

EIA SCREENING AND SCOPING REPORT

Ford Airfield

Environmental Impact Assessment Scoping Report

November 2018

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Prepared on behalf of Wates Developments Ltd and Redrow Homes Ltd

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1 INTRODUCTION

- 1.1 This report has been prepared by Barton Willmore, IEMA qualified assessors, on behalf of Wates Developments Ltd and Redrow Homes Ltd. The report accompanies a request for an Environmental Impact Assessment (EIA) Scoping Opinion from Arun District Council (ADC) in accordance with Regulation 15 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended)¹ (the "EIA Regulations").
- 1.2 In accordance with the EIA Regulations, a person who is minded to make an EIA application may ask the relevant planning authority to state in writing their opinion as to the information to be provided in the Environmental Statement (a "scoping opinion").
- 1.3 Regulation 15 (2) states that a scoping request must be accompanied by:
- (i) a plan sufficient to identify the land;
 - (ii) a brief description of the nature and purpose of the development, including its location and technical capacity;
 - (iii) an explanation of the likely significant effects of the development on the environment; and
 - (iv) such other information or representations as the person making the request may wish to provide or make.

The Site

Site Context

- 1.4 The site (see Site Location Plan at Appendix 1), is located within the administrative boundary of ADC. The village of Ford is located immediately to the north east of the site, with the villages of Climping and Yapton located to the immediate south east and west of the site. The town of Littlehampton is located approximately 1.5km to the east of the site while Bognor Regis is located approximately 2km to the south west of the site.
- 1.5 Agricultural fields are predominantly located to the north and north west of the site. The very northern part of the site is bound by Ford Lane. Ford train station is located approximately 700m to the northeast of the site.

¹ SI 2017/571 as amended by SI 2018/695

- 1.6 The east of the site is bound by Ford Road beyond which is agricultural land. The River Arun is located approximately 500m to the east of the site.
- 1.7 The southeast of the site is bound by a recycling facility (operated by Viridor) and Rudfield Industrial Estate while the very south of the site is bound by residential properties, located within Climping. HM Prison Ford is located approximately 200m to the southeast of the site.
- 1.8 The west of the site is bound by residential properties located within Yapton. Ford Industrial Estate is also located adjacent to the western site boundary and comprises a number of associated commercial and light industrial warehouse buildings. Yapton Road (B2233) borders the site to the south west, with agricultural fields beyond. National Cycle Route 2 also runs along Yapton Road.
- 1.9 A Waste Water Treatment Works (operated by Southern Water) is located by the central part of the site and Waste Management Facility (operated by Grundon) is located immediately north of the Water Treatment Plant. Both facilities are located outside the site boundary.
- 1.10 The site is not subject to any ecology, heritage or landscape designations. There are a number of listed buildings in the immediate surrounding area, including the Grade I Listed Parish Church of St Mary, and the Grade II Listed The Vicarage, Atherington House And Ford Place And Southdown House And The Lodge, Barn To The West Of Nos 1 And 2 Church Farm Cottage, and New House Farmhouse. The Medieval earthworks located east and southeast of St Mary's Church (Scheduled Monument) is also located approximately 500m to the southeast of the site.
- 1.11 Further designations in the wider area include Climping Beach Site of Special Scientific Interest (SSSI), located approximately 2.2km to the southeast of the site. The South Downs National Park is located approximately 2.5km to the north of the Site. Upstream of the site lies the Arun Valley, which consists of three Sites of Special Interest (SSSIs) in an area of wet meadows on the floodplain of the River Arun. The nearest of these to the site is Arundel Park SSSI, located approximately 4km north of the site.
- 1.12 According to the Gov.UK website the majority of the site is located in Flood Zone 1 (low risk of flooding). A small area to the north east of the site is located in Flood Zone 2 (medium risk of flooding). The site is not located within an Air Quality Management Area, which indicates that air quality within the locality will be generally good.

Site Description

- 1.13 The site extends to approximately 94.42 ha and predominantly comprises an area of land

formerly in use as an airfield. Large areas of the site now comprise agricultural fields, separated by hedgerows and trees. An area within the north west of the site is occupied by a trucking company.

- 1.14 Part of the north to south and east to west runways of the former airfield are located on the site as well as part of the south west section of the perimeter track. The runways are used for year-round Sunday markets and Car boot sales (every Thursday, Saturday and Sunday). It is anticipated that a separate planning application will be submitted for the reconfiguration of the market. Located to the northern end of the north-south runway are two large warehouse buildings, in use as the Arun Sports Arena and Flying Fortress play centre.
- 1.15 The perimeter track provides connectivity between the villages of Yapton (to the west of the site) and Climping (to the south of the site). Two public footpaths also pass through the northern and southern parts of the site. The northern footpath provides connection between the villages of Ford (to the northeast of the site) and Yapton. The southern footpath connects the villages of Climping and Yapton (to the west of the site).

The Proposed Development

- 1.16 The proposed development comprises the development of up to 1,500 dwellings, up to 37,000 sqm of employment floorspace, a local centre including retail, commercial and community facilities, primary school, nursery, a care/retirement home, healthcare facilities, public open space, new sports pitches and facilities, and associated access, infrastructure, landscape and ancillary works.
- 1.17 In terms of buildings heights, it is anticipated that the maximum height of the new residential dwellings will be up to 3 storeys in height.

2 SCOPING

- 2.1 This scoping exercise has been informed by desk-based research, professional judgement and other information available for the site. Table 1 provides a summary of the scoping exercise.

Table 1: EIA Scoping Summary

Topics	Potential Construction Phase Effects	Potential Operational Phase Effects	Likely Significant Effects (Pre-Mitigation)	Comments
Population and Human Health	✓ - T	✓ - P	✓	Chapter to be prepared.
Landscape and Visual Effects	✓ - T	✓ - P	✓	
Archaeology and Built Heritage	✓ - T	✓ - P	✓	
Biodiversity	✓ - P/T	✓ - P	✓	
Transport & Access	✓ - T	✓ - P	✓	
Air Quality	✓ - T	✓ - P	✓	
Noise & Vibration	✓ - T	✓ - P	✓	
Agricultural Land	✓ - P/T	x	✓	
Water Resources and Flood Risk	✓ - T	✓ - P	✓	
Land Contamination	✓ - T	✓ - P	✓	Topic scoped out of the ES.
Wind Microclimate	x	x	x	
Daylight, Sunlight and Overshadowing	x	x	x	
Lighting	x	x	x	
Waste	x	x	x	
Climate Change and Greenhouse Gases*	x	x	x	
Accidents and Disasters	x	x	x	

Key: ✓ Likely Significant Effect / x No Likely Significant Effect.
T – Temporary Effect / P – Permanent Effect

Environmental Disciplines Scoped Out

- 2.2 Further information on the topics scoped out of the EIA in Table 1 is set out in the following sections.

Land Contamination

- 2.3 A Geo-Environmental Assessment Report (ref: 29228-R01-(00)) has been undertaken for the Site and will be submitted alongside the planning application. The report assesses the potential for contamination associated with the Site's former and current land uses. The findings of the survey found that the Site is virtually free from contamination. The survey

identified an inert landfill consisting of a raised earth mound in the northeast portion of the Site and soil testing carried out recorded elevated concentrations of hydrocarbons (PAHs) and the presence of asbestos within the inert landfill. Very little contamination was recorded across the remainder of the Site with only two soil samples recording a single elevated concentration of lead and a marginally elevated concentration of PAHs. However, the report states that these samples are unlikely to pose a risk to future site users. Further investigation will be carried out in order to fully characterize the ground conditions across the Site and if necessary a remediation strategy will be developed to ensure that there is no risk to future site users or the surrounding environment. Based on the above, likely significant effects are not anticipated and this topic can be scoped out of the ES.

Wind Microclimate

- 2.4 Due to the low-rise nature of the proposed buildings likely significant wind effects are not anticipated and this topic has been scoped out of the ES.

Daylight, Sunlight and Overshadowing

- 2.5 The scale and massing of the proposed development will not cause changes to daylight or sunlight availability or cause overshadowing of residents or amenity space. It is therefore proposed to scope this discipline out of the ES.

Lighting

- 2.6 The proposals are not anticipated to produce a significant lighting impact. Lighting will be designed carefully in accordance with relevant British Standards and Institute of Lighting Professionals (ILP) (2011) Guidance Notes for the Reduction of Obtrusive Light. The effect of lighting from the proposed development will be considered within the Landscape and Visual and Biodiversity chapters of the ES. As such, this topic has been scoped out of the ES.

Waste

- 2.7 The proposals are not anticipated to produce significant amounts of waste during construction and operational waste will be managed in accordance with ADC requirements; therefore this topic has been scoped out of the ES.

Climate Change and Greenhouse Gases

- 2.8 Climate change and greenhouse gases, as a separate chapter, has been scoped out of the ES.

The introductory chapters will, however, summarise the findings of the ES relevant to climate change and the climate change adaptations integrated into the proposed development. This will draw upon technical chapters and reports, including the Flood Risk Assessment and Air Quality Assessment, and summarise the sustainability and energy provisions included within the proposed development. For a development of this nature this is considered a suitably proportionate approach.

Accidents and Disasters

- 2.9 The proposed development is primarily residential in nature and also includes commercial, educational and community uses. These uses are not considered to be hazardous and the site is not in a location which is at risk of disasters and instability or earthquakes. The risk of flooding will also be assessed within the Water Resources and Flood Risk chapter, as detailed below.
- 2.10 A detailed Unexploded Ordnance (UXO) Risk Assessment has been undertaken for the site (Appendix 2) which identifies that the site is within an area of medium risk of UXO (air dropped weapons) being present. The risk from all other UXO is considered low. The assessment recommends a number of mitigation measures to be undertaken prior to development and implementation of these will ensure that the UXO risk is managed and likely significant effects will not occur.
- 2.11 During construction, which is considered the only element which could be considered as hazardous, all applicable health and safety legislation will be complied with. This topic has been scoped out of the ES.

Environmental Disciplines Scoped In

- 2.12 For each of the topics scoped into the assessment further information on the details to be included in the assessment and the methodology to be employed are set out in the following sections.

3 POPULATION AND HUMAN HEALTH

- 3.1 An assessment of the potential effects of the proposed development on population and human health in relation to the local and wider area will be undertaken. This will include construction phase (temporary) and operational phase (permanent) effects. The issues to consider are anticipated to include changes to, and effects on:

- Population and housing;
- Employment – direct and indirect job creation through supply chain multiplier effects;
- Local expenditure;
- Education and training; and
- Primary healthcare infrastructure.

Approach

- 3.2 Baseline information will be collated in relation to population, housing, local expenditure, employment, education and primary healthcare facilities (namely GP and dental practice provision and primary and secondary school capacities).
- 3.3 The assessment will be undertaken using the following methodology:
- Baseline review using accepted Government sources such as census, Labour Force Survey and NOMIS. In addition, a review will also be undertaken of information available from Department for Education, annual schools census data, NHS, Digital Annual GP census data;
 - Review of the policy context - at local and national level;
 - Assessment of the significance of impacts using professional judgement and, where appropriate, published guidance such as the GVA Grimley Ltd for the Homes and Communities Agency Employment Density Guidance (2015) and Additionality Guide Fourth Edition (2014), where applicable; and
 - Development of mitigation measures, if and where appropriate.
- 3.4 Wider human health considerations that fall within the wider scope of the ES will be considered and summarised. This will draw on the conclusions of other ES chapters relevant to human health, including noise and transport.
- 3.5 On the basis that the proposed development will comprise public open space, new sports pitches and facilities, likely significant effects on open space provision are not anticipated

from the proposed development. Therefore, the consideration of open space provision has been scoped out of the assessment.

Summary

- 3.6 Table 2 summarises the socio-economic effects to be included ('scoped in') for detailed assessment in the Environmental Statement (ES).

Table 2: Population and Human Health Effects

Receptor	Effects	Scoped In
Population	Long term increase in population	✓
Employment	Increase in short term construction employment and long-term operational employment. Effect on training.	✓
Local Expenditure	Increase in local expenditure due to construction workforce spending and an increase in occupational expenditure	✓
Education	Increased demand for education facilities in the operational phase, and effects relating to the provision of education facilities. Effect on training.	✓
Human Health	Potential effects on human health from the proposed development including noise, air quality and transport.	✓
Healthcare	Demand for primary healthcare infrastructure during the operational phase and effects relating to the provision of healthcare facilities.	✓

4 LANDSCAPE AND VISUAL EFFECTS

- 4.1 An assessment will be undertaken of the likely significant effects of the proposed development on landscape and views (a Landscape and Visual Impact Assessment (LVIA)).

Baseline

- 4.2 This section summarises the conclusions of preliminary desk-based research carried out in respect to the landscape character and visual context of the site. The site is described in Section 1 of this report.
- 4.3 ADC's web site states that the Arun Landscape Study 2006 (produced for ADC by Hankinson Duckett Associates) does not constitute ADC policy, but will form part of the evidence base used in preparing the emerging Local Development Framework. This study would be used to inform the baseline landscape character.
- 4.4 The site lies within Local Landscape Character Area (LCA) 29 North of Yapton Coastal Plain defined by The Arun Landscape Study. LCA 29 is described as:
- *"Predominately arable fields of varying size and enclosure, with parkland and recreation adjacent to Yapton;*
 - *Bounded by woodland and railway line to the north;*
 - *Abuts Ford to the east; and*
 - *Urban influence along Ford Lane which runs through the middle of the character area".*
- 4.5 The Arun Landscape Study states that LCA 29 has Substantial Landscape Sensitivity, Slight Landscape Value and Low / Medium Landscape Capacity.
- 4.6 Visual receptors that may be affected by the proposed development which lie within or close to the site include users of public footpaths which pass through the northern and southern parts of the site, users of the B2233 and minor roads which run along boundaries of the site, users of National Cycle Route 2 which runs along the B2233 and local residents within local settlements including the villages of Ford, Climping and Yapton. Visual receptors within the wider area include users of the Public Right of Way (PRoW) network, people on roads and within settlements and other publicly accessible locations within the study area which will be agreed with ADC.
- 4.7 No designated landscapes that have the potential to be affected by the proposed development

have been identified.

