4 light windows with opaque wired glass. On the west wall are some surviving fixing bands for the copper lightning conductor strap.

Fuze Magazine

AREA/LOCATION:

STRUCTURE No. D5 was 41 & 87

DATE: 1936

NGR: TM 43798 48813



ORIGINAL FUNCTION: Fuze Magazine

LATEST FUNCTION: Fuze Magazine

CONSTRUCTIONAL TYPE: Brick
2ins) x 3.46m

DIMENSIONS: 5.85m (19ft
(11ft 4ins) Height:
2.58m (8ft 6ins)

DOCUMENTARY REFERENCE: AWRE 1971 41; PSA 1973 Explosives bdg (disused)

PHOTOGRAPHS:

RELATIONSHIPS WITH OTHER FEATURES: Associated with D4

DESCRIPTION:

The Fuze Magazine is a single storey brick built structure comprising an inner Fletton brick wall laid to English bond, a cavity and an outer cladding in red brick wall laid to stretcher bond, the cavity is ventilated by earthenware vents. It is set on a brick foundation course with a double layer Welsh slate damp proof course and has a flat asphalt covered concrete roof. The Magazine was entered from the northeast through a porch or shifting lobby (now collapsed), access into the magazine area was over a toe board, whose position is marked by surviving wooden batons. Internally the magazine is divided into a longitudinal corridor to the east and to the west are three small self contained magazine bays, each originally closed by a wooden outward opening door with brass door furniture. Each bay was ventilated by a metal vent in its west wall. The magazine corridor was lit by two pairs of 4 light metal framed windows to either side of the porch, which was itself lit by a similar window. The windows are fitted with opaque wired glass. On the southwest corner of the Magazine are a number of surviving fixing points for the lightning conductor earthing strap.

A number 87 is sprayed on the Magazine.

Centrifuge

AREA/LOCATION:

STRUCTURE No. EI was 176

DATE: 1966

NGR:TM 43341 47945



ORIGINAL FUNCTION: Centrifuge

LATEST FUNCTION: Centrifuge

CONSTRUCTIONAL TYPE: Reinforced concrete

DIMENSIONS: 14.96m(49ft) x 9.77m(32ft)
Height: 5.78m (gable)

DOCUMENTARY REFERENCE: AWRE 1971 176; PSA 1973 176 Lab (disused)

PHOTOGRAPHS: AA99/08489 and AA99/08490, DP068497-500, DP068511

RELATIONSHIPS WITH OTHER FEATURES:

DESCRIPTION:

The Centrifuge building is a rectangular concrete structure with gable ends to the north and south. It was originally entered from the west through 2 doorways, which have subsequently been sealed with breeze blocks. In the southern opening a steel cage door has recently been inserted. At eaves height on the west wall are two metal ventilation grills, also on this wall are various small bore electrical pipes and a cast iron rain-water pipe. The south gable is blank except for small bore electrical pipes and a 45cm square hole, the north gable is also blank except for a small square opening to the north east. The east wall is also featureless except for a small concrete-revetted emergency escape passage. The north and east sides of the building are protected by a shingle traverse supported by concrete wing walls on the northwest and southeast corners. The building is covered by a gently pitched roof supported on three RSJs with angle iron purlins supporting insulation boarding and the pressed metal outer cladding. To the west of the building is a metal flag pole that also might have served as a lightning conductor. Internally, immediately to the north of the door opening is a small square opening to a small toilet and washroom. The interior was lit by sealed florescent units and heated by radiators on all walls. In the centre of the building is the circular brick-lined centrifuge pit, diameter of 8.06m (26ft 6in), depth of 2.68m (8ft 9in). In the centre of the pit is the central mounting plate for the centrifuge with a cable duct leading to the northeast corner and a lower self-contained equipment room. In the pit's brick wall to the southwest, northwest, northeast and southeast are concrete piers, above which cutouts in the floor with metal mounting plates may mark the position of

a cruciform framework to support the centrifuge and its turning gear. To the south a set of concrete stairs provides access into the pit. It is finished in speckled pale green paint, the remainder of the interior is yellow. A ledge running at eaves height along the east and west walls formerly supported an overhead travelling crane. At the north end of the building are two self contained instrumentation rooms and a door (blocked) in the east wall that gave access to the emergency escape passage.

Vibration Test Building

AREA/LOCATION:

STRUCTURE No. E2 was 136

DATE: 1960

NGR:TM 43377 47978



ORIGINAL FUNCTION:Vibration Test Building

LATEST FUNCTION:Vibration Test Building

CONSTRUCTIONAL TYPE: Reinforced Concrete

DIMENSIONS: see text

DOCUMENTARY REFERENCE: UKAEA 1960 Preliminary scheme No.6 Vibration Test Buildings Nos 135, 136, 137, 138 Chief architect G W Dixon 7-4-60: AWRE 1962 Orfordness Buildings 135 and 136 Negative SW/X/135ORF136ORF/2 as at handover 135 22-1-62 136 22-6-62: UKAEA SW/S7841/135/AB/9 Orfordness Vibration Test Buildings Nos 135 and 136 Elevations and sections Architect G W Dixon ARIBA 7-3-62 (NT Orfordness); AWRE 1971 136; PSA 1973 136 Lab (disused) : AWRE nd, 6,7,9; Millington C F 1971 Design study for an environmental test building erected at AWRE Orfordness AWRE Report 0 34/71 TNA: PRO ES4/1282)

PHOTOGRAPHS:AA99/08491-6,DP070034, DP068501-506, DP068509-10, DP068512, DP068514, DP068517-521, DP070004

RELATIONSHIPS WITH OTHER FEATURES: Similar to E3

DESCRIPTION:

The Vibration Test Building is a large reinforced concrete structure, comprising a central chamber with a heavy concrete roof supported on pillars, and protected by a shingle traverse on its east and north sides. To its south and east are freestanding brick plant rooms.

In the centre of the Vibration Test Building is a large central chamber dimensions, 16.47m (54ft) by 7.30m (24ft). It was entered from a passageway to the south through large wooden outward opening doors covered with metal sheeting with a small pedestrian single door to the east. To the east of the main doors was a single exterior door to the toilet room, which was lit by a metal framed 3 light window. Inside the main doorway to the west is a small recess that may have contained a fire hose. On the opposite side a staircase gives access down to the floor of the central chamber beyond this staircase another staircase provides access to an upper walkway around the main cham-

Vibration Test Building

AREA/LOCATION:

STRUCTURE No. E3 was 135

DATE: 1960

NGR:TM 43483 48059



ORIGINAL FUNCTION:Vibration Test Building

LATEST FUNCTION:Vibration Test Building

CONSTRUCTIONAL TYPE: Reinforced Concrete

DIMENSIONS: See text

DOCUMENTARY REFERENCE: UKAEA Preliminary scheme No.6 Vibration Test Buildings Nos 135, 136, 137, 138 Chief architect G W Dixon 7-4-60:AWRE Orfordness Buildings 135 and 136 Negative SW/X/135ORF136ORF/2 as at handover 135 22-1-60 136 22-6-62: UKAEA SW/ S7841/135/AB/9 Orfordness Vibration Test Buildings Nos 135 and 136 Elevations and sections Architect G W Dixon ARIBA 7-3-62 (NT Orfordness);AWRE 1971 135; PSA 1973 Lab (disused): AWRE nd, 6, 7,9: Millington C F 1971 Design study for an environmental test building erected at AWRE Orfordness AWRE Report 0 34/71 (TNA: PRO ES4/1282),TNA:PRO ABI 6/2975

PHOTOGRAPHS: AA99/08495-7; Kinsey 1981, 108, DP070034, DP068507-508, DP068515-16

RELATIONSHIPS WITH OTHER FEATURES: Similar to E2

DESCRIPTION:

The Vibration Test Building is a large reinforced concrete structure, comprising a central chamber with a heavy concrete roof supported on pillars, and protected by a shingle traverse on its east, north and south sides. To its south and east are freestanding brick plant rooms.

In the centre of the centre of the building is a large central chamber dimensions, 16.47m (54ft) by 7.30m (24ft). It was entered from a passageway to the south through large wooden outward opening doors covered with metal sheeting with a small pedestrian single door to the east. Outside of the main door a single exterior door gave access to the toilet room, which was lit by a metal framed 3 light window and a small window in its east wall. Inside the main door way to the west is a small recess that may have contained a fire hose. On the opposite side a staircase gives access down to the working floor of the central chamber and beyond it another staircase to the east gives access to an upper walkway around the central chamber. Returning to the entrance.

passage in its ceiling are 4 very substantial eyehooks for lifting ropes. At the north end of the entrance passage is a lift pit. 5.2m (17ft) by 4.88m (16ft) and 3.45m (11ft 4ins) deep. On its north and south walls cut off bolts mark the former position of metal plates. In the southeast corner of the pit is a recessed vertical channel for electrical pipes and 3 pipes possibly for hydraulic fluids. The base of the main test chamber is 1.5m (5ft) above the level of the lift pit floor and measures 9.75m (32ft) by 4.88m (16ft), the height to the upper walkway is (12ft) 3.67m. The base of the chamber appears to be formed from a series of I beams, which allowed test equipment to be secured in various places on the floor. Set into the north wall are 7 vertical, metal plates with cruciform slots, these likewise were probably used for securing test equipment. On the east wall are 4 similar horizontal plates, stencilled between the central plates and to the north of the northern plate are the figures 54, 60, 66, these indicate the height above the floor surface (in inches). On the south wall are 3 horizontal metal plates with a central slot in each above the middle plate are stencilled numbers 1-30 ft and below the plate are stencilled the numbers 1-7.5m, at 0.50m intervals. Below the bottom plate there is a stencilled 'C Fold' the C is possibly earlier as it seems to be partially overpainted.

To either side of the chamber are cable ducts infilled with shingle, along the base of the north wall are 8 pipe openings, 3 of which are sealed by bolted circular plates. Along the base of the east wall is the remains of an air-conditioning system (not in-situ), at the southeast corner a passage leads back to the air-conditioning plant on the east side of the building. Surrounding the test chamber is an upper walkway which was formerly protected by a moveable handrail, whose fittings survive. Between the walkway and the outer wall is a cable duct on the north and south walls. There is also a fixed handrail and on the south, east and north walls along with various electrical pipes switches and junction boxes and a single rectangular cable duct. In the north east corner is a vertical ladder that gave access to the window level. Attached to the east wall is a large square section air-conditioning duct leading to the plant room to the south. On the north, east and south walls of the test chamber are inserted pipes, 4 each on the north and south walls and 3 on the east which connect back to the cable ducts around the edge of the walkway. Below these on each of the walls are pairs of circular threaded fixings.

The building's roof is a massive concrete slab supported on 16 square columns, the under side of the roof is 8.75m (28ft 6ins) from the floor of the chamber. On the underside of the roof and on the walls are various screw threaded holes for eyehooks, used to position heavy test equipment.

The openings between the columns were originally filled with wooden framed windows and glazed with perspex sheets. A ledge along the south and north walls of the main chamber carried rails for an overhead travelling crane. At the northeast corner of the main test chamber a doorway gives access to a service corridor running east-west along the north side of the building. For most of its length mounted on its north wall were large cork insulated air conditioning pipes. To the west a flight of stairs provides access to the top of the north lip of the lift pit and to the upper walkway around the test chamber this flight of stairs also gives access to a now blocked door to the emergency exit in the north wall. To the east a second flight of stairs gives access to the plant room attached to the eastern side of the building, a sign on one of the switches records 'Minerva cell DC supply isolation relay'. On the upper west wall of the test chamber a sign records 'telephone instrument room' below it is a light fitting, to the south are the remains of light fittings and wooden batons for a sign.

To the south and detached from the main test chamber is an air conditioning plant of brick cavity wall construction faced with Burwell whites laid to stretcher bond with a flat concrete roof supported on RSJs. This building measures 11.62m (38ft 1ins) by 6.04m (19ft 10ins) and is 4m (13ft). The block is divided into two by a brick partition wall the larger bay to the west was entered through two pairs of wooden doors, above the eastern opening is a wooden louvred vent which connects back to the air-conditioning plant and above the western door there is a wooden 2 light window. Between the two sets of door openings there is a large 3 light window at eaves height. Internally

are 3 large concrete machinery mounting plinths and 1 smaller plinth, sections of metal air-ducts also survive and a metal switch cabinet. In the north wall is a larger square opening formerly with a wooden louvred vent and to the west a small square opening which carries the ducting back towards the entrance passage. An opening in the partition wall carries the ducting into the smaller and now sealed eastern bay. The main western bay was lit by 8 lamps and on its east wall a sign by a pipe warns 'unfit for drinking'. The smaller east bay was lit by a 3 light metal framed window (now blocked) at eaves height. On the north wall a square section duct connects back to the main chamber.

Along the eastern side of the complex is another freestanding plant room of brick cavity wall construction and faced with Burwell whites and also has a flat concrete roof. It is divided into 3 bays, at the northeast corner the eastern wall of this bay is rebated back from the main elevation and was formerly entered through double door (now sealed), its northern side is lit by a 4 light steel framed window set at eaves height. To its west is a large rectangular opening housing 2 large diameter air-conditioning pipes that connect back to the pipes in the northern service corridor. To the northeast of these openings is a low concrete plinth. An historic photograph (Kinsey 1981, 108) shows a mobile air conditioning unit connected to the two large air conditioning pipes, and cables leading back to the north wall of the building. Returning to the main eastern side, there are 4 bay openings, the southern bay, which housed a transformer, is now sealed in breeze block. The remainder of the bays have metal concertina doors, internally there was a suspended floor whose concrete piers remain, to the rear is a cable or pipe duct one arm connects back to the main test chamber and also to the bays to the north and south. The roof is supported on steel RSJs and is lit by 3 roof lights and 18 pendant lights. A number of junction boxes, air-conditioning ducts and small-bore electrical ducts remain.

At the southern end of the main plant room is an open framed plant room constructed from 2 I section portal frames with a southerly wall of brick cavity wall construction faced in Burwell whites. In this wall is a large door opening to eaves height, the side walls to east and west were formerly infilled with wooden louvred vents with 5 light windows above. The building was also vented by 2 wooden framed clearstories. The exteriors of the vertical metal columns were protected by copper sheeting. Internally, there is a central walkway with now shingle filled cable ducts to either side, a single door (now blocked) led back into the south bay of the main plant block. Along the west side of the building is a much decayed section of steel duct work. Various electrical pipes remain attached to the north wall.