Approach

- 4.8 The assessment would be undertaken in accordance with Landscape Institute and Institute of Environmental Management and Assessment, 'Guidelines for Landscape and Visual Impact Assessment' (Third Edition, 2013) and would provide a review of the existing landscape planning policy context, published sources of landscape character and visual appraisal of the study area and an assessment of the potential landscape and visual effects of the proposed development, both at the construction and operational phases.
- 4.9 A study area for the LVIA will be defined. Baseline information for the study area will be collated, which will include topography, landscape planning policy designations, published sources of landscape character, designated landscapes, typical photograph viewpoints and any other relevant information.
- 4.10 Assessments will be made during construction; on completion; and 15 years thereafter, with the benefit of planting mitigation.
- 4.11 In accordance with current good practice, this assessment will address landscape and visual effects as separate issues. Landscape effects relate to both the effect on the physical features of the site, and on the landscape character of the site and surrounding area. Visual effects relate to effects on views of people from the surrounding area.
- 4.12 The landscape and visual impact assessment will include consideration of the likely effects of lighting associated with the proposed development.
- 4.13 The study area and a list of representative viewpoints for assessment would be agreed with ADC.
- 4.14 In summary the assessment will:
- Define the study area for the LVIA and identify representative viewpoints;
 - Assess the susceptibility to change of the landscape and visual receptors (the receiving environment);
 - Assess the magnitude of landscape and visual effects;
 - Assess the significance of landscape and visual effects; and
 - Identify requirements for any mitigation measures.

Summary

- 4.1 Table 3 summarises the landscape and visual receptors identified for inclusion in the assessment.

Table 3: Landscape and Views

Receptor	Effects	Scoped In
Views from publicly accessible locations, including roads, footpaths and public open spaces	Visual effects on users	✓
Landscape features, including existing vegetation	Landscape effects on the landscape resource	✓
Landscape Character	Effects on landscape character areas	✓

5 ARCHAEOLOGY AND BUILT HERITAGE

- 5.1 An assessment will be undertaken of the likely significant effects of the proposed development on the environment with respect to archaeology and built heritage.

Baseline

- 5.2 The site has been the subject of a heritage desk-based assessment (Appendix 3) which has been undertaken in accordance with the CIfA Standards and Guidance for Historic Environment Desk Based Assessments (2017). This study has established that archaeological investigations undertaken previously within the site have recorded Bronze Age, Iron Age and Roman settlement remains. The site is considered to have potential to contain further remains of these periods. The site also contains the remains of the former WWI and WWII airfield. The site is considered to have low potential for remains of all other archaeological periods.
- 5.3 The site has been subject to a geophysical survey (Appendix 4) which has been undertaken in accordance with the CIfA Standards and Guidance for Archaeological Geophysical Survey (2014). This survey has revealed numerous anomalies of diverse origins. The results are dominated by the remains and associated debris of the WWI and WWII Ford Airfield, including runways, hangars and tie-down areas. The disused Portsmouth to Arundel canal has been identified, as have a number of former field boundaries, footpaths and sites of Post-Medieval farm buildings; these are all well-correlated with multiple historic maps. Four different previously unrecorded areas of archaeological activity have been identified, expanding the archaeological understanding of the area. These are likely to be Prehistoric to Romano-British in date. They are in appearance not associated to each other; however, it is feasible more recent military usage of the fields may have truncated a larger settlement area. Limited modern and natural activity has also been identified.
- 5.4 As stated in Section 1, there are no listed buildings within the site. There are five listed buildings within the wider area of the site. These are the Parish Church of St Mary (Grade I), The Vicarage (grade II), Atherington House and Ford Place and Southdown House and The Lodge (grade II), Barn To The West Of Nos 1 And 2 Church Farm Cottage (grade II), and New House Farmhouse (grade II). The site is considered to lie beyond the settings of all of these designated heritage assets, except for Atherington House, as there is no intervisibility between them and the site. A small part of the central northern part of the site is considered to be within the setting of Atherington House where currently the industrial buildings at the northern end of the site can be seen from parts of the garden of the house. These buildings have a negative contribution to the significance of the house.

Approach

5.5 Initial baseline information was obtained using best practice guidelines, including the National Planning Policy Framework (NPPF) and PPG, Institute for Archaeologists (CIfA) guidelines, Historic England guidelines, local planning authority guidance and other guidance from statutory and non-statutory bodies where applicable. The baseline information examines the following:

- Relevant local planning policy;
- Relevant guidance found in the NPPF and PPG;
- Geology and topography, including previous site specific geotechnical information;
- A search of the Historic Environmental Record (HER) centred on the site and extending 1km from the boundary of the site (the study area);
- Archaeological and historical background (including published and unpublished sources), drawn from a variety of sources including the British Library and ADC;
- The results of on-site and adjacent archaeological investigations; and
- A site walkover survey.

5.6 In accordance with the NPPF and PPG, both designated and undesignated heritage assets will be considered:

- Scheduled Monuments;
- Archaeological remains;
- Listed Buildings; and
- Conservation Areas.

5.7 Table 4 summarises the archaeology and built heritage effects identified for inclusion in the assessment.

Table 4: Archaeology and Built Heritage

Receptor	Effects	Scoped In
Scheduled Monuments	• Direct impacts on Archaeology -- potential to damage or destroy archaeological remains • Impact on setting • Disturbance (visual, noise)	✓
Archaeological Remains		✓
Listed Buildings		✓
Conservation Areas		✓

6 BIODIVERSITY

- 6.1 An assessment will be undertaken of the likely significant effects of the proposed development on the environment with respect to biodiversity, including ecology and nature conservation.

Baseline

- 6.2 A detailed understanding of the ecological importance of the site has been obtained through desk study and site survey. A Phase 1 Habitat Survey was undertaken by Artemis Ecological Consulting Limited (Artemis) in July and August 2015 and August 2016 (Appendix 5) and further, species-specific surveys undertaken by Ecological Survey and Assessment Limited (ECOSA) between May and October 2017, which will be submitted as part of the planning application. Species specific surveys undertaken include:

- Bat transect surveys;
- Bat remote detector surveys;
- Dormouse surveys;
- Breeding bird surveys;
- Great crested newt habitat suitability index assessment;
- Great crested newt eDNA surveys;
- Reptile surveys; and
- Badger surveys.

- 6.3 There are no European or nationally designated sites on or directly adjacent to the site, nor within two kilometres of the site boundary. The site does not lie within the impact zone of any nearby international designated sites.

- 6.4 The majority of the site contains arable land which is of limited ecological value.

- 6.5 The following reports will be submitted as part of the Environmental Statement:

- A Phase 1 Habitat Survey Report; and
- An Ecological Impact Assessment Report.

Approach

- 6.6 A qualitative and quantitative ecological impact assessment will be undertaken, following the principles set out in the CIEEM publication 'Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland' (Second Edition, 2016). This will include an assessment of

cumulative and in-combination effects, details of appropriate mitigation measures and details of any residual effects (should any exist following mitigation), following consultation with the relevant statutory and non-statutory organisations. The findings of the ecological survey work will feed into the scheme design to ensure impacts are avoided where possible, in line with the CIEEM mitigation hierarchy. The assessment will also provide recommendations for enhancement, in line with local and national planning policy.

Scoping

6.7 Consideration will be given to the following potential effects:

- Construction
 - Temporary Land-take;
 - Habitat removal and damage;
 - Disturbance (visual, noise, Vibration);
 - Direct impacts (injury, killing) to species;
 - Hydrology and pollution (dust generation, pollution of aquatic habitats);
 - Lighting (construction); and
 - Construction site hazards.
- Operation
 - Permanent Land-take;
 - Habitat creation and enhancement measures within the development layout;
 - Air Quality / Pollution and Hydrology;
 - Urbanisation (e.g. movement, lighting, noise, domestic pets and predation, fly-tipping)
 - Permanent Lighting; and
 - Visitor pressure (disturbance / trampling) on retained on-site habitats and nearby designed sites.

Summary

6.8 Table 5 provides a summary of the key issues to be considered in relation to Biodiversity.

Table 5: Biodiversity Effects

Receptor	Effects	Scoped In
Ecological Designations	Construction: • Land-take • Habitat removal and damage	✓
Habitats	• Disturbance (visual, noise, vibration)	✓

Receptor	Effects	Scoped In
Species	• Direct impacts (injury, killing) to species); • Hydrology and pollution (dust generation, pollution of aquatic habitats) • Lighting • Construction site hazards Operation • Land-take • Habitat creation and enhancement measures within the development layout • Air Quality / Pollution and Hydrology • Urbanisation (e.g. movement, lighting, noise, domestic pets and predation, fly-tipping) • Visitor pressure (disturbance / trampling) on retained on-site habitats and nearby designed sites.	✓

7 TRANSPORT & ACCESS

- 7.1 An assessment will be undertaken of the likely significant effects of the proposed development on the environment with respect to transport and access.
- 7.2 The proposed development has been discussed with the local highway authority West Sussex County Council (WSCC) and Highways England (HE) who are responsible for the Strategic Route Network (The A3), including the A27.

Baseline

- 7.3 The scoping discussions have included agreeing appropriate parameters to establish baseline conditions, which will include *inter alia*:
- Existing traffic flows on the local and wider highway network, to be determined using traffic surveys and potentially the strategic transport modelling behind the Arun Transport Study², which supports the emerging local plan;
 - Existing highways conditions, to be determined based on on-site observations, discussions with WSCC and HE and the Arun Transport Study;
 - Existing site uses, their access arrangements and travel patterns, to be determined using surveys and/or the TRICS trip generation database;
 - Existing travel patterns in the local area, to be determined using 2011 Census data and the evidence base for the emerging local plan (e.g. the Community Profile for Ford Parish); and
 - Existing opportunities for walking, cycling and public transport use, to be determined based on site observations and a desktop review.

Approach

- 7.4 A Transport Assessment (TA) will be prepared to support the planning application. The TA will be prepared in accordance with Planning Practice Guidance (PPG) and the three tests set in Paragraph 32 of the NPPF:
- Will the opportunities for sustainable travel be appropriately taken up?;
 - Will safe and acceptable access be provided?; and
 - Will the residual impact, cumulative with other development be unacceptable (i.e.

² Systra. Arun Transport Study 2016

'severe')?.

- 7.5 The TA has been subject to detailed scoping discussions with WSCC and HE. Through the Scoping process, the study area for the TA will be agreed, as will the parameters relating to traffic generation, distribution and assignment.
- 7.6 The TA will assess the existing highway/transport conditions in the vicinity of the site and identify a highway and transportation mitigation package based upon the impact arising from the proposed development. The TA will be used to inform the ES chapter.
- 7.7 The ES Chapter will assess the likely significant effects on the road traffic generated by the proposed development. This requires assessment against different criteria as set out in the Institute of Environmental Assessment's (now IEMA) *'Guidelines for the Environmental Assessment of Road Traffic'*.
- 7.8 The following topics will be assessed for the construction and operational phases:
- Driver severance and delay;
 - Pedestrian and cycle severance and delay;
 - Pedestrian and cycle amenity;
 - Fear and intimidation;
 - Accidents and safety; and
 - Hazardous loads.
- 7.9 The assessment will be divided into two distinct phases in accordance with best practice as set out in the IEMA guidelines, to separately consider construction traffic and development (operational) traffic.
- 7.10 The extent of transport impact will be determined using the significance criteria for each topic area set out in the IEMA guidelines. The assessment will be based on the net change in journeys as a result of the proposed development and any infrastructure improvements delivered as part of the proposed development. The significance criteria will establish the magnitude of any beneficial or adverse effects the proposed development will have on the transport network.

Summary

- 7.11 Table 6 summarises the transport and access receptors identified for inclusion in the

assessment.

Table 6: Receptors Included in the Transport & Access Assessment

Receptor	Effects	Scoped In
Existing residents	Vibration impacts on existing properties due to HGVs; severance effects on existing communities; risks from hazardous loads; dust and dirt impacts	✓
Highway network	Net change in driver delay particularly during the peak hours; effect on personal injury accidents	✓
Pedestrians and cyclists	Changes in delay to journeys; impacts on amenity; fear and intimidation impacts; effects on personal injury accidents	✓

8 AIR QUALITY

- 8.1 An assessment will be undertaken of the likely significant impacts of the proposed development on local air quality, including dust and odour. This will consider both the potential impacts of existing sources of pollution on the proposed development as well as the impact of the proposed development on existing air quality in the local community. It will include the impacts of emissions from traffic as well as potential development constraints from the nearby waste and wastewater treatment facilities.

Baseline

- 8.2 The current air quality in the vicinity of the proposed development will be investigated drawing on ADC's Air Quality Status Reports and the Department for Environment, Food and Rural Affairs (Defra's) air quality modelling. Air quality in the immediate vicinity of the site is currently good and no air quality management areas have been declared.
- 8.3 The baseline odour will be assessed using a combination of qualitative and quantitative approaches consistent with the guidance produced by the Institute of Air Quality Management (IAQM). The assessment of impact of the emissions from the Waste Water Treatment Works will be agreed with Southern Water and ADC, and may include dispersion modelling to identify any constraints on development. The potential odour and dust emissions from the adjacent waste facilities (operated by Grundon and Viridor) will be assessed qualitatively using information available from their respective operators however as these facilities process sorted dry recyclables, odour is highly unlikely to be an issue and will be scoped out.

Approach

- 8.4 There are no designated ecological sites of relevance to the Site in relation to air quality impacts.
- 8.5 The air quality officer at ADC has been contacted and the scope and the broad approach of the assessment has been agreed.
- 8.6 The assessment will include the following:
- Review of relevant local air quality monitoring data and Defra's background pollutant maps;
 - Dispersion modelling of the emissions from the Waste water Treatment Works, using a model to be agreed with Southern Water and ADC, to define any odour constraints on the proposed development;

- Qualitative assessment of the impacts of the Grundon and Virador waste facilities on odour and dust on the proposed development using the relevant IAQM guidance;
 - Risk based assessment of the potential impacts during construction using the approach provided in IAQM guidance;
 - Detailed air quality dispersion modelling of emissions from the traffic associated with the proposed development to identify the impact on existing communities;
 - There will be no requirement to assess impacts at ecological sites;
 - The impacts on existing communities will be assessed using IAQM guidance on odour and the Environmental Protection UK and IAQM joint guidance on '*Land Use Planning & Development Control: Planning for Air Quality*'; and
 - The cumulative impacts with other development will also be assessed.
- 8.7 The aim of the risk assessment of the construction impacts on dust and particulate matter (PM₁₀) concentrations is to identify appropriate mitigation measures to be included in a Construction Environmental Management Plan (CEMP).
- 8.8 The air quality impact assessment will predict concentrations of nitrogen dioxide (NO₂) and particulate matter (PM₁₀ and PM_{2.5}) as these are the pollutants of concern from road traffic.
- 8.9 The modelling of the traffic emissions will be undertaken for three different scenarios, as follows:
- Baseline year;
 - Opening year without the proposed development; and
 - Opening year with the proposed development.
- 8.10 Additional scenarios will be completed if additional assessment of the cumulative impacts from committed developments is required.
- 8.11 The modelling exercise will utilise Annual Average Daily Traffic (AADT) flows for all affected roads from the TA produced for the site. The model will predict the annual mean concentrations for comparison with the relevant UK air quality objectives and the results will be verified using monitoring data.
- 8.12 Mitigation measures will be recommended based on the best practice guidance produced by the Sussex local authorities. The most recent version available at the time of the assessment will be used.
- 8.13 An assessment of the likely significant cumulative air quality impacts with the identified

committed developments will also be undertaken for the construction and operational phases of the proposed development.