To the north is the remains of a flag pole which seems to have also acted as a lightning rod.

ber. Returning to the entrance passage, in the ceiling of the passage are 3 very substantial eyehooks and 3 threaded fittings for further eyehooks. At the north end of the entrance passage is a lift pit with another pair of threaded fittings in its west wall and a further pair in the north wall overlooking the lift pit. The lift pit measures 5.2m (17ft)x 4.88m (16ft) and is 3.45m (11ft 4ins) deep. On its north and south walls pit cut off bolts mark the position of metal plates, and on its west wall are 2 metal catchplates, perhaps associated with the lift mechanism. In the south east corner of the pit

Along the base of the north wall are 8 pipe openings, the 2 larger openings are labelled inlet and outlet and 4 are sealed by bolted circular plates. At the south east corner of the chamber a passage leads back to the air-conditioning plant on the east side of the structure. Surrounding the main chamber is an upper walkway which was formerly protected by a moveable handrail, whose fittings survive. Between the walkway and the main wall is a cable duct on the north and south walls, fixed to the main outer walls is a handrail, various electrical pipes switches and junction boxes, a single rectangular cable duct and 4 wooden mounting blocks for pressure gauges, 3 of which survive. On the north and south walls are two pipes are labelled Air and Vac respectively. In the north east corner is a vertical ladder that gave access to the window level and perhaps the overhead travelling crane. Attached to the east wall is a large square section air-conditioning duct leading to the plant room to the south. On the north, east and south walls of the main chamber pipes inserted (4 each for north and south) and (3 on the east wall) which connect back to the cable ducts around the edge of the walkway. Below these on each of the walls are pairs of circular threaded fixings. On the upper west wall of the test cell a sign records, telephone instrument room' below it is a light fitting, another sign reads 'Vac Pump running, Vac Pump Stopped' with light fittings above. Also on this wall are large screw threaded fixings eyehooks and there is a single eye hook in the centre of the ceiling.

The roof of the structure is a massive concrete slab covered in shingle and supported on 16 square columns, the height from test cell floor to underside of the roof is 8.75m (28ft 8ins). The openings between the columns were originally filled with wooden framed windows and glazed with perspex panels. A ledge along the top of main chamber carried the rails for an overhead travelling crane. A plate records Becker Twin Lift Maximum Working Load 40 Ton Serial No. A-2647-2.

At the northeast corner of the main chamber a doorway gives access to a service corridor running east-west along the north side of the laboratory. For most of its length on its north side are large diameter cork insulated air-conditioning pipes. To the west a flight of stairs provides access to the top of the north lip of the lift pit and to the upper walkway around the main chamber cell this flight of stairs also gives access to a now blocked door in the north wall leading to the escape passage. A second flight of stairs to the east gives access to the plant room attached to the east side of the building.

To the south of the main chamber is a freestanding air-conditioning plant building of brick cavity wall construction faced with Burwell whites laid to stretcher bond with a flat concrete roof supported by RSJs. The building measures 11.62m (38ft 1ins)x 6.04m (19ft 10ins) and is 4m (13ft) tall. The block was divided into 2 by a brick partition wall, the larger bay to the west was entered through two pairs of wooden doors, above the eastern door is a wooden louvred vent which connects back to the air-con plant and above the western door there is a wooden 2 light window. Between the two sets of doors there is a large 3 light window at eaves height. Internally are 3 large concrete machinery mounting plinths and 1 smaller plinth, sections of metal air-ducts also survive and a metal switch cabinet to the west seems to be associated with a compressor for the lift in the main passage way. In the north wall is a larger square opening formerly with a wooden louvred vent and to the west a small square opening which carried the ducting back towards the entrance passage. An opening in the partition wall carries the ducting into the smaller and now sealed eastern bay. The main west bay was lit by 8 lamps and on its east wall is a metal water tank. The east bay was lit by a 3 light metal framed window at eaves height (now blocked). On the north wall a square section duct connects back to the main chamber.

At the south end of the main plant room is another open framed plant room constructed from 2 I section portal frames with a southerly wall of brick cavity wall construction faced in Burwell whites. In this wall is a large door opening to eaves height, the side walls to east and west were formerly infilled with wooden louvred vents with 5 light windows above. The building was also vented by 2 wooden framed clearstoreys roof vents. The exteriors of the vertical metal columns were formerly protected by copper sheeting. Internally there is a central walkway with now shingle filled cable ducts to either side a single door (now blocked) led back into the south bay of the main plant block. Along the west side of the building is a much decayed section of steel duct work. Various electrical pipes remain attached to the north wall.

To the north of the building is the remains of a flag pole which seems to have also acted as a lightning rod.

The building cost £120,000 and was equipped with a Dowty hydraulic vibration system.

Control Room

AREA/LOCATION:

STRUCTURE No. E4 was 139

DATE: 1960

NGR: TM 43325 48114



ORIGINAL FUNCTION: Control Room

LATEST FUNCTION: Control Room

CONSTRUCTIONAL TYPE: Brick

DIMENSIONS: 35.07m (115ft) x 15.88m(52ft) x
Height: 3.67m (12ft)

DOCUMENTARY REFERENCE: UKAEA SW/S7842/139 Control Room Orford Ness Control Building No 139 Plans, sections and elevations 1 12 61; AWRE 1971 139; PSA 1973 139 New Control Room (disused); TNA:PRO ABI 6/2975

PHOTOGRAPHS: AA99/08482 and AA99/08483, DP070005-6, DP070009, DP070017

RELATIONSHIPS WITH OTHER FEATURES: E1, E2 & E3

DESCRIPTION:

The Control Room is a large single storey rectangular building of brick cavity wall construction faced in Burwell whites laid to stretcher bond. It has a flat roof composed of reinforced concrete beams with concrete block infill and is felt covered. The building may be divided into two sections. The west of the building is slightly taller and wider with a central east-west longitudinal corridor. This may be entered from main entrance from the east and from the west end through a set of double-wooden doors with a louvred vent above. Internally, suspended from its ceiling are various heating and electrical pipes and there are the remains of fluorescent lighting tubes. To either side of this corridor are six bays, three to the front and three to the rear all with cable ducts in their floors. To reduce noise their walls and ceilings were covered by pierced, square plasterboard panels mounted on wooden batons. The southwest room comprises a large open room comprising two bays. The upper sections of the windows appear to have been glazed in a yellow-tinted perspex while the lower windows were glazed in clear glass. It is, however, known that a film company used the building and the yellow perspex, or sugar glass, originate from their activities. Each bay was lit by a large metal-framed ten-light window shielded with internal venetian blinds. Below the windows the exterior walls are finished in a red asphalt-like surface render.

At the east end there is a slightly lower and narrower block which housed the buildings service functions. This was entered through a recessed central porch floored with pink and white chequered flagstones. On the south wall to the west of the entrance are 3 single metal-framed windows set in precast concrete frames. On the return is a large 4 light metal-framed window set in a metal frame lighting a small messenger's room. The building was entered on the west side of the porch and to the east is a small enclosed room. A scar marks the position of a single-skin brick and metal-framed glass entrance to front. Internally, the entrance was separated from a small cloak room to the east by a timber-framed partition. To the west of the entrance is a small self contained switch room and on the front of the building to the west, a small self contained store room with evidence for a sliding door to the central corridor. To the rear of the entry porch is a widowless photographic dark room room with a number of switches and junction boxes attached to its walls. To its east is a single pink-painted (ladies)lavatory. To its east is the cleaners' room with a tile-lined floor. In the northwest corner of the building is a large gents locker room with showers and toilets. The east end of the building is floored in blue and white chequerboard pattern linoleum tiles. At the east end of the main coridor is a small lilac-pink painted tea room room. In the southeast corner of the building is a large lilac-pink mess painted room with a large 8 light metal framed window to the south, originally glazed in yellow perspex. Internally, are two large radiators, a single electric socket and a single light switch. The east end of the building is light by four 3-light metal framed windows set in concrete frames. On the north side is a small self-contained brick calorifier room. On the roof, at its centre, is a raised brick water header tank.

The building cost £33,000.

Magazine

AREA/LOCATION:

STRUCTURE No. E5 was 140

DATE: 1962

NGR:TM 43472 48411



ORIGINAL FUNCTION: Magazine

LATEST FUNCTION: Magazine

CONSTRUCTIONAL TYPE: Reinforced concrete
x 14.6m

DIMENSIONS: 28.34m (92ft 10ins)
48ft) Height to barrel
top 5.42m (17ft 9ins)

DOCUMENTARY REFERENCE: TNA:PRO AB16/2975 E139 12 Jun 62; AWRE 1971; PSA 1973
140 Magazine (disused)

PHOTOGRAPHS: AA99/08498-501, DP068522-24, DP070001-3

RELATIONSHIPS WITH OTHER FEATURES:

DESCRIPTION:

The Magazine is a reinforced concrete building comprising an entrance passage, two storage bays and a rear ventilation passage. The west and east sides of the building are revetted by a shingle traverse and there are traces of lightning conductor copper straps on the structure. The exposed roof surfaces of the Armoury are covered in Asphalt. To the east the entrance passage comprises a drive through barrel vaulted passage, orientated roughly north to south surfaced with a hard smooth concrete surface. Its total width is 4.58m (15ft) and internally it measures 5.18m (17ft) in height to the vault ceiling. Its entrances were closed at either end by now missing wooden outward opening doors, width 3.35m (11ft) set 2.68m (8ft 10ins) from the end of the south passage. To the south of the southern doors in the west wall is a recess containing the remains of an electrical control panel. To the west of the main doors are smaller wooden pedestrian doors clad on either side with metal sheeting, a sign on their exteriors reads 'emergency exit keep clear', above each of these doors are the remains of adjustable metal louvred vents. A small plastic sign on the north door records 'No. 1A', ..

a similar sign on the south door records 'No.2A'. Within the passage at eaves height are fixing plates on the west and east walls that probably mark the position of an overhead travelling crane. On the walls of the passage are a number of sealed magazine lights. To the west of the passage are two self-contained barrel-vaulted storage bays, formerly closed by double wooden outward opening doors, width 3.05m (10ft), height 3.63m (13ft). Entry to both the bays was over a toeboard, batons and screw holes at the entrance mark their positions. Internally the south bay measures 7.45m (24ft 6ins) x 4.55m (15ft), height 5.12m (16ft 10ins), its floor is surfaced in gritless asphalt and it is lit by two sealed fluorescent light units. It is ventilated to rear by a rectangular opening sealed by a plywood unit covered in aluminium with four copper vents. It cost £29,000. The north bay is larger and measures 9.15m (30ft) x 7.45m (24ft 6ins) with a height of 5.12m (16ft 10ins), its floor is also covered by gritless asphalt and it was lit by four fluorescent lights, to the rear it was vented by two rectangular vents with wooden covers. At some point there has been a fire in the north bay. Above each of the internal storage bays is a vertical ventilation shaft capped by a metal vent.

The two bays vent to a passage way to the west which is entered from the south through a single wooden door, its entrance way revetted against the shingle traverse by concrete wing walls. Within the passage way is a metal header tank, an electrical switch box and junction box, possibly for heaters.

Toilet

AREA/LOCATION:

STRUCTURE No. E6

DATE:1955

NGR:TM 43255 48374



ORIGINAL FUNCTION:Toilet

LATEST FUNCTION:Toilet

CONSTRUCTIONAL TYPE:Brick

DIMENSIONS: 3.03m (9ft 11ins)
x 2.21m (7ft 3ins) Height: 2.20m (7ft 3ins)

DOCUMENTARY REFERENCE:AWRE 1971 no number

PHOTOGRAPHS:AA99/08488

RELATIONSHIPS WITH OTHER FEATURES:

DESCRIPTION:

The toilet block is built from red 'Eastwoods 4 Pressed' bricks a single skin thick laid to stretcher bond with a mono pitch formerly timber roof clad with corrugated asbestos sheeting. There is a single entrance at the east end of the south wall and internally two toilet cubicles, each lit by a square window in the south wall.

Electrical Sub Station 2

AREA/LOCATION:

STRUCTURE No. E7 was 166

DATE: 1961

NGR: TM 43350 48149



ORIGINAL FUNCTION: Electrical Sub Station

LATEST FUNCTION: Electrical Sub Station

CONSTRUCTIONAL TYPE: Brick

DIMENSIONS: 11.57m (37ft 9in) x
4.41m (14ft 6in)
Height: 3.31m (10ft 10in)

DOCUMENTARY REFERENCE: UKAEA Orfordness building 166 work drawing for elec sub station SW/S7833/166/AB/1 architect G W Dixon 4.6.60; AWRE 1971 166; PSA 1973 166 Substation 2 (disused) 100 kva 11kv/415v

PHOTOGRAPHS: AA99/08487

RELATIONSHIPS WITH OTHER FEATURES: associated with E8

DESCRIPTION:

The Electrical Sub Station is a rectangular brick-built structure of cavity wall construction with an inner wall of red brick laid to English bond and faced in Burwell whites laid to stretcher bond. The building has a flat concrete roof. It is entered from the east through a double entrance, formerly with wooden doors, with a 3 light metal-framed window above. This is flanked to the north and south by four light metal framed windows with sloping tile sills. At the rear of the main transformer bay is a pebble-filled subfloor channel. On the rear and front internal walls are four electrical heaters and in the southeast corner are three steel CO₂ cylinders which were connected to a fire suppressant system of red painted pipes, which could be activated by an external emergency pull handle to the south of the main door. At the north end of the building is a small self-contained switch room entered through a single door and lit by a two light metal framed window in its north wall. Internally is the remains of a large switch cabinet over a sub-floor duct, a sign on the cabinet reads 'From 300KVA transformer'.