Summary

8.14 Table 7 summarises the air quality effects to be included for detailed assessment in the ES.

Table 7: Air Quality Effects

Receptor	Effects	Scoped In
Existing residents	Potential exposure to increased pollution levels during both construction and operation.	✓
Future residents and users of the proposed development	Potential exposure to unacceptable odour during operation.	✓
Future residents and users of the proposed development	Potential exposure to unacceptable dust and particulate matter during construction and operation.	✓
Future residents and users of the proposed development	Potential exposure to unacceptable air quality (i.e. levels above the national objectives) during operation.	✓

9 NOISE & VIBRATION

- 9.1 An assessment of potential effects of the proposed development with respect to noise will be undertaken. This will include the construction phase (temporary) and operational phase (permanent) effects. The potential effects of vibration during the construction phase (temporary) on residential receptors will also be undertaken.
- 9.2 The key considerations in relation to the noise and vibration assessment are as follows:
- Identification of existing noise sensitive receptors adjacent to the site and relevant highways;
 - The baseline noise conditions in the study area;
 - Identification of the significant sources of noise within the vicinity of the study area;
 - Acoustic modelling of noise sources to predict likely noise levels across the site;
 - Assessment of the predicted noise levels against relevant standards and guidance including British Standard (BS) 8233¹, BS 4142² and World Health Organisation (WHO) Community Noise³;
 - The assessment under the above standards and guidance will determine the significance of any effect; and
 - Suitability of the site for proposed noise sensitive uses (to be provided as a supporting appendix to the Noise and Vibration ES chapter).

Baseline

- 9.3 Environmental noise surveys will be undertaken to establish the source strength of existing noise sources in the vicinity of the site and prevailing noise levels at the site.
- 9.4 Baseline traffic data for relevant highways will be obtained from the TA.

Approach

- 9.5 The change in noise levels resulting from additional traffic flows associated with the proposed development will be predicted using IMMI 2017 environmental noise modelling software. The magnitude of the impact will then be assessed in accordance with guidance contained in Design Manual for Roads and Bridges Volume 11 Section 3 Part 7 – HD213/11 Noise and Vibration for the following scenarios:
- Baseline year;

- Opening year without the proposed development;
- Opening year with the proposed development;
- Future year (+15 years of opening) without the proposed development; and
- Future year (+15 years of opening) with the proposed development.

- 9.6 The effects on noise during construction will also be assessed qualitatively in accordance with the British Standard 5228: 2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise. The focus will be on mitigation measures to be included in a CEMP.
- 9.7 Consideration will be given to the effects of vibration due to construction operations on residential properties with reference to BS 5228: 2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration and BS 6472 Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting.
- 9.8 Site suitability for residential development will be assessed in accordance with the NPPF and Noise Policy Statement for England, and the associated PPG. British Standard 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' is the appropriate standard for the design of new dwellings. BS 4142:2014 Methods for Rating and Assessing Industrial and Commercial Sound will be considered where relevant.

Summary

- 9.9 Table 8 summarises the noise and vibration effects to be included for detailed assessment in the ES.

Table 8: Noise & Vibration Effects

Receptor	Effects	Scoped In
Existing residential receptors and community uses	Temporary noise effects during construction, and need for control/mitigation measures.	✓
Vibration sensitive receptors	Temporary vibration effects during construction, and need for control/mitigation measures.	✓
Existing noise sensitive receptors	Permanent noise effects of change in traffic flows associated with development.	✓
Proposed noise sensitive receptors	Permanent noise effects from existing noise sources in the vicinity of the development.	✓

10 AGRICULTURAL LAND

- 10.1 The proposed development would result in the loss of agricultural land, an irreversible effect and one that could result in significant environmental effects; therefore an assessment of the effects of the proposed development on agricultural land would be scoped into the ES. The purpose of the assessment would be to identify the agricultural land quality of the site and to assess what the effects of the proposed development would be in terms of the loss of 'best and most versatile' agricultural land.

Baseline

- 10.2 Provisional land classification maps produced by the Ministry of Agriculture, Fisheries and Food (now Defra) indicates that the site comprises land classified as Grade 1 which is excellent quality agricultural land. The Provisional Maps give an indication of land quality on larger sites but should not be relied on for site specific assessment of land quality. Natural England's (NE) Predictive BMV Land Assessment also classifies the area as having high likelihood of BMV land (>60% area BMV)³.
- 10.3 Part of the site has been subject to post-1988 agricultural land classification (ALC) surveys⁴. This has classified the surveyed land as mostly Grade 2, very good quality agricultural land, with a smaller area of Grade 3a, good quality agricultural land. Based on the provisional land classification maps and the post-1988 survey data, the land qualifies as best and most versatile land. The agricultural land quality based on the desk study will be confirmed following an ALC field survey.

Approach

- 10.4 The approach to be taken will comprise desk studies, including a review of published and unpublished soils and agricultural land quality surveys to determine current information about the site, prior to undertaking a detailed soil auger survey and small pit examination in the field to confirm soil types and additional desk studies/calculations to confirm the ALC grading of the land.
- 10.5 There is a well-established methodology for classifying the quality of agricultural land, set

³ Natural England, (2017). Likelihood of Best and Most Versatile (BMV) Agricultural Land - Strategic scale map London and the South East (ALC019). Retrieved from <http://publications.naturalengland.org.uk/publication/6056482614804480>

⁴ Natural England, (2018), MAGIC, retrieved from <http://www.magic.gov.uk/>

out in guidance issued by the then Ministry of Agriculture, Fisheries and Food in 1988. Agricultural land in England and Wales is graded between 1 and 5, depending on the extent to which climate, physical or chemical characteristics impose long-term limitations on agricultural use. Grade 1 land is 'excellent quality' agricultural land with very minor or no limitations to agricultural use, and Grade 5 is 'very poor quality' land, with severe limitations due to adverse soil, relief, climate or a combination of these. Grade 3 land is subdivided into Subgrade 3a ('good quality' land) and Subgrade 3b ('moderate quality' land).

- 10.6 The principal feature of national policies regarding agricultural land use is the emphasis on safeguarding scarce natural resources in the long-term national interest. Paragraph 112 of the NPPF advises that local planning authorities should take into account the economic and other benefits of best and most versatile quality land when making decisions on development. Where significant development of agricultural land is demonstrated to be necessary, areas of poorer quality land in Grades 3b, 4 and 5 should be used in preference to higher quality land in Grades 1, 2 and 3a.
- 10.7 The significance of effects on agricultural land will depend on the amount to be lost due to the proposed development. There is little current guidance on what area of loss is considered significant, however, 20ha is the threshold adopted in The Town and Country Planning (Development Management Procedure) (England) Order 2015 for Local Planning Authorities to consult Natural England before granting planning permission for a non-agricultural development that is not consistent with an adopted development plan, which would involve the loss of Grades 1, 2 or 3a agricultural land. This threshold will be taken into consideration in the assessment of the magnitude of impacts.

Summary

- 10.8 Table 9 summarises the agricultural land effects identified for inclusion in the assessment.

Table 9: Agricultural Land Effects

Receptor	Effects	Scoped In
Best and most versatile agricultural land	Change of use of land for non-agricultural development.	✓

11 WATER RESOURCES AND FLOOD RISK

- 11.1 An assessment will be undertaken of the likely significant effects of the proposed development on water resources and flood risk.

Baseline

Topography and Geology

- 11.2 A full topographical survey will be commissioned in order to accurately define the existing ground contours. This survey information will form the basis of the levels and drainage design for the proposed development.
- 11.3 A review of the British Geological Survey (BGS) indicates that the site is underlain by River Terrace deposits (comprising undifferentiated clay, silt sand and gravel) and the Newhaven Chalk bedrock formation. A site investigation will be carried out with BRE365 compliant soakage testing to confirm the depths of the underlying strata and potential for infiltration.
- 11.4 A desktop based geo-environmental appraisal has been commissioned to provide a preliminary 'risk assessment' and 'conceptual site model' in order to assess any potential sources of contamination associated with previous uses of the site.

Hydrology (Surface)

- 11.5 The River Arun is located approximately 500m to the east of the site and runs through a series of villages before discharging into the English Channel at Littlehampton. Based on aerial images of the area, it is perceived that a number of drainage ditches are located around the site, which most likely lead to the River Arun. The location of on site ditches will be confirmed as part of the topographical survey, and a site inspection should be undertaken to identify the ditch network leading to the River Arun if possible.

Hydrogeology

- 11.6 The site is underlain by a Secondary A and Principal aquifer, designated to the superficial deposits and bedrock, respectively. The Secondary A aquifer means that the site has permeable layers capable of supporting water supplies at a local scale. The Principal Aquifer is where layers of rock have high intergranular and/ or fracture permeability, meaning they usually provide a high level of water storage. They may support water supply and/ or river

base flow on a strategic scale.

- 11.7 According to the EA's groundwater map, the site is not located within a Source Protection Zone.

Water Quality

- 11.8 Upstream of the site lies the Arun Valley, which consists of three SSSIs in an area of wet meadows on the floodplain of the River Arun. The Arun Valley is considered to be of national and international conservation importance, and subject to designation as a Special Protection Area (SPA), candidate Special Area of Conservation (cSAC) and Ramsar site. Water quality data for the river can be obtained (if available) and a review of the data can be undertaken to establish whether the EA requirements are being met.

Flood Risk and Surface Water Drainage

- 11.9 An initial review of the EA's indicative flood map indicates that the majority of the site is located in Flood Zone 1 (low probability). This land is assessed as having a less than 0.1% (1 in 1000) chance of river or sea flooding occurring each year. A small area to the north east of the site is located in Flood Zone 2. This land is assessed as having between a 1% (1 in 100) and 0.1% (1 in 1000) annual probability of river flooding, or between a 0.5% (1 in 200) and 0.1% (1 in 1000) annual probability of sea flooding. No development is currently proposed within this area of the floodplain.

Approach

- 11.10 An assessment will be undertaken of the likely significant effects of the proposed development on the water environment.
- 11.11 The ES chapter will identify and assess the effects of the proposed development on surface water quantity and quality, groundwater quantity and quality, and wastewater drainage as a result of the change in land use and regime during the construction and completed development phases.
- 11.12 The assessment of likely significant effects will be based on a review of published data including evidence base documents, site surveys and site visits, online mapping ((BGS), EA, Ordnance Survey, etc.), and liaison with the EA, Water Company and Lead Local Flood Authority (LLFA).

Summary

11.13 Table 10 summarises the likely effects on the water environment identified for inclusion in the assessment.

Table 10: Water Resources and Flood Risk

Receptor	Effects	Scoped In
Groundwater	Construction and operational phase effects on groundwater.	✓
Surface water	Construction and operational phase effects on surface water quantity and quality.	✓
Wastewater generation	Construction and operational phase effects on the wastewater conveyance and treatment network.	✓

12 CUMULATIVE EFFECTS AND CONSULTATION

- 12.1 The ES will consider the potential for likely significant effects on the environment resulting from committed developments in the area. PPG1 identifies that:

"...There are occasions where other existing or approved development may be relevant in determining whether significant effects are likely as a consequence of a proposed development..."

- 12.2 Table 11 sets out the committed schemes which have been identified for the assessment of likely significant cumulative effects on the environment. It is considered appropriate to include major schemes within 2km of the site that either have planning permission or are in the process of being implemented, as well as major planning applications which have been submitted but not yet determined.

Table 11: Cumulative Schemes

Scheme Name & Application Number	Scheme Details	Planning Status	Approximate Distance from the Site
Yapton			
Land North of Burndell Road, Yapton Ref: Y/81/10	Proposed development comprising of the construction of 173 new dwellings and associated car parking, public open space, including childrens play areas, vehicular access and highway works.	(At appeal – APP/C3810/A/11 /2155343/NWF)	Adjacent to the eastern boundary of the site.
Land to the south of Ford Lane East of North End Road, Yapton Ref. Y/80/16/OUT	Outline planning application with some matters reserved for 4.5 hectares of residential development comprising 3.4 hectares of land for up to 100 dwellings (up to 30 (30%) affordable housing) together with 1.1 hectares of land set aside for public open space and strategic landscaping and 2.2 hectares of public open space and green corridors with vehicular access from Ford Lane and pedestrian/cycle access only from North End Road. This application is a Departure from the Development Plan.	(At appeal – APP/C3810/V/16 /3158261)	Approximately 260m to the west of the site boundary.

Scheme Name & Application Number	Scheme Details	Planning Status	Approximate Distance from the Site
Land off Burndell Road, Yapton Ref. Y/19/16/OUT	Outline application for the development of a maximum of 108 No. residential dwellings, vehicular access from Burndell Road, public open space, ancillary works & associated infrastructure.	(At appeal – APP/C3810/V?16 /3158261)	Approximately 470m to the west of the site boundary.
Land at Bilsham Road, Yapton Ref. Y/91/17/OUT	Outline application for the development of up to 250 residential dwellings (Class C3), vehicular access, public open space, ancillary works and associated infrastructure.	Pending Decision	Approximately 1.1km west of the site boundary.
Land east of Drove Lane, Yapton Ref: Y/92/17/OUT	Outline application with all matters reserved save access, for up to 300 dwellings, link road, surface drainage, open space and landscaping.	Pending Decision	Approximately 1.4km east of the site boundary.
Ford			
Land to the South of Ford Lane, Ford Ref: F/4/18/PL	Salt storage building, office building, parking & turning area & open storage areas for highways maintenance depot.	Approved	Approximately 80m north of the site boundary.
Land south of Burndell Road, Yapton Ref: F/7/15/OUT	Outline application for residential development comprising 45 dwellings.	Approved	Approximately 450 west of the site boundary.
Climping			
Land to West of Church Lane, South of Horsemere Green Lane Ref. CM/1/17/OUT Resubmission Ref. CM/13/18/OUT	Outline application with some matters reserved for the erection of up to 300 dwellings and ancillary development comprising open space, a building within use class D1 of up to 875 square metres net, a building for A1 use having a floor area of up to 530 sq. metres net, together with open space and ancillary works, including access points, car parking and drainage arrangements, with appearance, landscaping, layout; and scale wholly reserved for subsequent approval. The access detail, showing the points of access to the development, and indicated on Bellamy Roberts drawings numbered	Appealed	Approximately 280m south of the site boundary.