Pump House

AREA/LOCATION:

STRUCTURE No. E8 was 167

DATE: 1961

NGR:TM 43379 48156



ORIGINAL FUNCTION: Pump House

LATEST FUNCTION: Pump House

CONSTRUCTIONAL TYPE: Brick

DIMENSIONS: 13.84m(45ft 5in)x
5.46m (17ft 10in)
Height: 3.72m (12ft 2in)

DOCUMENTARY REFERENCE: UKAEA Orfordness combined pump house for fire mains & condensate & appliance room (NT Orfordness); AWRE 1971 167; PSA 1973 167 Condense & Fire Pump House 72000 gallons in two tanks

PHOTOGRAPHS: AA99/08484-87, DP070007

RELATIONSHIPS WITH OTHER FEATURES:

DESCRIPTION:

The Combined Pump House for Fire Mains & Condensate & Appliance Room has a truncated T-shaped plan and is built from brick cavity wall construction, with an inner red brick wall laid to English bond and faced in Burwell whites laid to stretcher bond. Contemporary drawings describe these bricks as Primrose Gaults. To either side of the main bay (167.2) are windowless self contained bays which were entered from the south through double wooden doors with window lights over. The bay to the west was numbered 167.1, the Condensate Building. The main bay is entered through a single door in its west wall. On the south wall are two large timber-framed openings for full-height double doors. Internally are two large machine bases, two smaller machine bases and pebble-filled cable

Laboratory 2

AREA/LOCATION:

STRUCTURE No. FI was 125

DATE: 1957

NGR: TM 43680 48237



ORIGINAL FUNCTION: Laboratory 2 Centrifuge LATEST FUNCTION: Laboratory 2 Centrifuge

CONSTRUCTIONAL TYPE: Reinforced concrete
(29ft 9ins)

DIMENSIONS: 30.67m (99ft 9ins) x 9.05m
Height: 6.90m (22ft 8ins)
Height to gable 8.75m (28ft 8ins)

DOCUMENTARY REFERENCE: UKAEA Lab No.2 Centrifuge Details of Plant Room Extension SW/S7851/Lab 2/AD18339 24 9 63; UKAEA Lab 2 Orfordness General Arrangement of Centrifuge Installation in Lab 2 Architect G W Dixon 24 6 62 (NT Orfordness); AWRE 125; PSA 1973 125 Lab II & Control Room (disused): AWRE nd, 13; Kinsey 1991, 110

PHOTOGRAPHS: AA99/08503-9, DP068477-80, DP068482-494

RELATIONSHIPS WITH OTHER FEATURES:

DESCRIPTION:

Laboratory 2 comprises a large open central chamber oriented roughly east to west with covered aisles to its north and south, a plant room to the west and is revetted in shingle. It is covered by a steel framed roof consisting of 9 trusses (including the gables), giving 8 bays. The last but one bays at either end are cross braced. The two gable trusses are angle iron A-frames the remainder of the trusses comprise steel channels and angle iron with queen posts. The trusses are raised 0.6m (2ft) above the concrete superstructure on steel columns. The roof was clad with pressed aluminium sheeting insulated with cork sheet and protected by a outer layer of roof felt. Internally, the building was lit by florescent tubes (missing) and a secondary emergency lighting circuit. At nearly eaves height on either side of the chamber there is a projecting ledge which supported rails for an overhead travelling crane. Running longitudinally down the building is a square sectioned air-conditioning duct formerly insulated with cork with a catwalk to its west. On the walls to either side of the main

chamber small bore electrical pipes remain. The main chamber was entered from the east through an entry porch which was originally closed by a pair of wooden doors, which were later made more secure by the addition of crude steel doors. In the southern aisle part of the centrifuge's (see below) mechanism remains, comprising a large red-painted concrete block and steel work framework.

The north aisle was accessed from the west through an entry porch, the outer section of the which was lit by 2 curved, probably perspex, roof lights and it was closed by a pair of outer wooden door whose scar remains. Internally the passageway was sealed by a further set of wooden doors subsequently passageway was further secured by a set of crude external steel doors with an electrical alarm or catch. The aisle roofs are formed from concrete beams between which are curved breeze blocks. To the west of the outer passageway are 2 small rooms of reinforced concrete, the outer and lower room was lit by a 10 light metal framed window to the west(now removed)and on its south side is a small 4 light window. This room is entered from the passage way through a single wooden door. Internally is a flourescent tube light, various electrical fittings and a tiled sink splashback.This room is separated from the room to the south by a brick partition wall laid to stretcher bond.The other room is lit by a 5 light metal framed window on its north side and accessed by a single wooden framed door from the passageway. Internally, are 2 toilet cubicles and a tiled splashback for a pair of sinks.

At the north end of the main chamber is the circular brick lined pit, which housed the Napier centrifuge, to the north and south of the pit are large cut-off I section girders that supported the centrifuge.The cahmber diameter is 30ft (9.14m)(and the centrifuge arm was 8ft (2.44m). Above the centrifuge to the west is the control room, which is accessed from a flight of concrete steps to the east. An 18 light metal framed window overlooks the centrifuge (from the control room).

To the south of the main passageway is a self-contained rectangular reinforced concrete plant block, 20.20m (66ft 3ins)x 6.67m (21ft 11ins), height 3.85m (12ft 8ins). Originally, the building was entered at its south end through a set of double wooden doors with a 4 light metal framed window above and through a set of roughly central double wooden doors. The west side was originally lit by three windows to the east two 16 light windows and between the 2 sets of doors a 12 light window. Subsequently the second window from the north has been partially blocked and a single door has been inserted access to which is through an added brick porch built of Fisons whites laid to stretcher bond.This has created a self contained control room with five holes in its east wall leading back towards the centrifuge/ main chamber. Internally there are various pipes and cable ducts surviving. At the north end of the main plant room the large air conditioning chiller unit survives with the main air intake from the longitudinal overhead duct within the unit air is forced through a series of filter banks and apparently chilled through a cascade of glass sheets sprayed with water. Signs on the side of the chiller unit state 'Washer Spray No 1, Washer Spray No 2, Reheater'. In the remainder of the room are 3 large machine plinths and a small machine base in the corner and infilled cable ducting. One of the plinths adjacent to the 12 light window it appears to be secondary and beneath the window is an inserted vent opening. In the roof are two square vent openings within the room various fittings and cable ducts survive. Butting against the west wall is a brick built outshot in Burwell whites, at its north end is an open transformer bay with an English bond wall to its north within the bay are 2 rectangular concrete plant mountings on its north and south walls are two pairs of gate brackets. To its south was the Rectifier Room, this is of brick cavity wall construction with Fison whites laid to stretcher bond.The building was entered through a set of tall wooden doors at its south end this side was lit by 2 upper large steel framed windows with a wooden louvred vent above the door and windows. The south wall was lit by a single large metal framed window. Internally there is a radiator, cable ducting and a number of cut off pipes high on the southern wall.

The early 1960s drawings suggests that the centrifuge may represent a secondary use for this laboratory. The extensions made to the plant room in 1963 may also relate to this suggested modification.

Laboratory 3

AREA/LOCATION:

STRUCTURE No. F2 was 126/128

DATE: 1956

NGR:TM 43947 48480



ORIGINAL FUNCTION: Laboratory 3 Climatic Testing

LATEST FUNCTION: Laboratory 3
Climatic Testing

CONSTRUCTIONAL TYPE: Reinforced Concrete

DIMENSIONS: see text

DOCUMENTARY REFERENCE: AWRE 1971 126/128; PSA 1973 126 Lab III & Control Room (disused) 128 Lab III Condense Pump House

PHOTOGRAPHS: AA99/085 I 1-13, DP068467-68, DP068470-75, DP068481

RELATIONSHIPS WITH OTHER FEATURES:

DESCRIPTION:

The Climatic Testing Laboratory F2 originally comprised two buildings The Laboratory 126 and adjoining to the east the Condense Pump House 128. The Laboratory comprises a large reinforced concrete chamber oriented roughly north to south with a barrel vaulted roof, described in 1973 as a foam slag arch (PSA 1973). The main entrance to the building is to the south through a substantial reinforced concrete canopy, the southern side of which is protected by a shingle traverse supported by concrete wing walls. A set of metal plates attached to the underside of the canopy mark the position of a central overhead lifting beam that passed into the main chamber. To the east of the main doors is an attached brick building which housed switch gear and air conditioning plant. On the opposite wall are various fuse and switch boxes.

The main chamber is 24.50m (80ft 5ins) long and 6.0m (19ft 6ins) wide and is divided into two uneven cells, to the rear the north cell is 13.50 m (44ft 4ins) long. At the southern end of the chamber where the concrete floor is at the entrance level the chamber is 6.25m (20ft 6ins) high to its apex. Separating the two cells is a large step, 15.30m (50ft) from the rear, north wall, and the floor level drops by about 0.90m (3ft) in the north part of the chamber to the foundation level.

The southern part of the chamber was the preparation area. It was originally sealed at the southern end by wooden doors. Subsequently crude steel framed doors have been attached to the exterior of the building. At eaves height three reinforced concrete tie beams support L shaped brackets for an overhead lifting beam which extended out into the external canopy area. The later steel doors have a cutout to accommodate this beam. The area was lit by fluorescent tubes and there are the remains of a secondary lighting system. On the walls to either side are the remains of cable ducting and small bore conduits for electrical sockets. On the east wall there are also large diameter duct pipes probably for warm air. A passage to the west leads through to an attached switch room (below).

To the north is the large insulated chamber with a suspended floor carried on four concrete dwarf walls. The northern part of the chamber was originally separated from the southern section by an Expandomesh and plaster wall, remains of which are still in situ, which had a large metal door carried on an overhead rail whose mounting brackets remain, the door slid westwards into a slot in the access corridor to the small switch room to the west. The door to the north chamber remains but has been dislodged. Scattered remains of cork insulation board cover the area in the northwest corner a large access corridor leads west into Condense Pump House(see below). Fixed to the wall of the main chamber are various small bore water pipes and electrical conduits. On the rear wall of the chamber in the lower east corner is a large bore pipe that probably leads to an external vent. Also on the rear wall are two enclosed magazine type lights and the remains of two gauges with labels 'TRICHLOROETHYLENE STRAINER INLET' and 'TRICHLOROETHYLENE STRAINER OUTLET'. The northern part of this chamber and the plant room to the west was badly damaged by fire when it was hit by a stray missile during explosive ordnance disposal work (pers comm Grant Lohar NT).

On the west side of the Laboratory is the Condense Pump House 128, this is a large rectangular reinforced concrete building, 16.98m (55ft 8ins) by 6.30m (20ft 8ins) and 4.30m (14ft 0ins) high). It comprises two self-contained rooms, to the south a small switch room and to the north the main plant chamber, both of which connect through to the main chamber

The small electrical switch room to the south is entered from the passageway contained the sliding door to the northern part of the chamber. From the exterior, to the west, it was entered through a pair of double outward opening doors, which were protected by a later brick porch, opening was later sealed by a crude steel grating. A second set of outward opening wooden doors were also attached to the outward end of the porch. The room contains the remains of electrical switch gear and metal cable ducting, probably from monitoring equipment. The room was lit by enclosed electrical bulbs and a red pipe probably carried a CO₂ fire suppressant system. An air conditioning duct runs longitudinally down the centre of the room. At the east end of the room the single door giving access into the main laboratory is aluminium clad.

The large plant room of the Condense Pump House was entered from the outside through a pair of outward opening wooden doors and was originally lit by two rectangular windows in the west wall subsequently blocked in brick. To the south of the door opening is a frame that probably held carbon dioxide bottles for the fire suppressant system. Internally, are the remains of a large cooling plant on the north wall, with three vents to roof. There are also a number of concrete mounting blocks of various sizes and cable ducts in the floor. In the southwest corner is a large electrical switch box with several signs, including 'LIGHTING', 'PLANT ROOM FANS AND PUMP', 'CALORIFIER PUMP', 'EXHAUST FAN', and 'UNIT HEATER'. Still attached to its walls are various small bore pipes, electrical conduits, box section cable ducts, lights and switches. In the north corner a large corridor runs eastwards to the northern end of the main chamber, the floor level of this corridor is the same as the lower floor level in the main chamber and reached by three steps down from the plant room. Externally on the north side of the Plant Room is a cast concrete flanking wall retain-

ing the shingle traverse and protecting a large rectangular air intake or vent with a metal grill over.

To the northwest of the plant room is an originally freestanding small rectangular building (3.52m (11ft 6ins) × 2.45 (8ft 0ins) and 2.45 (8ft 0ins) high) constructed of Burwell white bricks laid to English bond, which was formerly covered with a flat, steel framed, felted roof (now missing). It is entered from the east through a single wooden door opening with a concrete lintel. To the west is a wooden louvred vent and to the east originally was a small rectangular window subsequently blocked with red bricks. In the north wall are 5 pipe openings of various diameters. Internally are the remains of a switch and fuse box. The building might have been used to house a compressor.

This small block was subsequently extended to the south in red brick, which match those used to block the window. The new building was laid to English bond with closers with a rectangular window in the west side with a concrete lintel and a red tile sill. On the south side is a double wooden door, outward opening with a concrete lintel.

This extended building was subsequently linked to the main concrete plant room by the insertion of a new plant room and smaller toilet block, its north and south walls are constructed with red bricks cavity walls laid to stretcher bond, the west wall is laid to English bond and crudely tied in to the existing structure. Its roof is of reinforced concrete covered in asphalt. There are single outward opening wooden framed doors placed centrally in the south and north walls. In the north wall is also a metal framed 6-light window. The floor of the northern room is dissected by cable ducts and in the southeast corner are the remains of an electrical switch box and cable trunking. On the wall of this room are various electrical conduits, sockets, switches and lighting. The southern part of the extension was given over to a pair of toilet cubicles toilet and a washbasin compartment.

At the north end of the traverse is a large concrete cube 0.92 × 0.90 × 0.82m (3ft) with the remains of two steel channels set vertically in the top.