Scheme Name & Application Number	Scheme Details	Planning Status	Approximate Distance from the Site
	4724/013 and 4724/005 Rev A are access proposals to be determined at this stage of the application.		

- 12.3 Guidance is sought from ADC as to whether any other committed developments should be considered for the potential to lead to likely significant cumulative effects on the environment with the proposed development.

Consultation

- 12.4 The following statutory and other consultees will be consulted through the EIA process:

- Highways England;
- Environment Agency;
- Natural England;
- Historic England;
- National Health Service;
- Southern Water;
- ADC (various departments);
- WSCC; and
- any other stakeholder that ADC nominates.

- 12.5 Public consultation will be undertaken during the preparation of the planning application. The feedback received through the consultation will be summarised in the ES and written up in full in the Statement of Community Involvement submitted in support of the planning application.

13 ENVIRONMENTAL STATEMENT STRUCTURE

13.1 The ES will contain three main volumes as set out in Table 12 below.

Table 12: Environmental Statement Structure

Volume 1: ES Main Text and Figures		
Chapter No.	Chapter Title	Description
1	Introduction	Introduction to the ES, EIA requirements, details of project team, ES organisation and availability.
2	EIA Methodology	Methods used to prepare each chapter, description of ES structure and content, generic significance criteria, scoping and consultation and details of schemes included in the assessment of cumulative effects
3	Site and Development Description	Site description and details of the proposed development.
4	Alternatives and Design Evolution	Outline of the main alternatives considered by the Applicant.
5	Construction Methodology and Phasing	Details of anticipated programme for development and construction methodology.
6	Population and Human Health	Consideration of the potential effects on population and human health.
7	Landscape and Visual Effects	Effects of the proposed development on landscape character and visual amenity. This will include the consideration of night time light effects.
8	Archaeology and Built Heritage	Consideration of the effects of the proposed development on above and below ground heritage assets.
9	Biodiversity	Assessment of effect on biodiversity and ecology at the site.
10	Transport & Access	Transport and access effects.
11	Air Quality	Assessment of the effects of the proposed development on air quality as a result of construction activities and vehicle movements.
12	Noise and Vibration	Assessment of the effects of the proposed development on noise and vibration.
13	Agricultural Land	Assessment of the loss of agricultural land and effects on agricultural land holdings.
14	Water Resources and Flood Risk	Assessment of the effects on water quality, including effects relating to drainage and flood risk.
15	Summary and Residual Effects	Summary of the residual and interactive effects of the proposed development.
Volume 2		
Technical Appendices		Technical data and reports to support the chapters in Volume 1.
Standalone Document		
Non-Technical Summary		Summary of the ES in non-technical language.

13.2 The first five chapters of the ES would be introductory and provide essential information for the subsequent technical chapters. Further information on these chapters is set out below.

Introduction

- 13.3 This chapter will provide background to the EIA, describe the structure of the ES and identify the project team.

EIA Methodology

- 13.4 This chapter will set out the methodology used in the EIA, state the assumptions applicable to all disciplines, summarise the EIA Scoping process undertaken and summarise the public consultation process. Bespoke methodologies, limitations and assumptions will be contained in the technical chapters of the ES where required.
- 13.5 The significance of an environmental effect is determined by the interaction of magnitude and sensitivity, whereby the effects can be positive or negative. Generic criteria to be used in carrying out this process are detailed below. Some technical chapters will use discipline-specific criteria with their own terms for magnitude, sensitivity and significance. This will be explained in the relevant chapter.

Prediction of Impact Magnitude

- 13.6 The methodology for determining the scale or magnitude of impact is set out below.

Table 13: Methodology for Assessing Magnitude

Magnitude of Impact	Criteria for assessing impact
Major	Total loss or major/substantial alteration to key elements/features of the baseline (pre-development) conditions such that the post development character/composition/attributes will be fundamentally changed.
Moderate	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of the baseline will be materially changed.
Minor	A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible/detectable but not material. The underlying character/composition/attributes of the baseline condition will be similar to the pre-development circumstances/situation.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.

- 13.7 The sensitivity of a receptor is based on the relative importance of the receptor using the scale set out below.

Table 14: Methodology for Determining Sensitivity

Sensitivity	Examples of Receptor
High	The receptor/resource has little ability to absorb change without fundamentally altering its present character, or is of international or national importance.
Moderate	The receptor/resource has moderate capacity to absorb change without significantly altering its present character, or is of high importance.
Low	The receptor/resource is tolerant of change without detriment to its character, is of low or local importance.

Assessment of Effect Significance

- 13.8 Effect significance will be calculated using the matrix in Table 15. This illustrates the interaction between impact magnitude and receptor sensitivity.

Table 15: Effect Significance Matrix

Magnitude	Sensitivity		
	High	Moderate	Low
Major	Major Adverse/Beneficial	Major - Moderate Adverse/Beneficial	Moderate - Minor Adverse/Beneficial
Moderate	Major - Moderate Adverse/Beneficial	Moderate - Minor Adverse/Beneficial	Minor Adverse/Beneficial
Minor	Moderate - Minor Adverse/Beneficial	Minor Adverse/Beneficial	Minor Adverse/Beneficial - Negligible
Negligible	Negligible	Negligible	Negligible

Site and Development Description

- 13.9 This chapter will describe the setting of the site and the existing conditions on the site, as well as explaining the proposed development and setting out the development parameters. The parameter plans will be included as figures to the chapter.

Alternatives

- 13.10 This chapter would describe the evolution of the proposed development based on environmental constraints.

Construction Methodology and Phasing

- 13.11 This chapter will outline the anticipated construction programme, phasing and methodology and explain the assumptions made. This chapter will form the basis of the construction phase assumptions documented in each of the technical chapters of the ES.

Technical Assessments

13.12 Each ES chapter will follow the headings set out below to ensure the final document is transparent, consistent and accessible.

- Introduction;
- Planning Policy Context;
- Assessment Methodology;
- Baseline Conditions;
- Likely Significant Effects;
- Mitigation Measures;
- Residual Effects;
- Cumulative Effects; and
- Summary.

13.13 Each chapter sub-heading is explained in further detail below.

Table 16: Technical Chapter Format and Content

Sub-Heading	Content
Introduction	This section will introduce the assessment discipline and the purpose for which it is being undertaken.
Planning Policy Context	This section will include a summary of national, regional and local policies of relevance to the environmental discipline and assessment. Where applicable, relevant legislation will also be summarised.
Assessment Methodology	- This section will provide an explanation of methods used in undertaking the technical study with reference to published standards, guidelines and best practice. The application of significance criteria will also be discussed. - It will also outline any difficulties encountered in compiling the required information.
Baseline Conditions	This will include a description of the environment as it is currently (2017) and as it is expected to change given the project were not to proceed (i.e. 'do-nothing' scenario). The method used to obtain baseline information will be clearly identified. Baseline data will be collected in such a way that the importance of the particular subject area to be affected can be placed in its context and surroundings so that the effects of the proposed changes can be predicted.
Likely Significant Effects	This section will identify the likely significant effects on the environment resulting from the construction and operational phases of development.
Mitigation Measures	- Adverse effects will be considered for mitigation and specific mitigation measures put forward, where practicable. Mitigation measures considered may include modification of the project, compensation and the provision of alternative solutions (including alternative technology) as well as pollution control, where appropriate. - The extent of the mitigation measures and how these will be effective will be discussed. Where the effectiveness is uncertain or depends upon assumptions about operating procedures, data will be introduced to justify the acceptance of these assumptions. - Clear details of when and how the mitigation measures will be carried out will be given. When certainty of impact magnitude and/or effectiveness of mitigation over time exists, monitoring programmes will be proposed to enable subsequent adjustment of mitigation measures, as necessary.

Sub-Heading	Content
	• The opportunity for enhancement measures will also be considered, where appropriate. • Information will be included on the mechanism by which the mitigation will be secured (e.g. by planning condition) with outline arrangements for monitoring and responsibilities for doing so, where necessary.
Residual Effects	• The residual effects, i.e. the effects of the proposed development assuming implementation of proposed mitigation, will be determined. The residual effects represent the overall likely significant effect of the proposed development on the environment having taken account of practicable/available mitigation measures.
Cumulative Effects	• The cumulative effects of the proposed development and the identified committed developments will be assessed.
Summary	• A summary of the assessment and conclusions will be provided at the end of each technical chapter.

Summary and Residual Effects

- 13.14 The residual effects of the proposed development will be summarised in one table at the end of the ES setting out the overall beneficial and adverse effects of the proposed development. This chapter will also identify any interactive effects that could result from the proposed development, i.e. multiple effects impacting on a single receptor.

APPENDIX 1

SITE LOCATION PLAN



Project
FORD AIRFIELD

Drawing Title
SITE BOUNDARY PLAN

Date 01.10.14	Scale 1:5000@A1	Drawn by MD	Check by D.S.
Project No 23885	Drawing No RG-M-01	Revision D	

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**DETAILED UNEXPLODED
ORDNANCE RISK ASSESSMENT ASSESSMENT (RSK, JULY 2018)**

FELLOWS

The UXO risk management experts

Part of the Optima Group



Detailed Unexploded Ordnance Risk Assessment [In Accordance with CIRIA Report C681]

FIL Reference: 2078

Client: RSK Environmental Ltd

Project: Ford Airfield

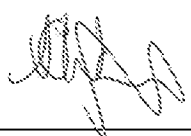
Site Location: Ford Road, Ford, Arundel, BN18 0FL

Date: 13th July 2018

Document Control

Version Date	Version	Author	Reviewer	Comments
13 July 2018	1.0	Nathan Oakes	Andy Ward	Original

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	Reviewed by	Approved by
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Acronyms and Abbreviations

AAA	Anti-Aircraft Artillery
AP	Armour Piercing
AP	Anti-Personnel
ARP	Air Raid Precaution (Wardens)
BD	Bombing Density
BGL	Below Ground Level
BGS	British Geological Survey (UK)
BH	Borehole
CDM	Construction (Design and Management) Regulations 2015 (UK)
CIRIA	Construction Industry Research and Information Association
CPT	Cone Penetrometer Test
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
ERP	Emergency Response Plan
ERW	Explosive Remnants of War
FFE	Free From Explosives
GI	Ground Investigation
GPS	Global Positioning System
HE	High Explosive
HSE	Health and Safety Executive
HSWA	Health and Safety at Work Act 1974
IB	Incendiary Bomb
JSEODOC	Joint Services Explosive Ordnance Disposal Operations Centre (UK)
LE	Low Explosive
LM	Luftmine (Germany)
LSA	Land Service Ammunition
MOD	Ministry of Defence (UK)
NEQ	Net Explosive Quantity
RAF	Royal Air Force
RN	Royal Navy
ROF	Royal Ordnance Factory
SAA	Small Arms Ammunition
SAP	Semi-Armour-Piercing
SI	Site Investigation
SIP	Self-Igniting Phosphorous
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V1	Vengeance Weapon 1 - Flying bombs or doodlebugs
V2	Vengeance Weapon 2 - Long range rocket
WW	World War

1. Executive Summary

Site details

The site is the former RAF and Royal Navy airfield known as RAF FORD or RNAS PEREGRINE. It is situated immediately adjacent to the village of Yapton, approximately 3.8km west of Littlehampton.

Risk Assessment

Unexploded Ordnance (UXO) risk at the site is assessed as:

UXO	RISK
German air dropped weapons	Medium
British Anti-Air defensive munitions	Low Risk
Other (Land service Ammunition / Historic [Home Guard] / Military Training)	Low Risk

Full detail of the UXO risk and the risk assessment process including site zoning is within section 11.

UXO Risk

The primary UXO risk associated with this site is considered to be deep buried aerial dropped bombs. There is also a risk of encountering shallow buried anti-aircraft munitions and other aerial or land service ordnance which may have been dumped or buried in caches.

Summary of findings

The site, a former Royal Navy Fleet Air Arm and RAF aerodrome has seen significant military usage throughout the 20th Century. Constructed in 1917, the airfield saw a variety of aircraft ranging from the biplanes of the early 20's to the jet powered aircraft of the 50's.

The site was heavily bombed and nearly destroyed on the 18th August 1940 while it was under the control of the Fleet Air Arm. Following this, the RAF took over and used the site as both a training centre and a variety of mixed roles, from Intruder Squadrons to night bombing.

Following the end of WWII, the site was utilised once again by the Fleet Air Arm but the station eventually closed. Following this, parts of the land were used as an Open Prison and other parts were given over to agriculture. There has been some recent construction with the Ford Trading Estate.

UXO Risk management recommendations

For all works within the site area:

A UXO Awareness Brief (UXOAB) be delivered to all site personnel. This can also include a site safety walk-through and provision of a UXO Emergency Response Plan for inclusion into the site HSE documentation.

Ground Investigation (GI) works:

Provision of a UXO Engineer to oversee intrusive GI works to include the use of a magnetometer (downhole scanning) to determine the presence or otherwise, of possible Unexploded Ordnance (UXO) contamination that could compromise any intrusive ground investigation works.

Excavations and shallow intrusive works within the site area:

Provision of an UXO Engineer to oversee shallow intrusive excavation works will reduce the risk of a UXO incident occurring. The UXO Engineer can be on-site to identify any items uncovered during excavation. This can reduce down-time and improve site efficiency.

Piling or deep excavations:

Due to the risk from German aerial bombs at the site, an intrusive magnetometer survey is recommended to assure safety of personnel and equipment during the piling works. This can be in the form of or Cone Penetration Testing (CPT) where load bearing or contiguous piling is planned.

For deep piling, CPT probing should take place to a minimum probe depth of 10m bgl.

Fellows International Limited [Fellows] can provide all of the above services and would be pleased to provide a proposal accordingly.

For further information, or to discuss requirements, please get in touch.

Web - www.fellowsint.com

Tel - 01243 551025

Email – research@fellowsint.com

2. Report Methodology

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at the site as described by the client.

Every reasonable effort has been made to ensure that all available historical information has been accessed and checked. Where possible, evidence has been included in the report to enable the client to understand the basis of the risk assessment. Fellows cannot be held responsible for any changes to the assessed level of risk or risk mitigation measures based on documentation or other information that may come to light at a later date. The accuracy of wartime records is frequently difficult to verify. As a result, conclusions as to the exact location, quantity and nature of the ordnance threat can never be definitive but must be based on the accumulation and careful analysis of all accessible evidence. Fellows cannot be held responsible for inaccuracies or gaps in the available historical information. All sources are referenced at Section 13.

The report recommends appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable (ALARP).

This report follows the guidelines outlined in CIRIA Report C681, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry'.

The author of this report visited West Sussex Records Office to obtain local information pertaining to this site.

Fellows has been supporting the UK construction industry with UXO Risk Management measures for over 2 decades and offer the complete UXO risk management process from the preliminary and detailed desk study through to the physical site survey and finally, the identification and removal or disposal of an item, either in house or in liaison with military disposal assets. Our desk top studies enable our clients to accurately assess the UXO risk and take proportionate, cost effective action to manage the risk posed by unexploded aerial bombs and other munitions.

As one of the first companies to offer this service in the UK, Fellows have unrivalled experience delivering the UXO Risk Management process and are proud of our reputation for quality and cost-effective delivery, gained from our years of experience. Fellows can support you through the whole risk management process from project start to final delivery.

While Fellows is mainly active in the UK, we also have a long history of operating overseas on projects all over the globe. We are proud to support both the construction and offshore industries with the right experience, people, qualifications and equipment to best identify, quantify and mitigate the UXO risk wherever it may be.

3. Requirement for UXO Risk Assessment

Background

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction or development projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, the legislation outlined below makes very clear that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) defines the responsibilities of parties involved in the construction of temporary or permanent structures. CDM 2015 establishes a duty of care extending from clients, principle co-ordinators, designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties if correct health and safety procedure has not been applied.

Although CDM 2015 does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation on parties to:

- Provide or obtain an appropriate assessment of potential UXO risks at the site
- Emplace appropriate risk mitigation measures if necessary
- Supply all parties with relevant risk information
- Prepare a suitably robust emergency response plan.

Other legislation

The 1974 Health and Safety at Work Act

All employers have a responsibility under the Health and Safety at Work Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable.

4. Site Description (Current)

Site location

The site is located on the former Ford Airfield in West Sussex. The site is approximately 3.8km west of Littlehampton, 4.8km southwest of Arundel and 6.9km northeast of Bognor Regis. The area is predominantly comprised of agricultural land, with some recent developments of commercial and retail properties within the site boundaries.

Mapping / aerial photography



Figure 1. Showing aerial photography of the approximate site boundaries outlined in red. (Google Earth Pro, 2018)

5. Site History

Ford Aerodrome (HMS PEREGRINE, RAF FORD)

Ford airfield was originally opened in March 1918 by German POWs for use by RAF and USAAF squadrons. Due to the late construction of the airfield, it was never utilised for its original purpose of being a “jumping off” point for France by the American troops. The airfield fell into disuse and was closed in 1920.

The airfield re-opened to civilian pilots in the next decade. During this time, experiments with in-air refueling were conducted from this airfield by the Ford Motor Company. Ford intended to fly the Ford Tri-motor Passenger aircraft commercially from this location, but it was not given an air worthy license by the government. Ford vacated the hangers and local flying clubs utilised these for private flying before finally being given over to the military again in 1937.

The Fleet Air Arm renamed the airfield HMS PEREGRINE and training units were stationed there at the beginning of WWII. Despite having little considerable involvement with the Battle of Britain, the Luftwaffe considered the airfield as strategically important. The airfield was bombed and heavily damaged by Luftwaffe Junkers Ju 87 aircraft on 18th August 1940. This was one of the the worst raids against airfield targets due to the extent of damage caused. This raid claimed 28 lives and destroyed the main airfield buildings and runway. 1946 RAF aerial photography shows some damage that has been repaired or buildings demolished and can be seen in figures 2 - 4.

Following this raid, the RAF quickly repaired and reused the airfield for counter attacks against Germany by Fighter-Bomber “Intruder squadrons”. These squadrons were tasked with roaming German occupied territories and attacking targets at will. This was further amalgamated into fighter-bomber sorties throughout D-Day preparations and commencement. The airfield was also utilised by the RAF Aerial Photography School with the purpose of training photographers in both reconnaissance and post-raid photograph interpretation. Fighters, night fighters, bombers and fighter-bombers were based here and played an important role in the Dieppe and D-Day operations. There are several recorded allied and enemy aircraft crashes recorded near Ford Aerodrome. These can be seen in Table 1. Other aircraft crashes in the county were found to have live UXO on board which was subsequently buried by soft mud and not discovered until years later.

Date	Aircraft	Location
24/10/42	Lancaster	Wicks Farm, Ford
20/06/42	Hurricane	Little Harn Farm, Ford
25/03/42	Hurricane	West of Ford
19/02/43	Beaufighter	Ford
12/06/43	Mosquito	Near Ford Airfield
10/09/43	Messerschmitt 108	Ford Airfield
19/11/1943	Halifax	Near Ford
24/11/1943	Spitfire	Yapton
30/01/44	Mosquito	Bilsham Corner, Yapton
23/05/44	Fortress B17	Ford Aerodrome
09/06/44	Mosquito	Ford Aerodrome
22/06/44	Marauder B26	Yapton
30/06/44	Lancaster	Ford Aerodrome
18/07/44	Spitfire	Bilsham Farm, Yapton
01/08/44	Mosquito	Ford Aerodrome
22/10/44	Mosquito	Ford Aerodrome
19/12/44	Halifax	Ford Airfield

Table 1. Showing aircraft crashes on or near Ford Aerodrome



Figure 2. Showing post war bomb damage. Craters are visible and have been circled in red.



Figure 3. Showing further bomb damage to areas near hangers.



Figure 4. Showing further craters in the fields and buildings adjacent to one of the runways.

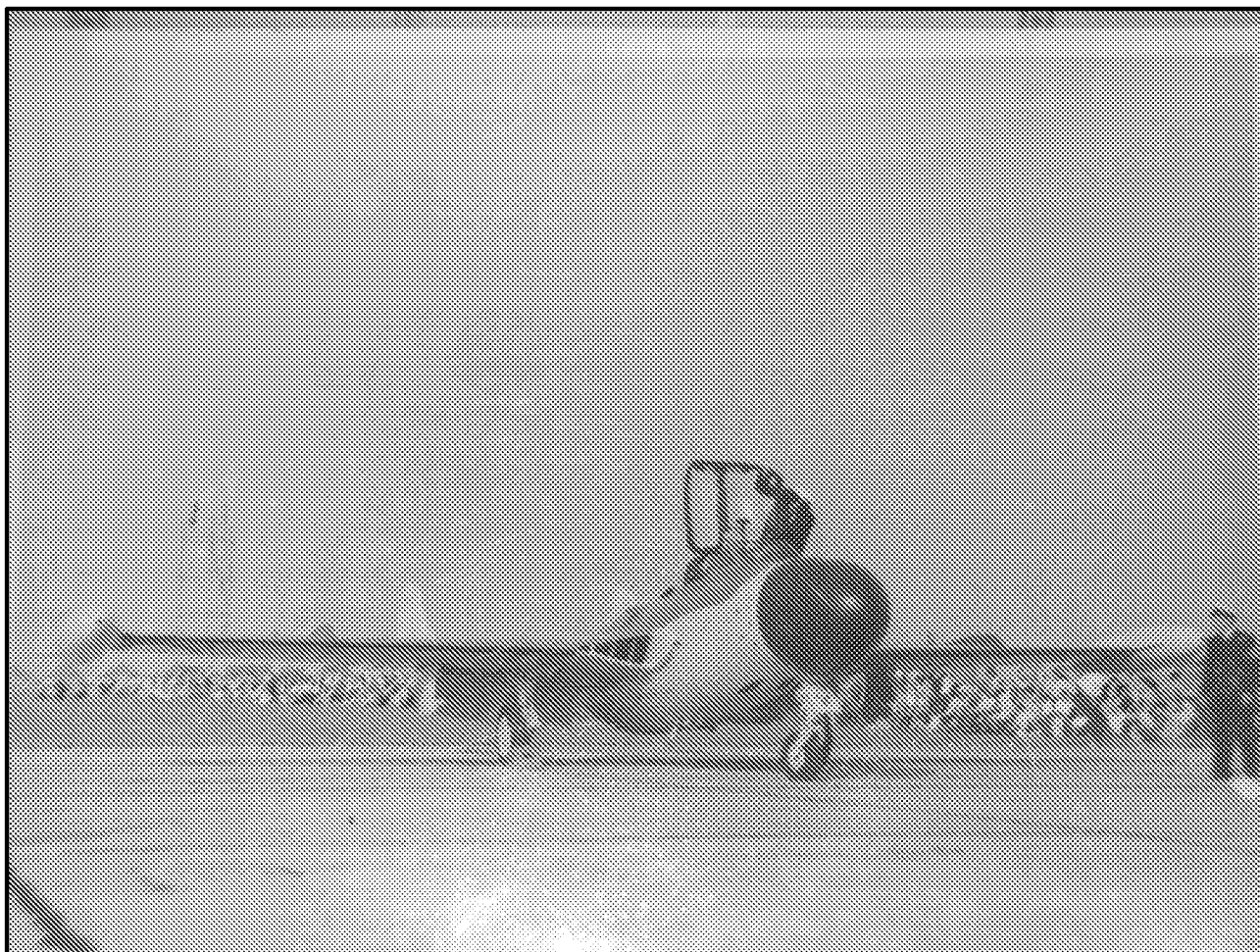


Figure 5. Showing a de Havilland Venom circa 1950's during the RNAS PEREGRINE open day [The Aviation Forum, n.d.].

Arundel Municipal District

Despite the close proximity of Tangmere and Ford airfields and the number of missiles and HE bombs dropped on the borough, none of Arundel's citizens are on the War Dead Roll for the entirety of the war.

On 13th August 1940, a Junkers Ju 88 bomber crashed into Swanbourne lake after being shot down by Tangmere based Hurricanes. The plane tore itself apart after striking the Beech trees on the west side of the lake. Much of the wreckage fell into the lake with the evidence becoming apparent after the drying of the lake in 1989 when an unexploded 50kg bomb was found on the mud. In the early part of 1990, further UXBs were found at the site, a single SC50kg and two SC250s. These were defused and removed for disposal.

On 2nd May 1941, the borough received 5 HE bombs to the east of London Road causing some slight damage to the roof of Green Lodge, Arundel Park, but no casualties.

It is assessed that this was an act of Tip and Run.

Chichester Rural District

With its proximity to military targets, the district saw its fair share of fighting. Twenty three enemy aircraft came down in 1940 alone. Despite the cost to the Luftwaffe, there were relatively few injuries or fatalities. On 19th August there were 3 civilian casualties at Broadreads Holiday Camp in Selsey.

The first Luftwaffe loss was a Heinkel HE111 shot down onto East Beach at Selsey on 11th July 1940 by Hurricanes of 145 Sqn from Westhampnett. Two crew were killed, three taken as POWs.

On the 21st July 1940, a Messerschmitt 110 was forced down almost in one piece onto Home Farm, Goodwood. The aircraft was repaired and test flown by the RAF.

The constant downing of German planes came to a head in the region on the 16th August. Five German planes and two British planes were shot down over the county and Tangmere airfield was heavily bombed. A crippled Hurricane landed in flames at the height of the bombing raid on Tangmere. The pilot later died in hospital. Later that day a Messerschmitt was shot down at Shopwyke House.

Two days later on the 18th August, the Stuka bombers returned and attacked Thorney Island, Poling and Ford airfield. Downed Stukas were found at Cut Mill in West Ashling, North Barn at Chidham and in Fishbourne Creek. The bomber in Fishbourne Creek had not jettisoned its bomb load, and these were thought to have been recovered more recently.

26th August saw heavy aerial fighting with a Heinkel He111 shot down at Bracklesham Bay, West Wittering. This plane was intact and slowly sank into the sands. It is now completely covered. Another bomber was shot down at Stansted House, Stoughton. The bombs of this exploded, taking the lives of all 5 crew and mortally wounding an RAF Pilot Officer who was billeted here.

29th August saw a Hurricane shot down in the sea by Selsey Bill. A rare Messerschmitt 109 was also shot down at Mapsons Farm, Sidlesham.

As night raids became more common, several more aircraft were shot down at Stocks Lane, East Wittering on 20th November.

Historical Developments

Military occupied areas were frequently not mapped until such time that the land became available for public use. During the war period, much of the land has not been mapped to protect the information.

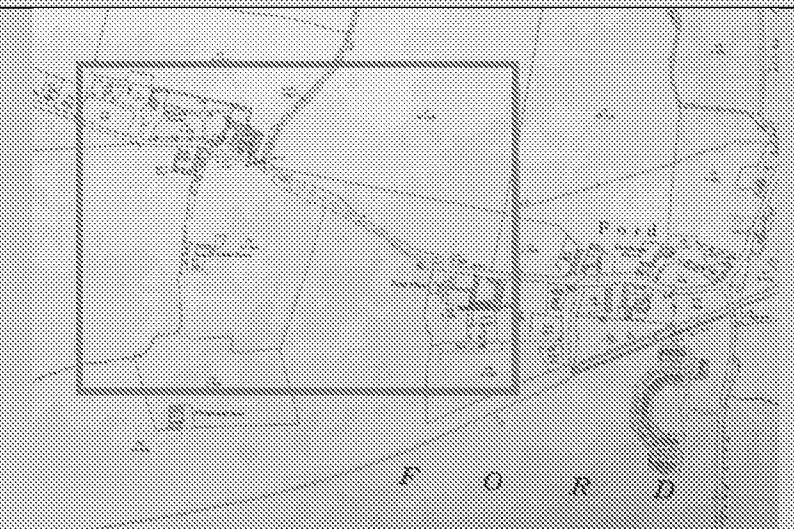
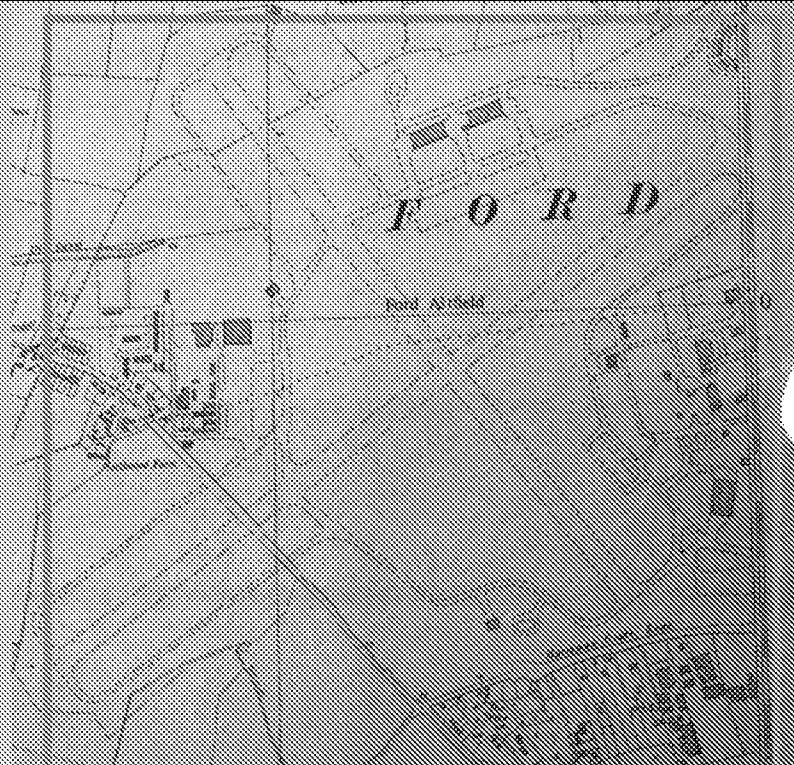
Data	Description	Map
1939	1939 revision of the OS map of the area. The airfield is not shown on this map, despite being constructed long before this. Military presence was not shown.	
1962	1962 revision of the OS map shows the airfield, but the majority of the aircraft pens and structures are still not shown. Much of the land was given over to agriculture at this point in time.	