Laboratory I

AREA/LOCATION:

STRUCTURE No. F3 was 123

DATE: 1956

NGR:TQ 44074 48572



ORIGINAL FUNCTION: Laboratory I Large Vibration

LATEST FUNCTION: Laboratory I
Large Vibration

CONSTRUCTIONAL TYPE: Reinforced concrete

DIMENSIONS: Height 6.83m (22ft
6in) (to eaves)

DOCUMENTARY REFERENCE: AWRE Project SAX/E52 Laboratory No. I General Arrangement
C W Glover and Partners Record Drawings as on 25 6 56; AWRE Project SAX/E52 Laboratory
No. I area Record Drawings as on 25 6 56 (NT Orfordness); AWRE 1971 123 and 127; PSA 123
Lab I (disused) 127 Lab I Store)

PHOTOGRAPHS: AA99/08503-8, AA99/08514-18, DP068441-44, DP068446-66, DP068469,
DP070016

RELATIONSHIPS WITH OTHER FEATURES:

DESCRIPTION:

The Large Vibration Laboratory, Laboratory I, comprises a large rectangular central structure oriented southeast to northwest protected by a substantial shingle traverse. To the north west is a plant room and a detached store (127) and to the northeast an electrical switch room. The main chamber is entered through a substantial concrete passage to the southeast and another at its northern end and entering from the southwest. The main bay is 30.69m (100ft) x 9.13m (30ft) and is divided into two unequal portions, the larger Vibration Laboratory to the southeast, length 17.32m (57ft) and the smaller bay to the north west, length 12.15m (40ft) that housed a Drop Test Laboratory. The dividing wall is 1.22m (4ft) thick with a 3m (9ft 9ins) wide opening connecting the two parts of the bay. There is a pit (now water filled) running almost the full length of the bay along the northern side. The pit is 3.18m (10ft 5in) wide and 2.74m (9ft) deep, there is an access ledge at its southern end

and running along the north wall. The pit passes beneath the dividing wall and fittings on its surface indicate that both openings had some form of sliding screen closures. Coupled with the separate entrances it probably indicates that discrete tests could be carried out in either bay. At the southern end of the pit is a flight of concrete steps leading down into the pit and a steel ladder. On the pit walls there are numerous mounting plates, rings and electrical switch boxes. In the north east corner is the remains of an air-conditioning type duct which may have connected to ducts above that run through the east wall and out of the bay. Roughly centrally placed within the pit, just to the E of the dividing wall, are two small projecting platforms about 1.1m (4ft) below the main floor level. Immediately to their east on the main floor; on either side of the pit, are numerous large mounting bolts. Attached to the walls of the bay are numerous small bore pipes that contained the electrical wiring for lights and wall mounted sockets. Also mounted on the walls are slightly larger bore pipes with occasional gauges and glass bulbs perhaps for the delivery of hydraulic fluids. Painted signs on the walls 'VAC AND AIR' mark the position of removed pipes. There are also painted 'EMERGENCY STOP' and 'CO2 STOP' signs with associated switches by the southern entrance. At the eastern end of the north wall are numerous openings leading into the plant room to the north. On wall of the bay there is an iron ladder leading up to overhead walkways allowing access to air conditioning ducts and lighting. The shallow pitched roof is constructed from angle iron and comprises nine W-shaped trusses, raised slightly above the wall top, forming 7 roof bays. The roof was clad in pressed aluminum sheeting and externally insulated with 0.05m (2ins) cork panels stuck to the cladding with bitumen and covered by felt sheeting, the raised vertical sides were similarly treated. From the northwest plant room two large square ducts enter the main bay through the northwest gable. One of these runs along the centre of the roof space supported within the trusses and had 4 vertical square ducts dropping down from it, two of which survive. The other duct entering the main chamber divides into two and these then run along the sides of the chamber also supported within the roof space. These lateral ducts had regular rectangular downward facing vents. These two systems presumably combined to circulate air within the bay. On the north wall of the main chamber, just to the east of the dividing wall is a large diameter, heavy gauge iron pipe, which has been closed off by a similar gauge end plate. This ran outside and the other end is open, but covered by a circular baffle plate.

Three rows of double fluorescent tube lights run longitudinally along the bays. There was also a secondary system of pendant light fittings some of which remain within the roof space and some of which reach down into the bay.

At a height of 4.58m on the north and south walls of the main chamber are ledges marking the position of rails for overhead travelling cranes.

The small bore electrical conduits described above are also in the smaller bay. They appear to originate here with three square junction boxes on the west wall, possibly running through into the northwest plant room. A fourth larger junction box on the west wall appears to be part of a different system. The main conduits from this run along the north wall and end in a mass of connectors half way along the smaller bay. There are also several other ducts in the west wall that probably run through to the same plant room. On the north face of the partition wall above both of the openings are pairs of vertical battens, pulleys and rotating catch plates, probably indicating the presence of screens to conceal the activities within the bays. Just before the north west end of the pit it widens on both sides for 2.55m (8ft 4in) to a 4.34m (14ft 3in) total width. At this end the pit finishes flush with the end wall, unlike the east end where there is an access ledge around the end).

The south eastern entrance comprises a main entrance passage 15.50m long (51ft) by 3.35m (11ft) wide and 3.19m (10ft 6ins) high. Originally it was closed by two hinged externally opening wooden doors (the inner having counterweights), giving a central bay of 10.10m (33ft) which was lit by three lights set in ceiling recesses. On its north side are two rooms which may have contained switch and monitoring equipment. The western of these two rooms had double wooden doors, now missing.

There is a painted notice to the east of these doors 'ROOM 7 RAC...SUP' above this a switch box and below is another painted sign : 'AIR 60 PSI'. Also on its wall is a large entry or alarm bell. A blocked door gave access from the northwest corner of this room into the main Bay. The eastern room had a single wooden door, also now missing. A duct runs through both rooms from the main chamber bay to the exterior. The eastern end of the entry passage is closed by a crude steel gate.

The entrance from the southwest is 14.15m (46ft 6ins) by 3.35m (11ft) wide and 3.19m (10ft 6ins) high. It was originally closed by a pair of wooden swing doors, the internal door again counterweighted, giving an internal bay 9.20m (30ft) in length. Within the passage way is large entry or alarm bell there are also numerous cable conduits leading from a fuse box recessed into the wall close to the entrance. This entrance passage was also lit by three lights set within ceiling recesses. Subsequently, and during AWRE occupancy the southern end of the passage was sealed by a crude steel gate and is respected by the latest interior painting. This was later partially removed and replaced by a concrete block wall infill and modern steel gate. On the southeast side of the passageway is single door to perhaps a former staff room and beyond two toilet cubicles. In the southwest wall, the larger room is lit by a 30-light metal framed window, now replaced by steel grill, and the two toilet cubicles are each lit by 6-light metal framed windows with wired opaque glass.

To the northwest of the large chamber is a self-contained rectangular reinforced concrete plant room, dimensions 21m (69ft) x 6.14m (20ft) and 3.89m (12ft 8ins) high, with a flat bitumen covered roof. On the three sides abutting the main chamber is an external brick skin wall to act as damp course against the shingle traverse. The plant block is divided into two uneven rooms. At the southwest end the room was originally from the north through a large opening closed with a roller shutter, which survives on the interior. Subsequently this large opening was blocked by a brick cavity wall with a 15 light metal framed window and a double wooden outward opening door. The room was also lit by a 15 light metal framed window in the southeast wall. Outside to the south is a small free-standing brick locker housing a centrifugal pump by Holden & Brooke. Returning to the main plant room, the interior is partitioned by a brick wall with a blocked doorway at its west end. The large plant room is lit by one 9-light and two 15-light metal framed windows in the northwest wall. It was originally entered by two double doors at each end which were subsequently blocked by breeze blocks. In the centre is a large breeze block in-filled opening that may have contained a vent. An iron ladder fixed to the wall gives access to the roof, also attached to the wall is external electrical lighting and an emergency bell. In the north east wall is a single small louvred vent. It was not possible to gain access to the main plant room, but it was seen to contain the remains of a filter unit. This was connected through large square ducts in the ceiling to the ducting system in the main laboratory chamber.

To the north of the main chamber is another self-contained plant room that was probably devoted to electrical switch gear. This building is 15.88m (52ft) by 6.12m (20ft) and 3.85m (12ft 6ins) high. It is constructed of reinforced concrete with a brick skin on its southeast, southwest and northwest sides where it abuts the shingle traverse. It too is divided into two rooms by a single brick thick wall laid to stretched bond with an inset central wooden connecting door. The bay to the east is slightly smaller and is entered through a double door opening formerly sealed with wooden louvred doors. It was lit by one 6-light window with a louver beneath and to the east a 9-light window with a large louver beneath. There is also a ceiling vent with a metal louve. Internally there is the remains of the central heating system. Rectangular metal cable ducts connecting back to the main laboratory run around the east and south walls. Air conditioning ducts mounted on the south wall also connect through to the main laboratory chamber. There is a wall mounted electrical fuse box and electrical lighting. In the southwest corner is a stand for five CO₂ bottles which connect to a fire suppressant system of red metal pipes. An adjacent sign reads 'CO₂ ISOLATING SWITCH'. A red pipe also runs to an externally mounted box containing a pull handle attached to a wire. Above this is a small red painted alarm bell. Another red pipe connects to the air conditioning ducts and there is a connector for another CO₂

cylinder. Roughly in the centre of the room is a concrete machine plinth 3.10m (10ft) by 1.02m (3ft 4ins) with fixing bolts at one end and brick footings. Stencilled signs on the walls record 'V1 PLANT EMERGENCY STOP' and 'V2 PLANT EMERGENCY STOP'. The northwestern, and slightly larger bay, was entered by a tall central double door in the north wall flanked by two 15-light metal framed windows. Inserted into one light of the west window is a large ducted extractor fan. Attached to the walls are various rectangular section metal cable ducts running to several switching and fuse boxes in the northwest corner. There is also a large junction box on the dividing wall to the north of the door. Red piping runs around the room from the five cylinder CO2 rack in the adjacent bay to several outlet points around the walls. On the south wall is a metal box with a plate reading 'GOODMANS INDUSTRIES LIMITED DC SUPPLY SET FOR VIBRATION GENERATOR TYPE 10B INPUT 400/440 VOLTS 3 PHASE PT NO N0.7620-S WEMBLEY ENGLAND'. In the east and west walls, centrally placed at a height of 2.78m (9ft) (to top) are the cut off stumps of an I section lifting beam. The room was heated by two radiators. At its east and west end are two cable gullies in the floor. Pendant electric lights were used throughout. At the east end of the building is a round alarm button mounted externally.

Laboratory Store

AREA/LOCATION:

STRUCTURE No.F3 was 127

DATE: 1956

NGR:TQ 44037 48579



ORIGINAL FUNCTION: Laboratory Store

LATEST FUNCTION: Laboratory Store

CONSTRUCTIONAL TYPE: Reinforced concrete

DIMENSIONS: 10.92m (35ft 10ins) x 6.1m (20ft) Height: 3.92m (13ft)

DOCUMENTARY REFERENCE: AWRE 1971 127; PSA 1973 127 Lab Store

PHOTOGRAPHS:

RELATIONSHIPS WITH OTHER FEATURES: To rear of F3

DESCRIPTION:

To the northwest of Laboratory I is the former Laboratory Store is a rectangular reinforced concrete building with an integral flat concrete asphalt covered roof. On the south west side was a large full height entrance which has subsequently been blocked with red brick wall laid to English bond with an off centre, single wooden door beneath a concrete lintel to the southeast. Above it is a centrally mounted external light. The former large opening is flanked by 6-light metal framed windows with wired opaque glass. Below each window is a single protruding L iron with mounting holes. On northwest side was originally a double door opening with the remains of an external light above the door. To its south a 9-light metal framed window with wired opaque glass. A further window to the south has subsequently been blocked with the same type of bricks as on the south face entrance, although these are laid to stretcher bond. The northeast side of the building was lit by two 15-light metal framed windows with opaque wired glass. The southeast side of the building is blank. Internally the building is split into three rooms. The original partition wall between the southwestern and central rooms was constructed of brick laid to English bond, into this has been inserted a single wooden door. The brick used around this insertion matches those used to block the large entrance and window. Remaining in the southern room are two pendant lights, a wall socket and two switches. The original north bay has been divided into two by the insertion of a single skin breeze block wall. The later central room contains two pendant lights, a GEC distribu-

tion board/fuse box, and a single small mounting block similar to those in the north bay. On the partition wall are two horizontal wooden boards, the upper was used as a coat rack. In the north bay itself are five mounting blocks of various sizes and an off centre cable duct running outside beneath the north wall. There is a small vertical brick chimney directly above the largest mounting block, also in the room are the remains of two pendant lights. In the northeast corner of the east wall are several small bore metal pipes running through the wall and back towards the main laboratory buildings. There are also several pipes of various sizes running through the west wall. On the inserted wall are several plates used for mounting the horizontal boards.

Control Room

AREA/LOCATION:

STRUCTURE No. F4 was 124 & 67

DATE: 1956

NGR:TM 44196 48630



ORIGINAL FUNCTION: Control Room

LATEST FUNCTION: Control Room

CONSTRUCTIONAL TYPE: Reinforced concrete and brick
9ins) x 11.70m

DIMENSIONS: 12.14m (41ft
(38ft 5ins) Max
height 4.60m (15ft 0ins)

DOCUMENTARY REFERENCE: AWRE 1971 124; PSA 1973 124 Control Room (disused)

PHOTOGRAPHS: AA/08518; DP068438-40

RELATIONSHIPS WITH OTHER FEATURES: F3 Laboratory 1, F8, after 1963 the Impact Facility F5

DESCRIPTION: F4 is sometimes described as a Laboratory although its function was as a control and monitoring building for Laboratory 1 (F3) and later the Hard Impact Facility (F5). It is an L shaped building covered by a shingle traverse, constructed mainly of reinforced concrete but with brick elements and is covered by a flat concrete roof sealed with asphalt. The building was originally entered from the east through a reinforced concrete porch with an open side to the south and a three light metal Crittall window in its east wall. The north exterior side of the porch is blank except for the remains of electrical fittings. Perhaps around 1963, when the building became the control centre for the Hard Impact Facility, the open southern side was bricked up and a brick porch with double wooden doors added. To the west of the porch is a taller three bay structure with a projecting wing wall from the southeast corner to retain the shingle traverse. The south bay housed two toilet compartments and is lit by a three light Crittall window. In the central bay is a blocked double entrance. In the angle of the L is a later brick wall laid to stretcher bond with a concrete roof shielding the toilet compartment and the former entrance. The southwest bay is entered through the main covered porch area and retains some air conditioning plant. This in turn gives access to large monitoring room with a suspended floor to the west, which retains a few metal cabinets. On the roof of the porch section is a small galvanised metal header tank enclosed by Burwell white bricks.