Table 2. Summary table of the develop and demolition works which have taken place in the site before and after WWII [Ordnance Survey, 1939 – 1962].

Recent developments.

At the end of WWII, the airfield was returned to the Fleet Air Arm. At this point, the airfield was closed to make essential improvements. The runways were extended and reconstructed using concrete to accommodate newer jet powered aircraft.

In August 1951 the airfield was the site of the first Naval jet fighter unit comprised of Supermarine Attackers. Military occupation of the airfield ceased in 1958 and control was once again given over to civilian flights. Flying by civilians stopped in 1980.

The site was returned to agricultural use and some of the buildings used as an open prison. The majority of the aircraft hangers and pens were removed around this time.

The site is mostly agricultural with some newer sections of industrial and commercial properties. The Ford Trading Estate and Water Treatment plant are both examples of the change, both built close to the original runways. Part of the site has been utilized by the local Rifle club and on Sundays it is used for car boot sales and markets.

6. Site Environment

Proposed scope of works

There are mixed developments proposed in various sections of the site. This ranges from residential dwellings to areas designated for employment purposes (commercial, most likely). There is likely to be areas of piling. The map in figure 6 and aerial photography in figure 7 show the extent of different types of development.

Ground conditions

There is expected to be up to 5m of alluvial soils present across much of the site. Beneath this, it is expected that it will be chalk bedrock of varying strata and hardness.

Site geological conditions

The site sits on superficial River Terrace deposits which is comprised of sand, silts and clays. These are fluvial in origin and undifferentiated.

Bedrock geology in the area is of the Lewes Nodular Chalk, Newhaven Chalk, Seaford Chalk, Culver Chalk and Portsdown Chalk formations. These formations are undifferentiated and are shallow marine in origin. These are carbonate material lain in distinctive beds over time.

Local Borehole information

Borehole / Trial pit reference	Date	Location	Hole Depth	Strata [Thickness]
SU90SE2	n.d.	On site	20'3"	1'0" Soil 15'0" Sandy Clay 4'3" Chalk

Borehole / Trial pit reference	Date	Location	Hole Depth	Strata [Thickness]
SU90SE3	n.d.	On site	20'0"	1'0" Soil 16'0" Sandy Clay 3'0" Chalk
SU90SE4	n.d.	On site	20'0"	1'0" Soil 14'0" Sandy Clay 5'0" Chalk

Table 3. Showing historic borehole logs in the vicinity of the site.

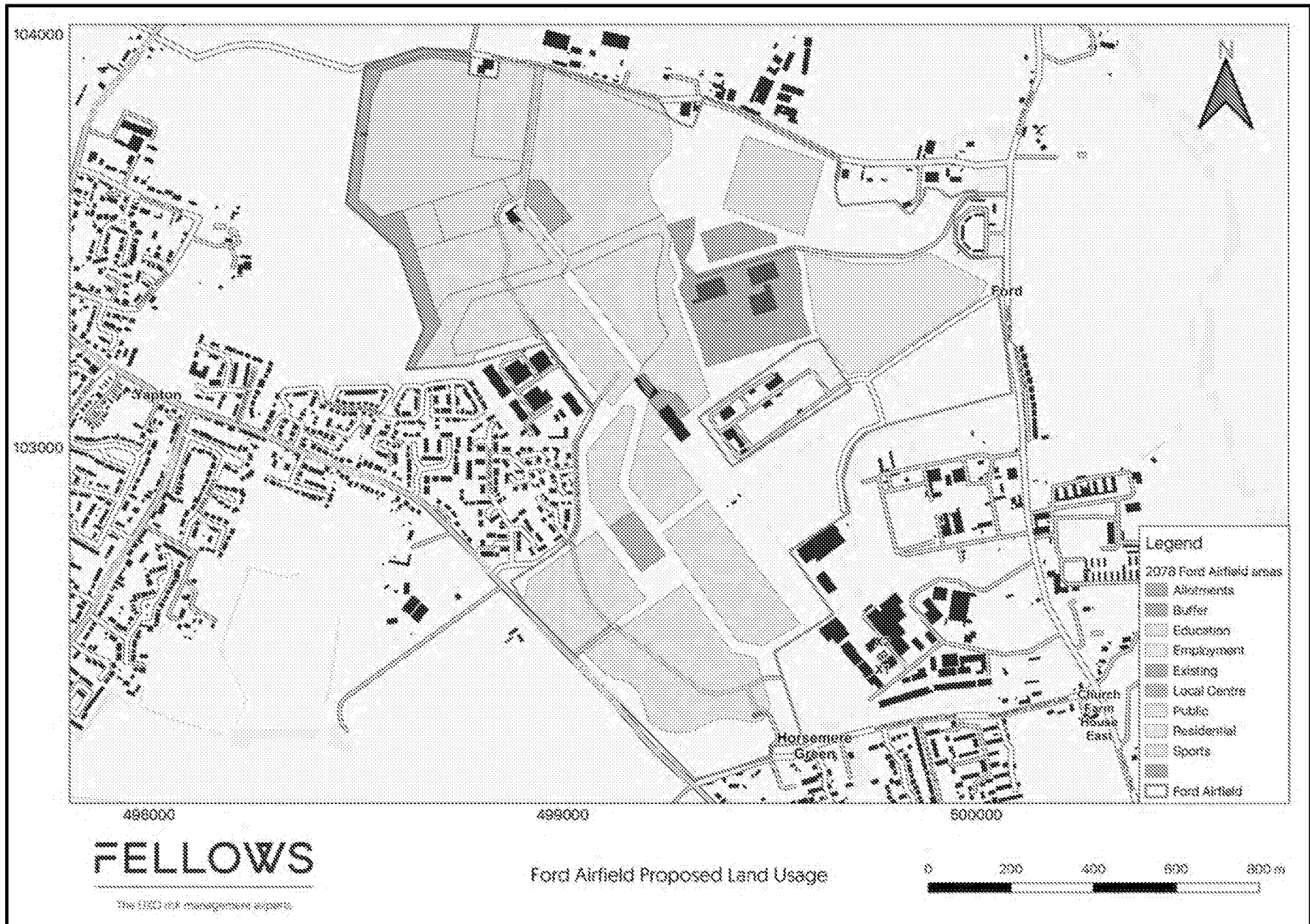


Figure 6. Showing mapping of the proposed areas of development areas.



Figure 7. Showing aerial photography with proposed development are

7. Sources of Potential Unexploded Ordnance

UXO found at construction and development sites in the UK originates from three principal sources:

➤ Munitions deposited as part of military training or exercises.

In the UK, this can be historical from WW1 or before but also more recent, especially as land reserved for military use is released for development.

➤ Dumping

Munitions abandoned or dumped, either deliberately post war, accidentally lost in transit or due to ineffective working practices during manufacture, storage and transportation.

➤ Wartime activity (including aerial bombing)

This includes ordnance resulting from wartime activities including enemy bombing, long range shelling, area or site denial weapons (mine fields or airfield pipe mines) and munitions from defensive activity such as anti-aircraft batteries or pre-invasion measures.

Other factors which may increase UXO risk

Transportation of aggregates containing munitions to an area that was previously free of UXO has led to small munitions contaminating a previously low risk site. This is usually related to construction activities employing material dredged from a contaminated offshore borrow site although the use of explosive contaminated soil or fill from higher risk areas should also be considered.

8. Aerial Bombing

General

During WWI and WWII, many towns and cities across the UK were subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place, notably the London 'Blitz', but bombing also affected many other towns and cities including Portsmouth and Southampton.

Approximately 10% of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this report concerns German air-delivered ordnance dropped during WWII, although other forms of explosive contamination will also be considered.

The most common type of UXO discovered today is the aircraft delivered high explosive (HE) bomb. These are comparatively thick-skinned and dropped from enemy aircraft. If the bomb did not detonate when it was dropped, the force of impact enabled the bomb to penetrate the ground, often leaving behind it an entry hole. These entry holes were not always apparent, and some went unreported, leaving the bomb buried and unrecorded. The bomb then became an Unexploded Bomb or UXB.

Additional forms of German aerial UXO will be considered including WWII 'Vengeance' weapons (V1 and V2 rockets), small Incendiary Bombs (IBs), and Anti-personnel (AP) bomblets.

World War One aerial bombing

WWI bombs were generally smaller than those used in WWII and were dropped from a lower altitude, resulting in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress.

Only limited information is available of WWI attacks and targeting and there is nothing to suggest that the site area suffered serious WWI aerial attack. The threat from WWI German UXBs is therefore considered to be very low and will not be considered further in this report.

World War Two aerial bombing

Targeting

Although the Luftwaffe had designated primary bombing targets across the UK, their high-altitude night bombing was not accurate. As a result, thousands of buildings were damaged and civilian fatalities were common. Bombs were also jettisoned over opportunistic targets and residential areas were sometimes struck.

When Luftwaffe aircraft wished to escape due to interception by fighter aircraft or anti-aircraft fire they would jettison their bomb-load to increase speed and manoeuvrability. This is commonly referred to as tip and run and it has resulted in bombs being found in unexpected locations.

Decoy sites

RAF and Royal Navy decoy sites were constructed in the vicinity of legitimate targets to deceive and decoy enemy bombers. For obvious reasons, such sites were often built in remote and uninhabited areas. Some were more successful than others and received relatively high bombing rates.

There were no decoy sites within 5km of the site boundaries. The area surrounding the site was predominantly rural, with two nearby coastal towns (Bognor Regis and Littlehampton).

Aerial bombs

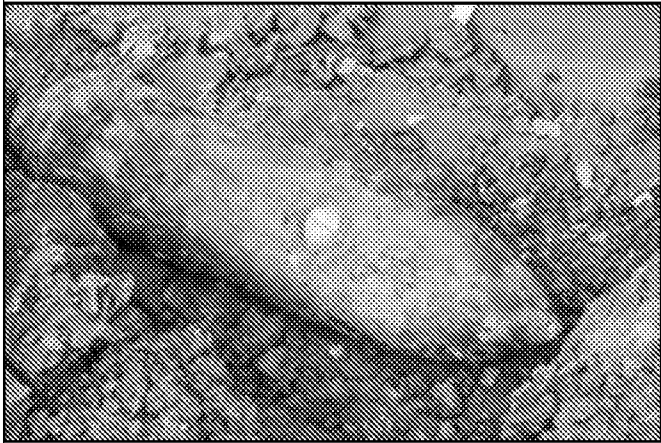
The most commonly dropped German aerial weapon was the SC50 (50Kg). The next largest weapon is the SC250 (250Kg bomb HE bomb). These were dropped primarily against soft targets such as gas and electricity installations, factories, housing and transport infra-structure.

Although the Luftwaffe deployed larger bombs in the area, their deployment was infrequent, the majority of bombs dropped were SC50 (50kg) and SC250 (250kg) HE bombs.

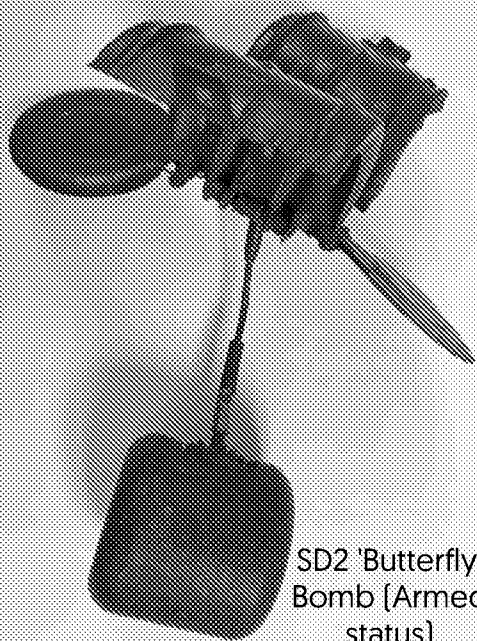
Larger incendiary or 'Flam' bombs were also known to have been dropped in the area. Outwardly similar to the SC250, these contained flammable mixed oil and a small HE bursting charge and were designed to shower burning oil over softer, flammable targets.

UXB risk of encounter has been assessed by using the SC50 and SC250 as the primary risk weapon.

WWII German aerial Ordnance

Type	Description	
High Explosive (HE) Bombs	 German SC250 (recovered casing)	The SC series of HE Bombs were a thin cased general-purpose bomb used as general demolition bombs. Most bombs were 50kg, 250kg or 500kg, although larger bombs of up to 1,800kg were also used. About half the weight of these HE bombs comprised of explosive fill.
	 German SC50 (London 2015)	The SC50 had a one-piece drawn steel body and its total weight was 48 to 55 kg.[1] It was dropped on targets across the UK. The SD series of bombs were thicker cased, with a lower charge weight used against hardened targets.

Type		Description
Incendiary bombs	 1kg Incendiary Bomb	The 1 kg B1E incendiary bomb consisted of a cylinder of magnesium alloy, with an incendiary filling of thermite. Rivetted to the body was a steel tail with three fins. These bombs did not explode but were ignited by a small percussion charge, fired upon impact. They were dropped in a variety of containers. Later an explosive head was incorporated into the IB.