Impact Facility

AREA/LOCATION:

STRUCTURE No. F5 was 171

DATE: Late 1963 or early 1964

NGR: TM 44227 48670



ORIGINAL FUNCTION: Impact Facility

LATEST FUNCTION: Impact Facility

CONSTRUCTIONAL TYPE: Reinforced concrete

DIMENSIONS: 15.27m (50ft) x 3.67m
(12ft) Concrete base maximum height 3.05m (10ft)

DOCUMENTARY REFERENCE: AWRE 1971 171; PSA 1973 impact facility (disused)

PHOTOGRAPHS: NMR 20457, RAF/58/6492 (F41) frames 079-083 27 Aug 64; OS65054,V, frame 108 30 Apr 65; AA99/08519 and AA99/08520; DP068429-37, Kinsey 1981, 107

RELATIONSHIPS WITH OTHER FEATURES: F4 (124)

DESCRIPTION:

The remains of the Impact Facility comprise a reinforced concrete wall oriented southeast to northwest with a battered rear (southwest) this side also has an extended tank at its base now infilled with shingle. On the top of this wall are the remains of the steel and timber superstructure which housed cameras to record the impact of the rocket sledge at the base of the wall, these remains project about 1.7m above the concrete base. On the rear wall there are also the remains of steel mountings that are also probably associated with the superstructure. At the southeast end of the wall are the remains of electrical fittings and a small well formed square section bronze fitting of unknown function below. Adjacent to it are the remains of a telegraph pole with electrical fittings. On the northeast face of the wall are a number of spalled areas that represent where the bombs impacted on the wall. To the northeast a large expanse of largely featureless cast concrete slab extends away from the wall. On this slab are two electrical switch boxes and a number of metal grid covers that gave access to the cable ducts. Around the boundary of the slab are a number of fixing point for guy wires, probably to secure the track for the rocket sleds.

This facility was specifically constructed to assist in the development of the nuclear WE177 'lay down' series of bombs.

Plinth F

AREA/LOCATION:

STRUCTURE No. F6 was 113

DATE: 1956

NGR: TM 43656 24831



ORIGINAL FUNCTION: Electrical Transformer

LATEST FUNCTION: Electrical Transformer

CONSTRUCTIONAL TYPE: Reinforced Concrete

DIMENSIONS: 7.34m (24ft) x 4.63m (15ft)

Height: 2.84m (9ft 4ins)

DOCUMENTARY REFERENCE: AWRE 1971 113; PSA 1973 Plinth F 250 kva 11kv/415v

PHOTOGRAPHS: AA99/080, DP068445

RELATIONSHIPS WITH OTHER FEATURES: Identical to F7 112, adjacent to F1

DESCRIPTION:

This structure is a simple rectangular reinforced concrete blockhouse open to the north and protected to the east, south and west by a shingle traverse supported by wing walls to the east and west. Internally are three concrete mounting plinths, on the east wall

Plinth E

AREA/LOCATION:

STRUCTURE No. F7 was 112

DATE: Late 1950s

NGR:TM 44055 48421



ORIGINAL FUNCTION: Electrical Transformer

LATEST FUNCTION: Electrical Transformer

CONSTRUCTIONAL TYPE: Reinforced concrete
4.60m

DIMENSIONS: 7.40m (24ft 3ins) x
(15ft)ins) Height 2.85m (9ft 4ins)

DOCUMENTARY REFERENCE: AWRE 1971 112; PSA 1971 Plinth E 300kva 11kv/415v

PHOTOGRAPHS: AA99/08510, A0000146

RELATIONSHIPS WITH OTHER FEATURES: Identical to F6

DESCRIPTION:

The Instrumentation Bay is a small rectangular reinforced concrete structure within a shingle traverse. It has been damaged by explosive demolitions and is missing part of its roof, internally are exposed reinforcing bars. It was originally open to the south, its remaining sides were protected by a shingle traverse supported by concrete wing walls.

Mess Room

AREA/LOCATION:

STRUCTURE No. F8 was 130

DATE: 1956

NGR: TM 44210 48631



ORIGINAL FUNCTION: Store?

LATEST FUNCTION: Mess Room

CONSTRUCTIONAL TYPE: Brick
0ins) x 3.90m

DIMENSIONS: 5.20m (17ft
(12ft 9ins) Height:
2.48m (8ft 1ins)

DOCUMENTARY REFERENCE: AWRE 1971 130; PSA 1973 Mess Room

DESCRIPTION:

This small single storey brick built store is oriented north to south and is constructed from Burwell whites laid Flemish bond with closers. It has a flat asphalt covered concrete roof. On the west side is a large double opening with a concrete lintel and later breeze block infill, iron fittings probably mark the position of a former door frame. To the east of the door is an electrical socket. Its north elevation is blank except for an external light fitting. The east elevation south has a double window opening with concrete lintel and sloping tile sill. In the south elevation was a window opening which has subsequently been blocked and a single door inserted. Internally on the north wall is a horizontal white tile band splashback, and on the south wall are remains of electrical switch gear. It has a red painted concrete floor slab.

Black Beacon

AREA/LOCATION:

STRUCTURE No. GI was 40

DATE: 1928

NGR:TM 44510 48811



ORIGINAL FUNCTION: Black Beacon

LATEST FUNCTION: Black Beacon

CONSTRUCTIONAL TYPE: Concrete and timber

DIMENSIONS: see below

DOCUMENTARY REFERENCE: AWRE 1971 not shown; PSA 1973 40 Beacon (disused)

PHOTOGRAPHS: AA99/08471-3; A000117-124, DP068424-7, Kinsey 1981, 97

RELATIONSHIPS WITH OTHER FEATURES: G2

DESCRIPTION:

The Black Beacon is an octagonal tower set on a mass concrete base with buttresses at each corner standing to a height of 2.9m (9ft 6ins), each of its walls measures 2.7m (8ft 10ins). In its north elevation is a 4 light wooden casemate window with a tile sill protected by an iron grille, below the window is a hole through which protrude a bunch of cut-off co-axial cables. In the south elevation is an identical window. To the west is an abutting brick concrete entry porch. To the north a set of double wooden outward opening doors give access to the west side of the octagonal brick base. Internally are remains of electrical switch gear. The upper storeys of the Black Beacon are timber framed and covered by tarred weather boards and it has a felt roof, its eastern side is protected by a lightning conductor. Entry to the beacon is at first floor level by means of a modern flight of wooden and steel stairs. Its first floor is lit by wooden 4 light windows with central hinges in its northwest, southwest, southeast and northeast sides. On the second storey are hinged observation ports on all side. The tower continued into use with AWRE and adjacent to it was a telemetry mast whose concrete footings survive..

Work Shop

AREA/LOCATION:

STRUCTURE No. G2 was 46

DATE: 1933

NGR:TM 44518 48832



ORIGINAL FUNCTION: Generator House, Work shop

LATEST FUNCTION: Display Room

CONSTRUCTIONAL TYPE: Brick

DIMENSIONS: Length 7.37m (24ft 2ins)
Width 5.7m (18ft 9ins) Height

DOCUMENTARY REFERENCE: AWRE 1971 46; PSA 1973 Workshop (disused)

PHOTOGRAPHS: AA99/08474-5; 67 Kinsey 1981, 97

DESCRIPTION:

The former Generator House and Workshop is a single storey red brick building laid to stretcher bond with gable ends to the east and west with wooden framed ocular windows in each of the gable end walls. Internally there is a single wooden kingpost truss with raking struts and a steel rsj lifting beam, on the floor are the scars from the removal of plant. The roof is currently clad in modern galvanised, corrugated metal sheeting and the building is vented with terracotta vents at floor and eaves height. In the north elevation are two wooden 8 light windows with concrete sills and lintels, the west elevation is blank. Abutting the south elevation is a later red brick porch laid to English bond with a flat concrete roof, entry is through double wooden doors on the east side of the porch. On the south elevation is a large, probably inserted, metal framed 15 light window. To the east was a probably secondary outshot which has subsequently been demolished, its position marked by a scar on the south wall. The opening to the main building has been infilled in red brick and a 9 light metal framed window.

Subsequent to the demolition of the outshot a concrete slab was laid at the southeast corner to support two barrels of 0.92m diameter (3ft). Immediately to the south of the building is a possible tank support width 1.69m (5ft 7ins) x length 0.32m (1 ft) height (1ft 1in) 0.42m (1ft 4ins).

Headquarters

AREA/LOCATION:

STRUCTURE No. G3 was 47

DATE: 1956

NGR:TM 44542 48793



ORIGINAL FUNCTION: Headquarters

LATEST FUNCTION: Headquarters

CONSTRUCTIONAL TYPE: Concrete

DIMENSIONS: See below

DOCUMENTARY REFERENCE: AWRE 1971 47; PSA 1973 SET HQ Offices; Kinsey 1981, 97

PHOTOGRAPHS: AA99/0847173, AA99/08476-77, DP068428

RELATIONSHIPS WITH OTHER FEATURES: adjacent to G4 49

DESCRIPTION:

The former Headquarters building comprises three main elements, to the north are the foundations of a large prefabricated building, a linking corridor to the east and to the south the foundations of a large brick built structure. To the north a large L-shaped pre-fabricated building 44.3m x 23.8m (145ft 4ins x 78ft) was constructed from reinforced concrete columns set 0.92m (3ft) apart and infilled with concrete slabs. Double doors at the western end of the northern block gave access to a longitudinal corridor that divided the building into two with rooms to either side, at the eastern end of the corridor and on its north side were toilets and a self-contained electrical switch and a telephone switch room. At its eastern end and set perpendicular to it was another corridor accessed through double doors to the north, this linked to the building to the south and at the eastern end of the prefabricated building also defined a largely open, perhaps stores area. To the south the building appeared to have had a largely open plan and may have been used for stores. Its concrete foundation slab measures 24.2m (79ft 5ins) x 12.35m (40ft 6ins) and its walls were of cavity wall construction from Fletton bricks. The building was entered from the west through a recessed porch and double doors which gave access to a longitudinal corridor; faint scars to either side mark the position of bay or room divisions. At its eastern end is a small quarry tile covered concrete plinth 1.57m (5ft) x 1.02m (3ft 4ins), perhaps for holding batteries. At some point the two buildings were joined, scars on its floor mark the position of two rooms and the linking north-south corridor. Externally to the rear concrete feet mark the position of a metal framed lean-to 8.95m (29ft 5ins) x 5.8m (19ft).

Boiler House

AREA/LOCATION:

STRUCTURE No. G4 was 40 and 49

DATE: 1956

NGR:TM 44524 488 | 1



ORIGINAL FUNCTION: Boiler House

LATEST FUNCTION: Boiler House Demolished

CONSTRUCTIONAL TYPE: Concrete

DIMENSIONS:

North-South Range: Length 9.08m (29ft 10ins) Width 4.22m (13ft 10ins)

East-West Range: Length 5.16m (16ft 11ins) Width 8.05m (26ft 5ins)

DOCUMENTARY REFERENCE: AWRE 1971 40 and 49; PSA 1973 Boiler House additional fuel oil tank 2000 gallons 1969 water tank room above

PHOTOGRAPHS: AA99/08472-3; Kinsey 1981, 96

RELATIONSHIPS WITH OTHER FEATURES: adjacent to G3

DESCRIPTION: The Boiler House was originally an L-shaped building with a double brick skin of fison Burwell whites. Former door ways are distinguishable by steel strip thresholds. Access to east-west range was by means of a single door in the northwest corner of the building, this range split into 2 rooms. In southwest corner are 6 pipes for cable routes, the pipes seem to be contemporary with the casting of the floor. Adjacent to the north wall is an infilled hole, it appears to be for cable routes but is evidently a secondary feature, directly next to this hole are 2 metal fixings set into the floor presumably for plant. In the southeast corner are 6 metal fixings for plant, probably for two different machines. In the central room are the foundations of three brick piers each one brick in width, the bricks are stamped 'Fletton Limited' and may represent a tank support. The southern bay is roughly divided into two by a brick partition wall, the bay to the east was entered through a double door on its south side. The western bay was entered from the south through a double door, marked by a metal strip. Internally is a rectangular blue engineering brick plinth and to its east small scar on the floor marks the position of another machine base. The eastern bay was originally entered through double doors in its north east corner, internally is a concrete machine plinth and to its west a partition wall, in the central bay are three further small machine beds these are in part built from LBC bricks.

Small Vibration Laboratory

AREA/LOCATION:

STRUCTURE No. G5 was 48

DATE: 1956

NGR:TM 44550 48823



ORIGINAL FUNCTION: ?Garage

LATEST FUNCTION: Small Vibration Laboratory

CONSTRUCTIONAL TYPE: Brick

DIMENSIONS: 6.95m(24ft 10ins)6.05m (19ft 10ins)
Height: 2.9m (9ft 6ins)

DOCUMENTARY REFERENCE: AWRE 1971 48: PSA 1973 Small Vibration Lab Garage (disused)

PHOTOGRAPHS:

RELATIONSHIPS WITH OTHER FEATURES: Associated with G5

DESCRIPTION:

The Small Vibration Laboratory, perhaps adapted from a garage, is a single storey rectangular building of brick cavity wall construction faced in Burwell whites laid to stretcher bond contrasting with a red brick face to the west. It has a flat 17cm thick concrete roof. Metal framed windows with concrete sills and lintels are used throughout, on the insides of the windows are wooden runners for blinds or covers.

The building is entered from the west through a double door opening protected by a projecting red brick porch laid to stretcher bond which projects 1.26m (4ft 2ins) from the face of the building. This appears to be a later modification as this wall overlies an earlier metal rail door stop. In the south elevation is a double light window, the east elevation has three double light windows and the north elevation has a double light window. The western end of the building appears to have been reconstructed, the westernmost 0.9m (3ft) of which appears to have been rebuilt and laid to English bond.

Internally is a solid concrete plinth 1.57m (5ft) x 0.61m (2ft) x 0.9m (2ft 11ins) on top of which is a steel plate, on the floor are three steel plates, probably for machinery mounting. Against the north wall are two power cable inlets, and against the south wall a single inlet.

The building probably housed equipment to power the circular test track to its west. This comprises circular concrete track 0.92m (3ft)wide with an external diameter of 6.98m (22ft 11ins), on the surface of which are the slight grooves with a gauge of 0.4m (1ft 4ins)which marks the track of a test vehicle. The centre of the track is gravel filled and a filled narrow channel leads back to building G5 that probably housed the equipment to power the test track.

Office Annexe

AREA/LOCATION:

STRUCTURE No. G6 was 50

DATE: 1959

NGR:TM 44544 48755



ORIGINAL FUNCTION: Hut

LATEST FUNCTION: Demolished

CONSTRUCTIONAL TYPE: Pre-fabricated timber hut

DIMENSIONS: 11.16m (36ft 8ins)
x 4.95m (16ft 3ins)

DOCUMENTARY REFERENCE: AWRE 1971 50; PSA 1973 SET Office Annexe

PHOTOGRAPHS: AA99/08477; Kinsey 1981, 96

RELATIONSHIPS WITH OTHER FEATURES: Covered passage to 47

DESCRIPTION:

The remains of the office annexe comprise a concrete foundation slab, scars on its surface indicate a longitudinal corridor that was entered from the north, to either side at its northern end were four small rooms and to the south a large open room, perhaps a store. On its eastern side a concrete path led to a single door.

Police Lookout Tower

AREA/LOCATION:

STRUCTURE No. G7 was 38

DATE: 1956

NGR:TM 44620 48568



ORIGINAL FUNCTION: Police Lookout Tower

LATEST FUNCTION: Police Lookout Tower

CONSTRUCTIONAL TYPE: Timber

DIMENSIONS: 3.66m (12ft) square
Height to platform 7.52m (24ft 8in)
to eave of hut 9.60m (31ft 6in)

DOCUMENTARY REFERENCE: AWRE 1971 38 Police Lookout; PSA 1973 Police Lookout Tower (disused)

PHOTOGRAPHS:

RELATIONSHIPS WITH OTHER FEATURES:

DESCRIPTION:

The Police Tower is a four stage timber tower with the remains of wooden cabin on top and an internal staircase.

Compound

AREA/LOCATION: G Area

STRUCTURE No. GEH 5

DATE: 195?

NGR: TM 44517 48822



ORIGINAL FUNCTION: Compound

LATEST FUNCTION:

CONSTRUCTIONAL TYPE: Concrete

DIMENSIONS: 3.05m (9ft 10ins) square

DOCUMENTARY REFERENCE:

PHOTOGRAPHS:

RELATIONSHIPS WITH OTHER FEATURES: GI

DESCRIPTION:

At each of the four corners of this concrete slab are 4 sawn off scaffold poles forming a 2.3m (7ft 7ins) square. This probably represents the remains of a fenced off storage compound.

Bomb Ballistics Building

AREA/LOCATION:

STRUCTURE No. HI was 44

DATE: 1933

NGR:TM 44553 49208



ORIGINAL FUNCTION: Bomb Ballistics Building

LATEST FUNCTION: Bomb Ballistics Building

CONSTRUCTIONAL TYPE: Mass concrete/brick

DIMENSIONS: 7.8m (25ft 7ins) x 3.98m
(13ft)
Height: 6.69m

DOCUMENTARY REFERENCE: AWRE 1971 44 (Old BB); PSA 1973 Old Ballistics Buildings dis-used

PHOTOGRAPHS: AA94/3750-3; AA94/3764

RELATIONSHIPS WITH OTHER FEATURES:

DESCRIPTION:

The ground floor of the building is constructed from mass concrete with a single room, which is open to the north. Its door jambs are infilled with brick and probably originally held a double wooden door. Internally the upper storey is supported by two original RSJs and two modern galvanised steel portal frames, which have replaced two vertical I girder columns. At the top of the southwest corner is a single vent opening. On the floor of the bay are two large concrete plinths and on the walls the scars left by the removal of electrical equipment.

Above this bay is a first floor brick built observation room. This is entered from a modern galvanised steel staircase leading to set of double wooden doors in its east wall. The stairs also give access to the roof observation platform. Its southeast corner is cut away and there is an angled wooden observation window. In the west wall is a steel framed window, perhaps dating to the 1950s, in its north wall is a 12 light metal framed window, both windows have concrete sills and lintels. On the

Electronics Workshop

AREA/LOCATION:

STRUCTURE No. H2 was 118

DATE: 1958

NGR:TQ Not known



ORIGINAL FUNCTION: Electronics Workshop

LATEST FUNCTION: Demolished

CONSTRUCTIONAL TYPE: Concrete

DIMENSIONS: 11.17m (36ft 4ins) x 5.6m (18ft 4ins)

DOCUMENTARY REFERENCE: AWRE 1971 118; PSA 1971 Electronics Workshop

PHOTOGRAPHS:

RELATIONSHIPS WITH OTHER FEATURES: Adjacent to 58 Plinth G

DESCRIPTION:

This concrete foundation slab marks the position of a prefabricated hut with a double entrance door to the west with an internal recess for a mat. In the floor of the building are a number of cable ducts formerly covered by wooden boards, a number of which survive.

Antenna

AREA/LOCATION: Lighthouse Road

STRUCTURE No. H50

DATE: circa 1960

NGR:TQ not known



ORIGINAL FUNCTION: Antenna

LATEST FUNCTION: Demolished

CONSTRUCTIONAL TYPE: Concrete

DIMENSIONS: Diameter
25.37m (83ft 3ins)

DOCUMENTARY REFERENCE:

PHOTOGRAPHS: NMR 20457, OS65054,V, frame 029, 30 Apr 1960

RELATIONSHIPS WITH OTHER FEATURES: adjacent to H1

DESCRIPTION:

To the south of H1 are the remains of a large circular feature 25.37m (83ft 3ins) in diameter to centre of outer ring. At its centre is a large sawn-off 0.42m (1ft 4ins) square post set into concrete. The outer concrete foundation is 1.07m (3ft 6ins) wide and set into it are fixing bolts for a timber superstructure, a number of fragments of which remain along with ceramic insulators, within the circle are five large straining blocks for anchoring the guy wires and a number of smaller concrete blocks. There are three more straining blocks between this feature and the Bomb Ballistics Building.

To the northwest of the circle is a concrete slab 18.32m (60ft) x 6.1m (20ft) to its east is an electrical input box.

It was probably erected during the late 1950s or early 1960s, it is not known if it was part of a research facility, to gather intelligence information, or for use in position fixing for trials work.

Plinth G

AREA/LOCATION: Lighthouse Road

STRUCTURE No. 58

DATE: 1955?

NGR:TQ not known



ORIGINAL FUNCTION: Electrical Transformer

LATEST FUNCTION: Electrical Transformer

CONSTRUCTIONAL TYPE: Concrete

DIMENSIONS: 6.1m (20ft) x 3.2m
(10ft 6ins)

DOCUMENTARY REFERENCE: AWRE 1971 58; PSA 1971 Electrical transformer

PHOTOGRAPHS:

RELATIONSHIPS WITH OTHER FEATURES: Adjacent to H2

DESCRIPTION:

The remains of the Transformer compound comprise a foundation wall 6.1m (20ft) x 3.2m (10ft 6ins), at its north end are three ceramic cable pipes, one of which retains a cut-off High Voltage

Lavatory

AREA/LOCATION: The Street

STRUCTURE No. BI I was 27/168

DATE: 1962

NGR: TM 43813 49030



ORIGINAL FUNCTION: Lavatory

LATEST FUNCTION: Lavatory

CONSTRUCTIONAL TYPE: Brick

DIMENSIONS: 8.08m (26ft 6ins) x
3.90m (12ft 10ins)
Height: 2.71m (8ft 10ins)

DOCUMENTARY REFERENCE: AWRE 1971 168; PSA 1973 168 Lavatories at hangar

PHOTOGRAPHS:

RELATIONSHIPS WITH OTHER FEATURES:

DESCRIPTION:

The Lavatory block is a rectangular red brick building of cavity wall construction with a flat concrete roof. To the south is a projecting porch supported on tubular steel columns, formerly with a weather screen to the south. On this side a single door gives access to the Gents with 3 metal framed square windows to the east lighting 3 toilet cubicles. The Gents is also lit by a four light window in its rear, north, wall, the east wall is blank. To the west is the Ladies toilet it is entered from the rear and is lit by two square windows in the west wall and a single window in the south wall.

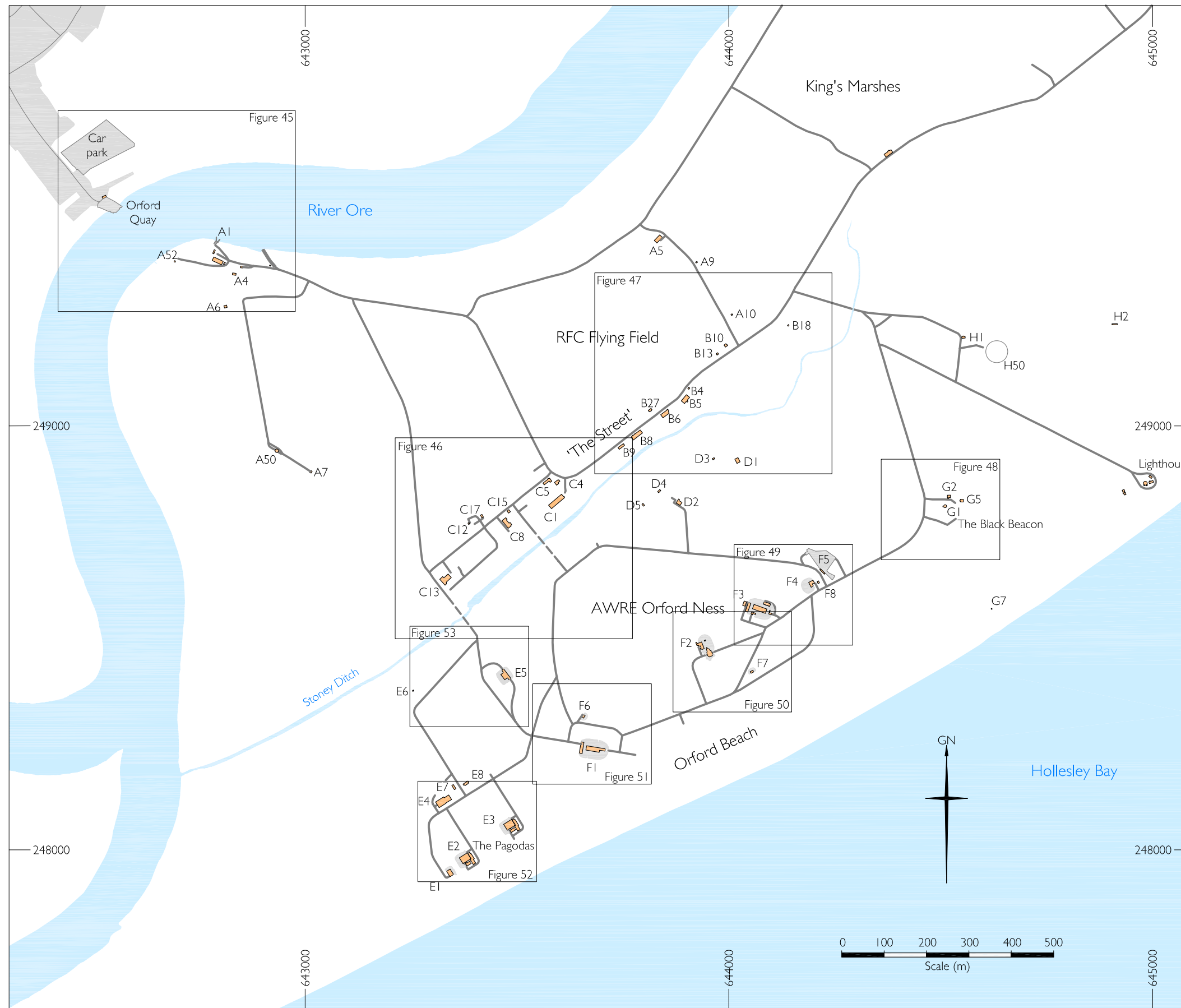


Figure 44: Reference plan
(1:10000 at A3)

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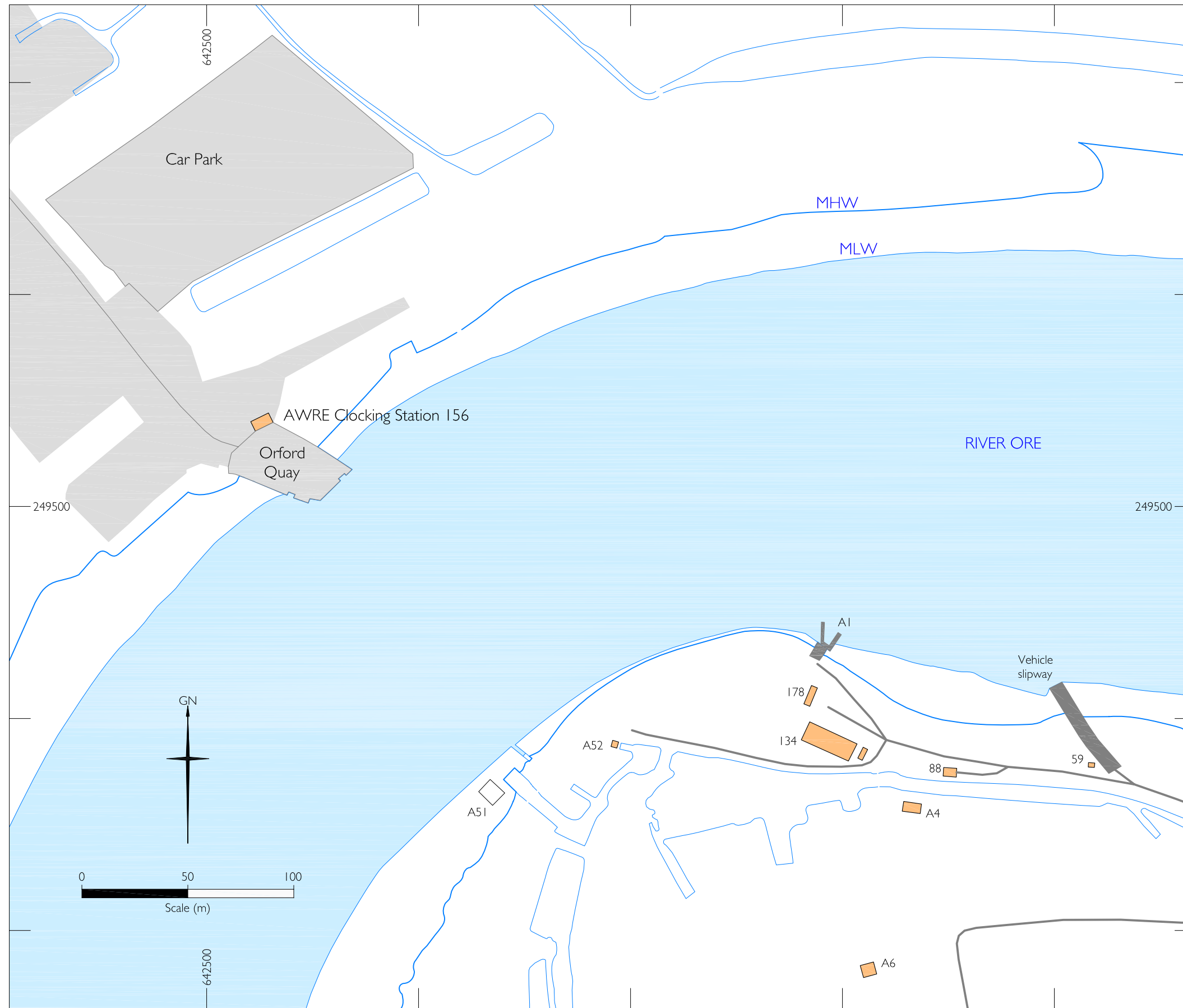