Type		Description
Anti-Personnel (AP) bombs	 SD2 'Butterfly' Bomb [Armed status]	A Butterfly Bomb (or <i>Sprengbombe Dickwandig</i> 2 kg or SD2) was a German 2 kilogram anti-personnel submunition used by the Luftwaffe during the Second World War. It was so named because the thin cylindrical metal outer shell which hinged open when the bomblet deployed gave it the superficial appearance of a large butterfly. The design was very distinctive and easy to recognise. SD2 bomblets were not dropped individually but were packed into containers holding between 6 and 108 sub munitions. These broke open in air and scattered the sub-munitions.

UXB Initiation

Unexploded ordnance does not spontaneously explode. Military high explosive is generally reasonably stable and requires significant energy, normally via a fuze and initiation system for detonation to occur. In the case of unexploded German bombs discovered within the construction site environment, there are a number of other potential initiation mechanisms.

Direct impact

Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling machinery or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action could cause a bomb to detonate.

Fuzes

Most German bomb and mine fuzes were electric and were highly engineered compared to their British equivalents. A small proportion of German WWII bombs employed clockwork fuzes. It is probable that clockwork or mechanical fuze mechanisms would have corroded since WWII and this will generally prevent them from functioning.

Friction impact

Impact from construction machinery or processes could initiate the shock-sensitive fuze explosive. The effects of chemical breakdown of explosive fill and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive around the fuze pocket which could detonate the main charge.

Consequence of interaction

When considering the potential consequences of a detonation, it is necessary to identify who may be affected. These will vary depending on the site-specific conditions but can be summarised as:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

Failure Rate of German air-delivered ordnance

It has been estimated that 10% of the German HE bombs dropped during WWII failed to explode as designed. There are a number of reasons why an air-delivered weapon might fail to function as designed:

- Malfunction of the fuze or initiation mechanism (either electric or clockwork)
- Failure of the bomber aircraft to arm bombs correctly
- Jettisoning of the bomb before it was armed or from a very low altitude. Likely if the bomber was under attack or attempting a forced landing due to damage.

Unexploded ordnance is still regularly encountered across the UK and is dealt with on a routine basis by military and commercial Bomb Disposal teams.

Bomb penetration

An important consideration when assessing the risk from a UXB is the likely maximum depth of penetration. There are several factors which determine the depth that an unexploded bomb will penetrate to:

- Size and shape of bomb
- Height of release
- Velocity and angle of bomb
- Nature of the ground cover
- Underlying geology

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvial deposits are easier to penetrate than gravel and sand. Layers of hard strata will significantly retard and may stop the trajectory of a UXB.

Impact angle and velocity

It is assessed that bombs struck at an angle 80-85° from vertical and at c. 270 metres per second. These are standard figures used for bomb release from an aircraft at normal altitude. Other factors such as low speed or altitude of the bombing aircraft may alter these figures, but no records are available to suggest any low level raids or incidents.

Buried bombs

When bombs strike but do not detonate, they can easily remain undetected. Note that the entry hole of an SC50 (the most commonly deployed German HE bomb) could have been as small as 20cm in diameter and therefore easily obscured within dense crops, or unmaintained vegetation, rough soil or rubble from previous damage.

The J-Curve Effect

J-curve is the term used to describe the characteristic curve commonly followed by an air-delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface.

Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly however is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth but can be up to 15m leading to bombs settling underneath undamaged buildings.

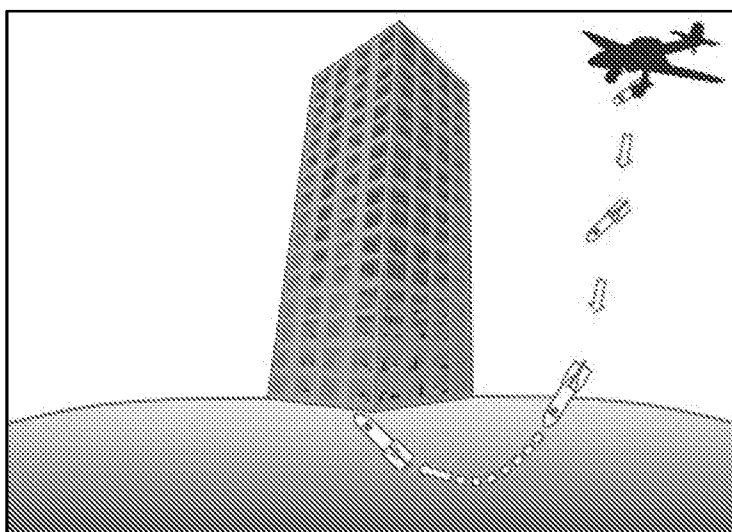


Figure 8. Demonstrating the J-Curve

Abandoned bombs

Research did not indicate the presence of any abandoned bombs within the site boundary.

Bombing density at Site

The airfield was considered a key target by the Luftwaffe and was subjected to a number of air raids. A large scale raid was conducted in 1940, of which the majority of the airfield was all but destroyed. There is considered to be a high local bombing density on the airfield itself, with a much lower bomb density on the area surrounding the site.

9. UXB Risk at this Site

Local geology

The local geology consists of soft alluvium and chalk, which is considered to be a soft sedimentary rock. As a result of this, and the fact that it is expected to be uniform across the site, the geology is considered to allow bombs to penetrate deep into the ground.

Post war / previous works

As a former airfield, the peripheral areas were covered with hangers, Nissen huts and hard standing structures. The airfield itself had substantial hard standing and not the typical grass runways that smaller airfields usually supported. As a result, there is expected to be some impact on the maximum bomb penetration depth in areas of hard standing.

As there has been significant areas of the site turned over to agriculture, it is unlikely that surface munitions will still be present on the site. As an Open Prison, it is likely that several clearance operations have been conducted post war, although this could not be verified at the time of writing this report.

Bomb penetration

Due to the local geology and the previous usage of the site, the maximum bomb penetration depth for an SC50 (50kg) bomb is expected to be approximately 6m in open ground and 4m in areas of hard standing. An SC250 (250kg) bomb is considered to have a maximum penetration depth of 9m in open ground and 6m in areas of previous buildings and the runway.

10. Other Military Ordnance

In addition to aerial bombs, there may also be a risk from other items including discarded or forgotten land munitions from both wartime and peacetime military use. Typical military activities may include:

- Former mine-fields; often on beaches on the South and East coasts of England
- Home Guard weapons and munitions
- Anti-Aircraft sites
- Training & firing ranges
- Military bases
- Munitions manufacture and storage sites

During the early years of WWII huge preparations were underway to defend the UK against German attack. This often included the hiding or caching of defensive ordnance at or near to strategically or tactically important locations.

Items may include small arms ammunition, mortar bombs and hand grenades or even crudely manufactured defensive weapons designed for Home Guard use such as the No.76 SIP (Self Igniting Phosphorus) grenades. These items, resembling a milk bottle are frequently found in original crates during shallow excavations or building demolition and although small in size can inflict life-changing injuries if not dealt with correctly.

The potential risk of encountering allied ordnance on construction sites is particularly elevated in areas previously associated with military activity. This includes munitions deposited by military training exercises, dumped as a result of poor working practices, or deliberately placed to prevent adversary occupation.

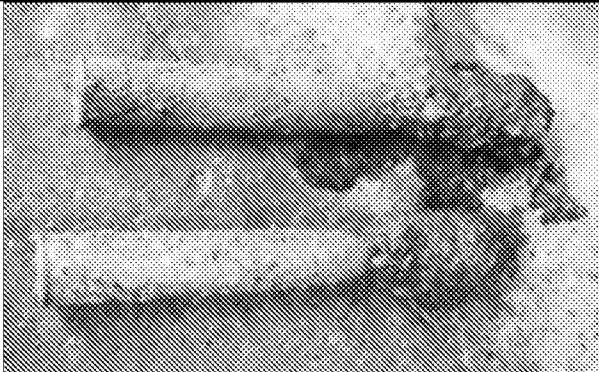
As the site is a former military establishment, it is not inconceivable that there may be dumped, discarded or buried munitions present within the site boundaries. The area was initially used by the Fleet Air Arm, then given over to the RAF after a period of heavy enemy bombardment. Aircraft munitions and land service munitions would have been present on the site boundary.

Anti-Aircraft Artillery

Urban areas can be at risk from buried unexploded Anti-Aircraft projectiles fired during WWII.

At the onset of WWII two types of Anti-Aircraft Artillery (AAA) guns were deployed:

- Heavy Anti-Aircraft Artillery (HAA), using large calibre weapons, such as the 3.7" QF (Quick Firing) gun. Normally fixed batteries.
- Light Anti-Aircraft Artillery (LAA) using smaller calibre weapons, such as 40mm Bofors gun. Often mobile, vehicle mounted batteries.
-

Type		Description
Anti-Aircraft Shells	 40mm AA Shells found at W Sussex site	Fixed (Heavy) Anti-Aircraft batteries were set up all around the country to defend potential targets from aerial attack. Size of guns and shells ranged from small, quick-firing 40mm Bofors guns to larger 3.7 or 4.5inch guns. 3.7 Inch = 12.7kg 94mm x 438mm 40mm = 0.9kg 40mm x 311mm 4.5 Inch = 24.7kg 114mm x 578mm

LAA batteries were intended to engage fast, low flying aircraft and were typically deployed around military bases, RAF airfields or important installations. These batteries were mobile and could be moved to new positions with relative ease when required. The most numerous of these were the 40mm Bofors gun, which could fire up to 120 x 40mm HE shells per minute to over 1,800m.

HAA projectiles were high explosive shells, usually fitted with a time delay or a barometric pressure fuze to make them explode at a pre-determined height. If they failed to explode or strike an aircraft, they would eventually descend back to earth.

Although the larger unexploded fall-to-earth projectiles could enter beneath the ground surface, they did not have a great penetration ability and are therefore likely to be found close to WWII ground level. If encountered, the high explosive fill and fragmentation hazard of these items of UXO would present a significant risk.

The smaller 40mm projectiles are similar in appearance and effect to SAA and, although still dangerous, present a lower hazard due to its decreased explosive content.

Numerous unexploded AAA shells were recovered during and following WWII and are still occasionally encountered on sites today.

AAA Emplacements

There were 4 British Anti-Aircraft Artillery emplacements within 5km of the site. These are tabulated below:

Location	Distance from Site
Ford	On site
Fordwych	2.1 km SE
Atherington	2.5 km SE
Toddington	3.5 km E

Table 4 Showing British anti-aircraft emplacements within 5km of the site.

Due to the proximity of the AAA sites, there is a low risk from unexploded fall-to-earth AA projectiles although it is assessed that these would have been discovered and dealt with during rural land use or local redevelopment.

Other munitions

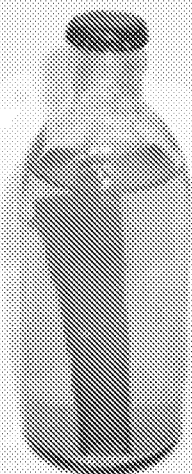
There is evidence that the airfield was mined during the war to prevent enemy forces from using the airfield in the case of a land invasion. Canadian Pipe Mines were used on the majority of southern airfields for this purpose and despite orders to remove these after the war, many remain to this day. Records show that Ford aerodrome had its minefield extended.



Figure 9. Showing Canadian Pipe Mines.

Other defensive munitions

As the threat of invasion lingered over Britain during WWII, large areas of land were requisitioned for military training and exercises. Thousands of tonnes of munitions including HE bombs, artillery projectiles, Naval shells, bulk explosives and infantry weapons such as grenades and small arms ammunition were used in weapon testing and military training. It has been estimated that at least 20 per cent of the UK's land has been used for military training at some point.

Type		Description
No.76 SIP Grenade		No.76 SIP (Self Igniting Phosphorus) grenades. These items, resembling a milk bottle are frequently found during shallow excavations or building demolition and although small in size can inflict life-changing injuries if not dealt with correctly. Found in wooden crates of 24 items.

Type		Description
Hand Grenades	 British No36 'Mills' grenade	Contains a small amount of High Explosive and a rudimentary time delay fuze. The absence of a pin and fly-off handle indicate the item is potentially live. The distinctive segmented (Pineapple) casing gives the fragmentation effect on detonation.

Small Arms Ammunition

The most common type of ordnance encountered on land formerly used by the military are items of Small Arms Ammunition (SAA). SAA refers to the complete round or cartridge designed to be used with hand-held infantry weapons such as rifles, machine guns and pistols. SAA can include bullets, cartridge cases and primers/caps. Items of SAA can be accidentally initiated by striking the casing or coming into contact with fire. SAA presents only minimal risk although it must be disposed of correctly if found on-site.

Type	Description
Small Arms Ammunition	 Small arms of various sizes from 4 or 5mm calibre (diameter) up to 12 to 13mm. Generally, the head is inert and made of lead or similar dense material. Brass cases without the head pose no risk.

11. Overall UXO Risk Assessment

In establishing the UXO risk at this site, Fellows take the following factors into account:

- The amount and nature of WWI and WWII German aerial bombing
- The nature and conditions of the site during at the time
- Other military use of the site i.e. AA Gun sites, storage, training
- The extent of post-war development and UXO clearance operations on site
- The scope and nature of the proposed works and assessed bomb penetration depth
- The nature of non-aerial ordnance that may have contaminated the site area

Risk Assessment

The risk assessment matrix below is based upon the chance of encountering items of ordnance and the consequence of interaction with them. This can range from the detonation by design (via fuzing and explosive train) of a large aerial bomb to the accidental breakage of old Home Guard glass bottle grenades.

In accordance with standard UK risk assessment methodologies, the overall risk is gained by multiplying the likelihood (chance of encounter) with the consequence (consequence of interaction) and is graded from negligible to Very High risk.

Descriptors

Chance of encounter

1	2	3	4	5
Not at all likely	Unlikely	Possible	Likely	Almost certain

Consequence of interaction with munition

1	2	3	4	5
First aid incident	Minor injuries	Severe injuries	Fatalities	Multiple fatalities

Overall risk calculation (Chance of Encounter X Consequence of interaction)

1-5	6-10	11-15	16-20	21-25
Negligible	Low Risk	Moderate Risk	High Risk	Very High Risk

Aerial bombs

Due to the extent of bomb damage RAF FORD received, the primary risk to this site is considered to be deep buried aerial bombs. The extent of surface change on the site mitigates the risk of shallower buried and on-surface UXO and practice bombs.

AAA Emplacements

There is a risk of buried AA munitions due to the relative softness of the soil in the area. Again, the surface UXO would have likely been cleared due to the extent of change and agricultural usage of much of the site.

Other (Land service Ammunition etc.)

Buried land service munition caches and dumped RAF munitions may be present on the site due to the extended usage of the site during the war period for both homeland defence and training purposes.