Figure 45: The quay area
(1:2000 at A3)

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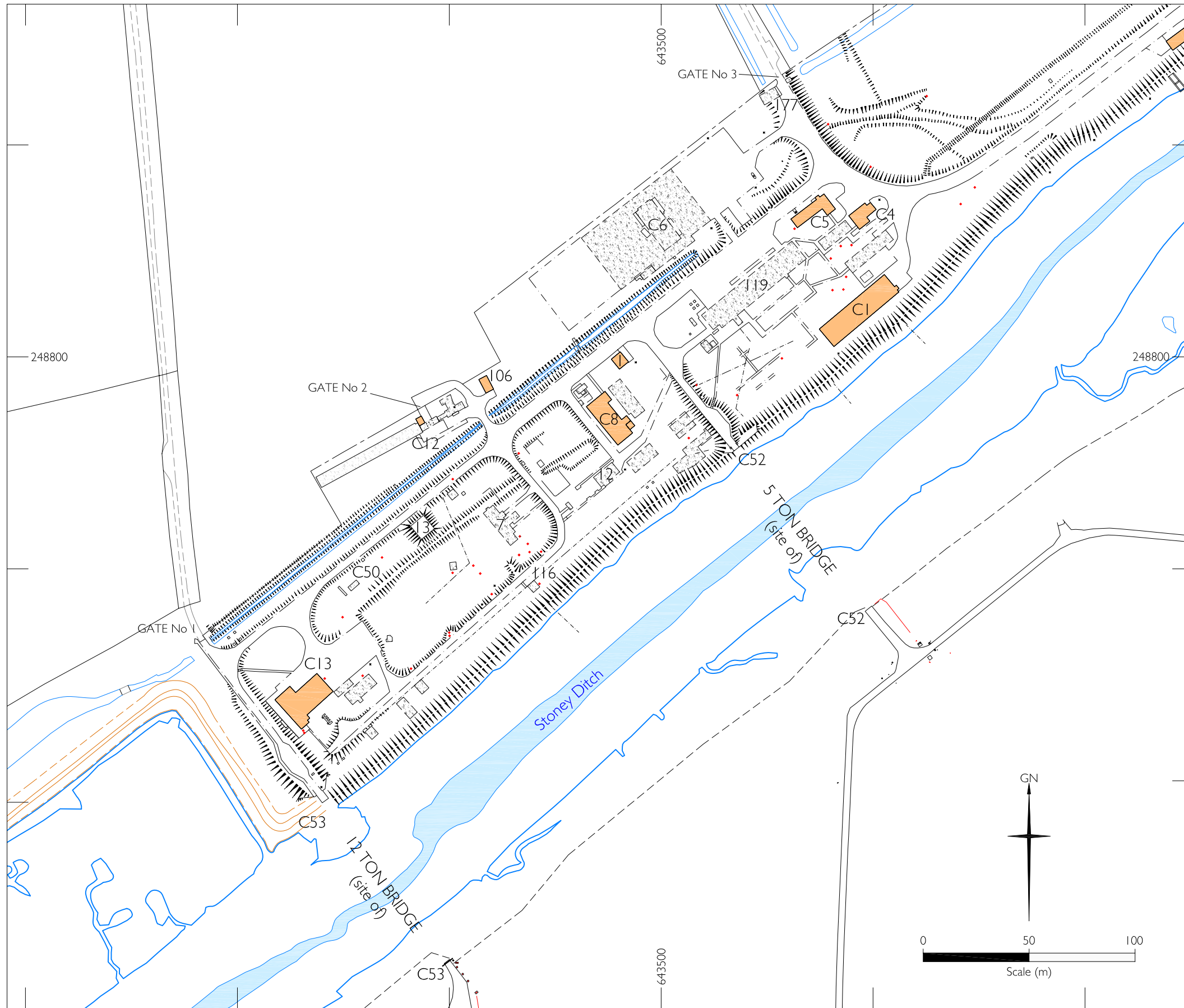


Figure 46: West end of The Street
(1:2000 at A3)

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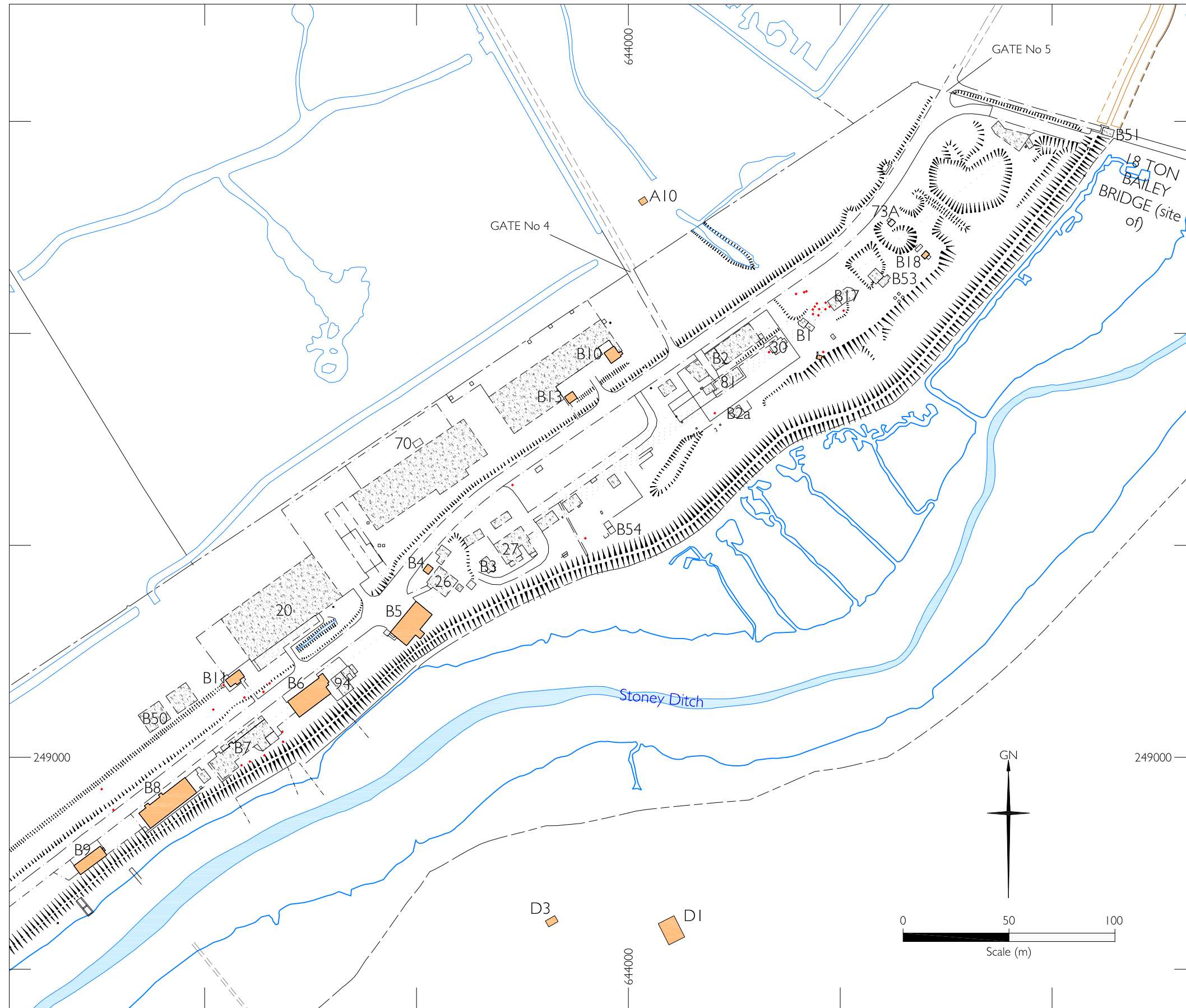


Figure 47: East end of The Street
(1:2000 at A3)

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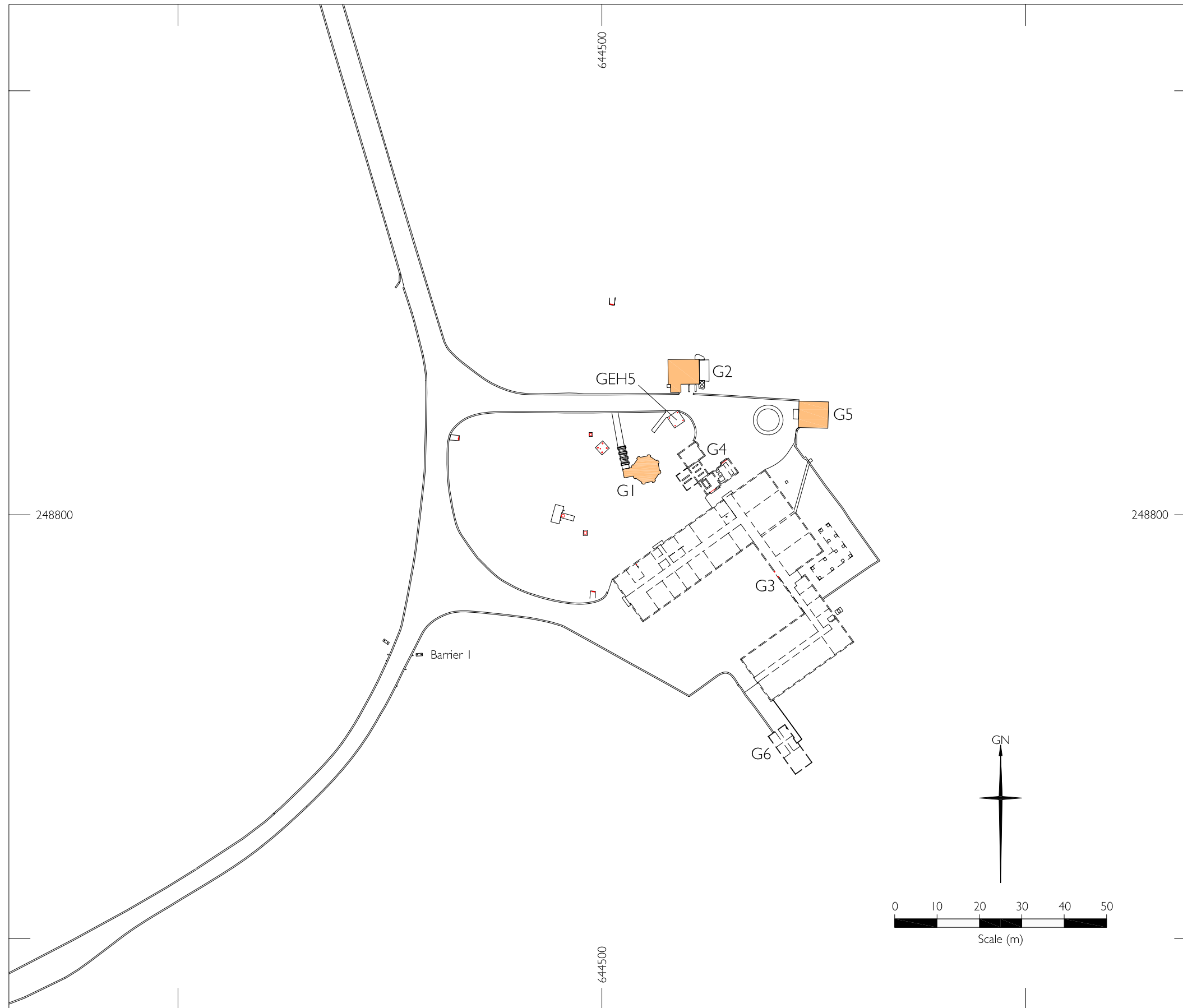


Figure 48: AWRE headquarters area
(1:1000 at A3)

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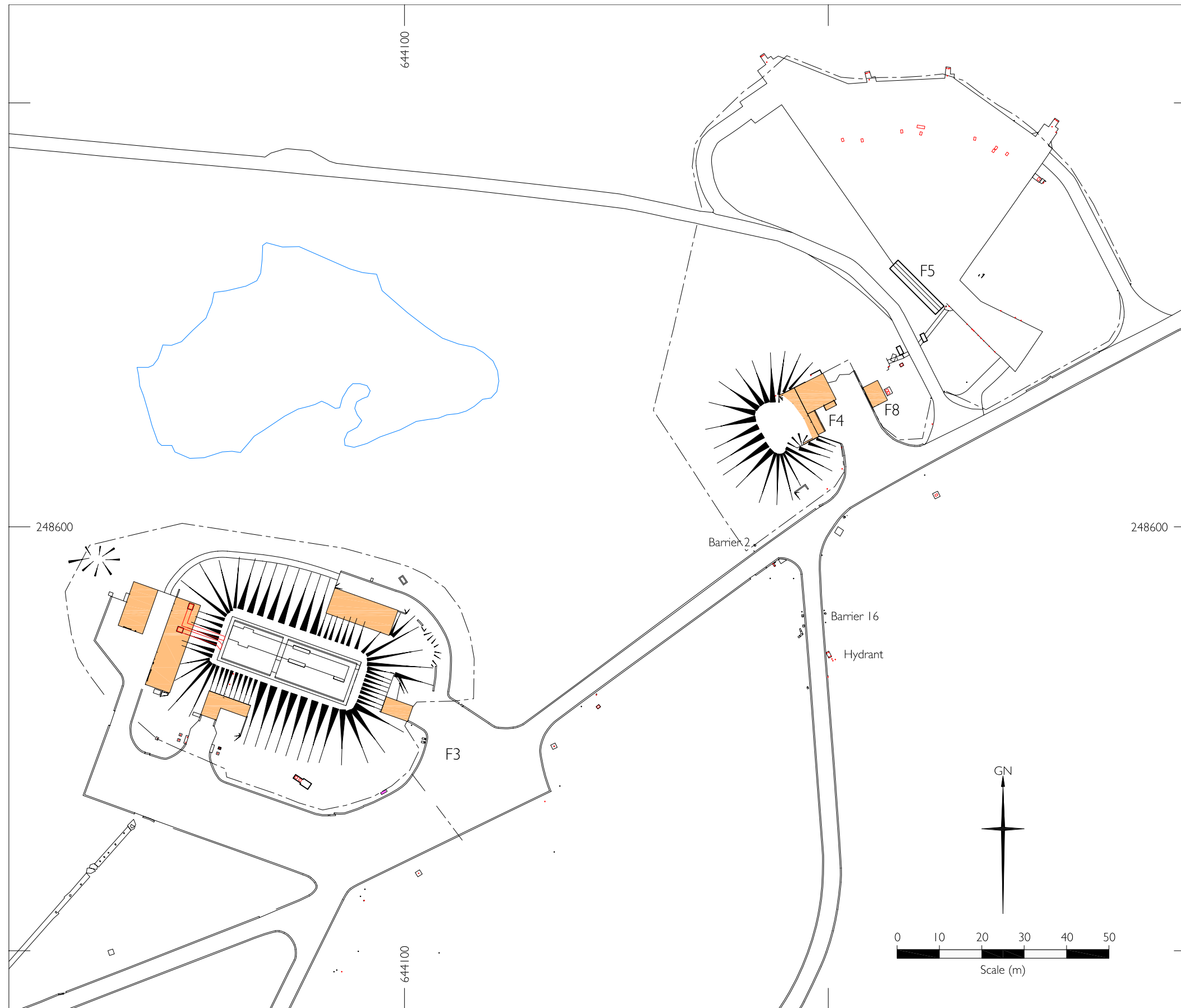


Figure 49: Laboratory F3 and Impact Facility F5
(1:1000 at A3)

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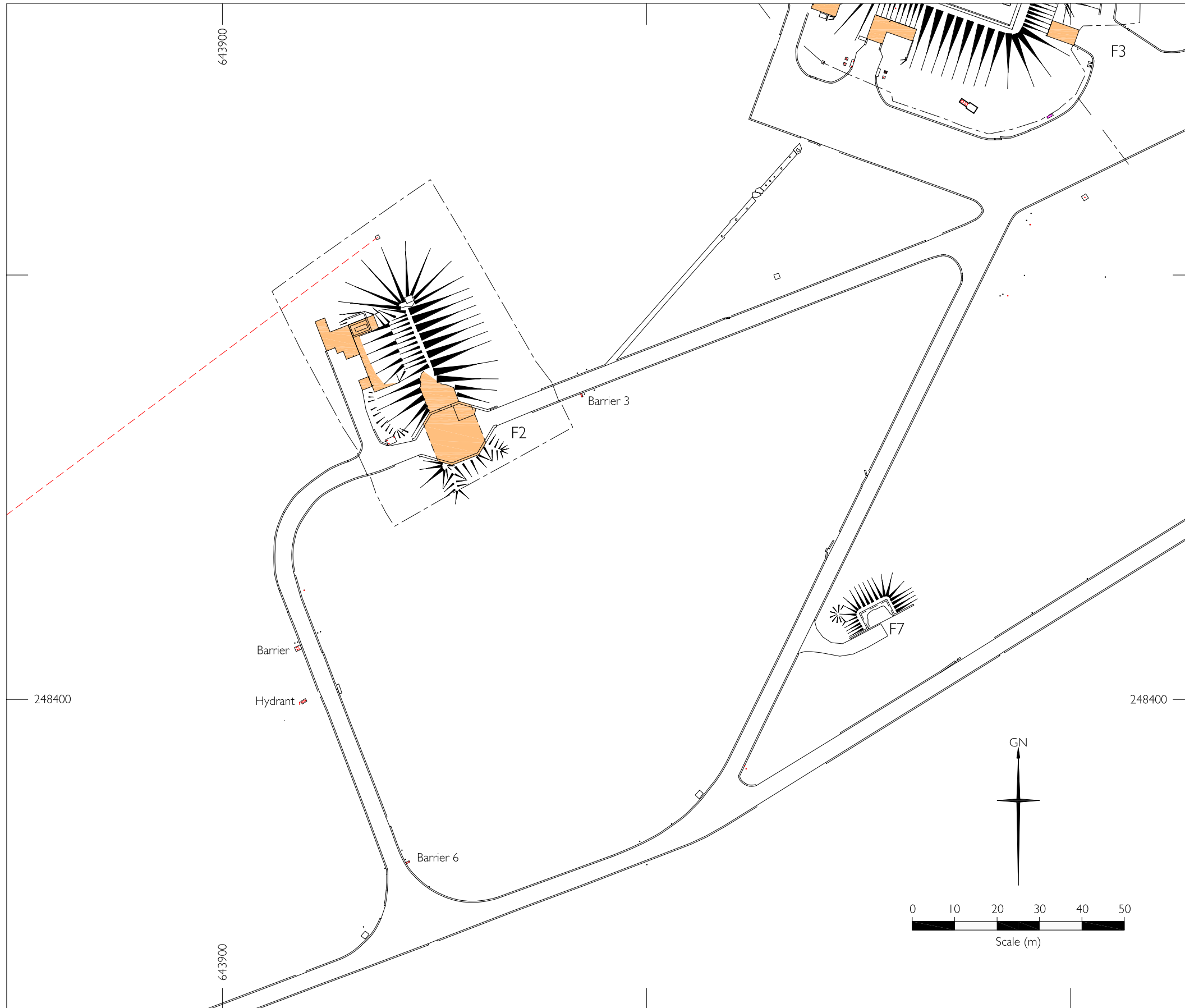


Figure 50: Laboratory F5
(1:1000 at A3)

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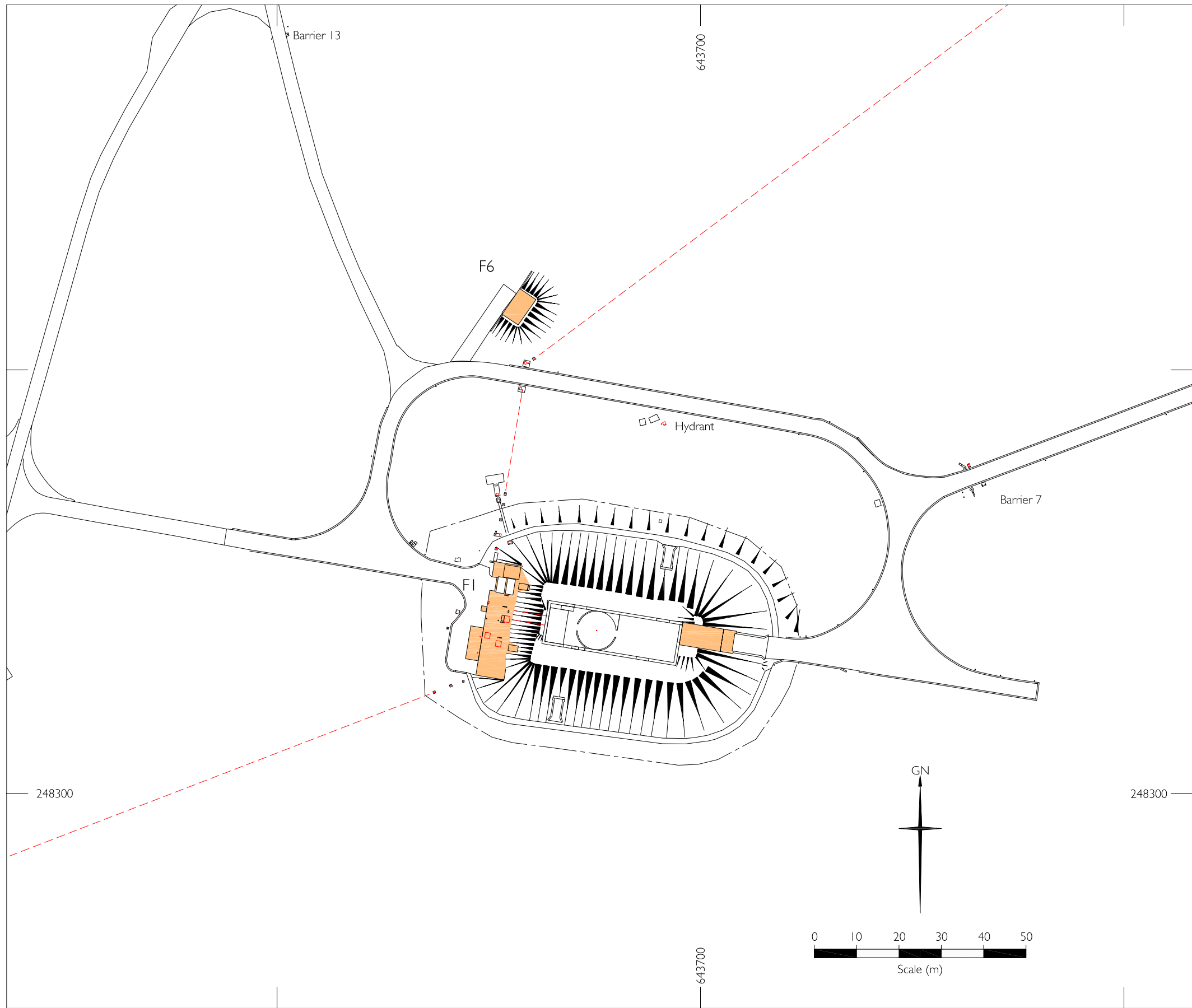


Figure 51: Laboratory F1
(1:1000 at A3)

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Figure 52: Pagodas and Control Room
(1:1000 at A3)

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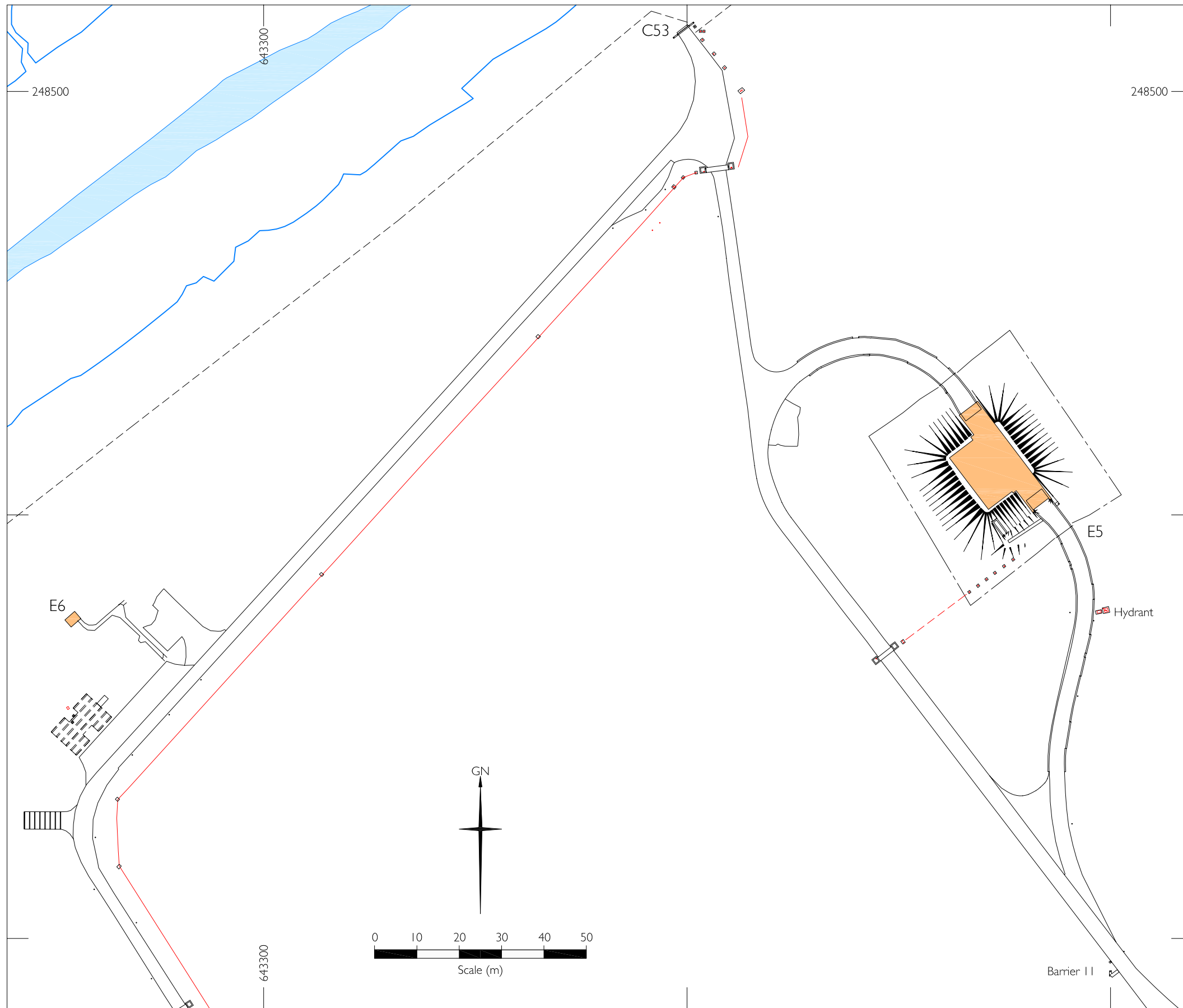


Figure 53: Magazine
(1:1000 at A3)

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ENGLISH HERITAGE RESEARCH DEPARTMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for sustainable management, and to promote the widest access, appreciation and enjoyment of our heritage.

The Research Department provides English Heritage with this capacity in the fields of buildings history, archaeology, and landscape history. It brings together seven teams with complementary investigative and analytical skills to provide integrated research expertise across the range of the historic environment. These are:

- * Aerial Survey and Investigation*
- * Archaeological Projects (excavation)*
- * Archaeological Science*
- * Archaeological Survey and Investigation (landscape analysis)*
- * Architectural Investigation*
- * Imaging, Graphics and Survey (including measured and metric survey, and photography)*
- * Survey of London*

The Research Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support outreach and education activities and build these in to our projects and programmes wherever possible.

We make the results of our work available through the Research Department Report Series, and through journal publications and monographs. Our publication Research News, which appears three times a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities. A full list of Research Department Reports, with abstracts and information on how to obtain copies, may be found on www.english-heritage.org.uk/researchreports

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