There is considered to be a risk of Canadian Pipe Mines on the site. It is common knowledge that southern airfields were mined to prevent use by invading forces and there is very limited evidence of their removal post-war. Pipe mines have been found on many airfields during recent developments, and no clearance appears to have been conducted on Ford Airfield.

Overall Risk Assessment

ACTIVITY	THREAT ITEM	CHANCE OF ENCOUNTER	CONSEQUENCE	RISK	JUSTIFICATION
Shallow Excavation (<2m) i.e. Trial Pits	HE Bombs	2	5	10	- Significant military usage throughout WWII and years immediately after for training and night raiders. - Surface and immediate subsurface risk mitigated by agricultural use and historic site change following 1950's. - Possible buried caches due to extended military usage. - Possibility of pipe mines
	AAA Shells / IBs	2	4	8	
	Other munitions	3	4	12	
Window Sampling / shallow Bore-holes	HE Bombs	2	5	10	
	AAA Shells / IBs	2	4	8	
	Other munitions	3	4	12	

ACTIVITY	THREAT ITEM	CHANCE OF ENCOUNTER	CONSEQUENCE	RISK	REASONS
Deeper excavations (>2m) i.e. Basement excavations	HE Bombs	3	5	15	- Historic sources indicate major raid which all but destroyed the airfield. - Soft alluvium and chalk will likely allow deeper bomb penetration
	AAA Shells / IBs	3	4	12	
	Other munitions	2	4	8	

ACTIVITY	THREAT ITEM	CHANCE OF ENCOUNTER	CONSEQUENCE	RISK	REASONS
Piling/deep boreholes	HE Bombs	3	5	15	- Piling will reach bombs buried beyond the scope of previous excavation works. - Geology would allow heavier bombs to bury themselves further.
	AAA Shells / IBs	1	3	3	
	Other munitions	1	2	2	

12. Recommendations to Reduce UXO Risk to ALARP

The risk of encountering deep buried HE bombs is assessed as medium. The risk of encountering British anti-aircraft munitions and land service ammunition is considered to be low, but not nil. Due to this, the following risk management options are recommended:

For all works within the site area:

A UXO Awareness Brief (UXOAB) be delivered to all site personnel. This can also include a site safety walk-through and provision of a UXO Emergency Response Plan for inclusion into the site HSE documentation.

Ground Investigation (GI) works:

Provision of a UXO Engineer to oversee intrusive GI works to include the use of a magnetometer (downhole scanning) to determine the presence or otherwise, of possible Unexploded Ordnance (UXO) contamination that could compromise any intrusive ground investigation works.

Excavations and shallow intrusive works within the site area:

Provision of an UXO Engineer to oversee shallow intrusive excavation works will reduce the risk of a UXO incident occurring. The UXO Engineer can be on-site to identify any items uncovered during excavation. This can reduce down-time and improve site efficiency.

Piling and deep excavations:

Due to the risk from German aerial bombs at the site, an intrusive magnetometer survey is recommended to assure safety of personnel and equipment during the piling works. This can be in the form of or Cone Penetration Testing (CPT) where load bearing or contiguous piling is planned.

For deep piling, CPT probing should take place to a minimum probe depth of 10m bgl.

Fellows International Limited [Fellows] can provide all of the above services and would be pleased to provide a proposal accordingly.

For further information, or to discuss requirements, please get in touch.

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Email – research@fellowsint.com

13. References

The following sources of information were consulted in putting together this report:

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APPENDIX 3

HERITAGE DESK BASED ASSESSMENT (ORION, NOV 2016)

Land at Ford, West Sussex
Heritage Desk Based Assessment
November 2016

Land at Ford, West Sussex
Heritage Desk-Based Assessment
November 2016

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Report
Heritage Desk-Based Assessment

Site
Land at Ford, West Sussex

Client
Wates Developments

Date
November 2016

Planning Authority
Arun District Council

Site Centred At
499400 102910

Prepared and Approved By
Rob Bourn (BA MA CMifA)

Report Status
Final

Orion Ref
QU-0021/1

Executive Summary

- 1.0 Introduction
 - 2.0 Statutory and Planning Policy Framework
 - 3.0 Archaeological and Historical Background
 - 4.0 Proposed Development and Predicted Impact on Heritage Assets
 - 5.0 Summary and Conclusions
- Sources Consulted**

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- Figure 2 Location of Sites Mentioned in the Text
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- Figure 4 1839 Ford Tithe Map
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- Figure 11 1980 OS 1:10,000 Scale Map
- Figure 12 1992 OS 1:10,000 Scale Map
- Figure 13 2006 OS 1:10,000 Scale Map
- Figure 14 Aerial View of Study Site (from Google Earth)

Prehistoric

Palaeolithic	450,000 -12,000 BC
Mesolithic	12,000 - 4,000 BC
Neolithic	4,000 - 2,200 BC
Bronze Age	2,200 - 700 BC
Iron Age	700 - AD 43

Historic

Roman	43 - 410AD
Saxon/Early Medieval	410 - 1066AD
Medieval	1066 - 1485AD
Post Medieval	1486 - 1901AD
Modern	1901 - Present Day

Executive Summary

This Heritage Assessment considers land at Ford, West Sussex. In accordance with government policy (National Planning Policy Framework), this assessment draws together the available archaeological, historic, topographic and land-use information in order to clarify the heritage significance and archaeological potential of the site.

The assessment has established that archaeological investigations within the site have recorded Bronze Age, Iron Age and Roman remains. Associated remains are likely to be present within the study site. The site also contains the remains of the WWI and WQWII airfield.. It is considered to have low potential for remains of all other archaeological periods. The assessment has also established that the site is located beyond the setting of nearby designated heritage assets.

The assessment concludes that the development of the site would impact on archaeological remains of no more than local significance. Pre-determination archaeological evaluation is likely to be required in support of a future planning application. Further mitigation works may be required in due course. The assessment also concludes that there will be a negligible impact on the setting and significance of nearby designated heritage assets.

1.0 Introduction

- 1.1 This heritage assessment considers land at Ford, West Sussex (Fig. 1). The proposed development comprises up to 750 residential dwellings, including employment, community facilities and areas for sports pitches and open space. The site is located at grid reference 499400 102910. The site is hereafter referred to as the study site.
- 1.2 In accordance with the Standard and Guidance for Historic Environment Desk Based Assessments (Chartered Institute for Archaeologists 2014), the assessment draws together available information on designated and non-designated heritage assets, topographic and land-use information so as to establish the potential for non-designated archaeological heritage assets within the study site and the potential effect on the significance of nearby designated heritage assets. The assessment includes the results of a site survey, an examination of published and unpublished records and charts historic land-use through a map regression exercise.
- 1.3 The underlying geology of the site is river terrace gravels overlying Lewes Nodular Chalk Formation. The site is flat lying at c. 5mOD.
- 1.4 As a result, the assessment enables relevant parties to assess the significance of heritage/archaeological assets on and close to the site and consider the potential for hitherto undiscovered archaeological assets, thus enabling potential impacts on assets to be identified along with the need for design, civil engineering or archaeological solutions.

2.0 Planning Background and Development Plan Framework

Ancient Monuments & Archaeological Areas Act 1979

- 2.1 The Ancient Monuments & Archaeological Areas Act 1979 (as amended) protects the fabric of Scheduled Monuments, but does not afford statutory protection to their settings.

Planning (Listed Building and Conservation Areas) Act 1990

- 2.2 The Planning (Listed Building and Conservation Areas) Act 1990 sets out broad policies and obligations relevant to the protection of listed buildings and conservation areas and their settings.

- 2.3 Section 66(1) states:

'In considering whether to grant planning permission for development which affects a listed building or its setting, the local planning authority or, as the case may be, the Secretary of State shall have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses'.

- 2.4 Section 69 of the Act requires local authorities to define as conservation areas any *'areas of special architectural or historic interest the character or appearance of which it is desirable to preserve or enhance'* and Section 72 gives local authorities a general duty to pay special attention *'to the desirability of preserving or enhancing the character or appearance of that area'* in exercising their planning functions. These duties are taken to apply only within a Conservation Area. The Act does not make specific provision with regard to the setting of a Conservation Area that is provided by the policy framework outlined in section 2.2, below.

National Planning Policy Framework (NPPF) & National Planning Practice Guidance (NPPG)

- 2.5 Government policy in relation to the historic environment is outlined in section 12 of the National Planning Policy Framework (NPPF), entitled Conserving and Enhancing the Historic Environment. This provides guidance for planning authorities, property owners, developers and others on the conservation and investigation of heritage assets. Overall, the objectives of Section 12 of the NPPF can be summarised as seeking the:

Delivery of sustainable development

- ✧ Understanding the wider social, cultural, economic and environmental benefits brought by the conservation of the historic environment;
- ✧ Conservation of England's heritage assets in a manner appropriate to their significance, and
- ✧ Recognition of the contribution that heritage assets make to our knowledge and understanding of the past.

- 2.6 Section 12 of the NPPF recognises that intelligently managed change may sometimes be necessary if heritage assets are to be maintained for the long term.

- 2.7 Paragraph 128 states that planning decisions should be based on the significance of the heritage asset and that level of detail supplied by an applicant should be proportionate to the importance of the asset and should be no more than sufficient to understand the potential impact of the proposal upon the significance of that asset.

- 2.8 *Heritage Assets* are defined in Annex 2 as: A building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Heritage asset includes designated heritage assets and assets identified by the local planning authority (including local listing).

- 2.9 *Archaeological Interest* is defined as a heritage asset which holds or potentially could hold evidence of past human activity worthy of expert investigation at some point. Heritage assets with archaeological interest are the primary source of evidence about the substance and evolution of places, and of the people and cultures that made them.

- 2.10 *Designated Heritage Assets* comprise: World Heritage Sites, Scheduled Monuments, Listed Buildings, Protected Wreck Sites, Registered Park and Gardens, Registered Battlefields and Conservation Areas.

- 2.11 *Significance* is defined as: The value of a heritage asset to this and future generations because of its heritage interest. This interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting.

- 2.12 *Setting* is defined as: The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral.
- 2.13 The NPPF is supported by the National Planning Policy Guidance (NPPG). In relation to the historic environment, paragraph 18a-001 states that:
"Protecting and enhancing the historic environment is an important component of the National Planning Policy Framework's drive to achieve sustainable development (as defined in Paragraphs 6-10). The appropriate conservation of heritage assets forms one of the 'Core Planning Principles'."
- 2.14 Paragraph 18a-002 makes a clear statement that any decisions relating to listed buildings and their settings and conservation areas must address the statutory considerations of the Planning (Listed Buildings and Conservation Areas) Act 1990 as well as satisfying the relevant policies within the National Planning Policy Framework and the Local Plan.
- 2.15 Paragraph 18a-013 outlines that the assessment of the impact of a proposed development on the setting of a heritage asset needs to take into account and be proportionate to the significance of the asset being considered and the degree to which the proposed development enhances or detracts from the significance of the asset and the ability to appreciate the significance.
- 2.16 The NPPG outlines that although the extent and importance of setting is often expressed in visual terms, it can also be influenced by other factors such as noise, dust and vibration. Historic relationships between places can also be an important factor stressing ties between places that may have limited or no intervisibility with each other. This may be historic as well as aesthetic connections that contribute or enhance the significance of one or more of the heritage assets.
- 2.17 Paragraph 18a-013 concludes:
"The contribution that setting makes to the significance of the heritage asset does not depend on there being public rights or an ability to access or experience that setting. This will vary over time and according to circumstance. When assessing any application for development which may affect the setting of a heritage asset, local planning authorities may need to consider the implications of cumulative change. They may also need to consider the fact that developments which materially detract from the asset's significance may also damage its economic viability now, or in the future, thereby threatening its on-going conservation."
- 2.18 The key test in NPPF paragraphs 132-134 is whether a proposed development will result in substantial harm or less than substantial harm. However, substantial harm is not defined in the NPPF. Paragraph 18a-017 of the NPPG provides additional guidance on substantial harm. It states:
"What matters in assessing if a proposal causes substantial harm is the impact on the significance of the heritage asset. As the National Planning Policy Framework makes clear, significance derives not only from a heritage asset's physical presence, but also from its setting. Whether a proposal causes substantial harm will be a judgment for the decision taker, having regard to the circumstances of the case and the policy in the National Planning Policy Framework. In general terms, substantial harm is a high test, so it may not arise in many cases. For example, in determining whether works to a listed building constitute substantial harm, an important consideration would be whether the adverse impact seriously affects a key element of its special architectural or historic interest. It is the degree of harm to the asset's significance rather than the scale of the development that is to be assessed."
- 2.19 Paragraph 134 of the NPPF outlines that where a proposed development results in less than substantial harm to the significance of a heritage asset, the harm arising should be weighed against the public benefits accruing from the proposed development. Paragraph 18a-020 of the NPPG outlines what is meant by public benefits:
"Public benefits may follow from many developments and could be anything that delivers economic, social or environmental progress as described in the National Planning Policy Framework (Paragraph 7). Public benefits should flow from the proposed development. They should be of a nature or scale to be of benefit to the public at large and should not just be a private benefit. However, benefits do not always have to be visible or accessible to the public in order to be genuine public benefits."
- 2.20 In considering any planning application for development, the planning authority will be mindful of the framework set by government policy, in this instance the NPPF, by current Development Plan Policy and by other material considerations.

- 2.21 The Arun District Local Plan 2003 has the following relevant saved policies relating to the historic environment:

POLICY AREA16 Ancient Monuments and Sites of National Archaeological Importance

There will be a presumption in favour of the preservation of scheduled and other nationally important monuments and archaeological remains. Development which adversely affects their sites or settings will not be permitted.

POLICY AREA17 Sites of Archaeological Interest

Permission will not be granted for development that would be harmful to the significant archaeological interest of a site. Where the presence of archaeological remains is known or suspected:

- i. the applicant must arrange for archaeological assessment of the site to be carried out before the planning application is determined;*
- ii. where the assessment shows that the physical preservation of remains in situ is not justified, conditions may be attached to any permission granted that development will not take place until provision has been made by the developer for a programme of archaeological investigation and recording. The programme will be carried out prior to the commencement of the development; and*
- iii. whenever practicable, opportunities should be taken for the enhancement and interpretation of archaeological remains left in situ.*

POLICY DEV11 Setting of Listed Buildings

Proposals which adversely affect the setting of a Listed Building, or group of Listed Buildings will be resisted. Where the principle of development in the grounds of, or near to Listed Buildings is acceptable, it should be sensitively designed and constructed of appropriate materials to ensure that the special qualities of the older buildings remain unimpaired. Where relevant, appropriate space about the building or buildings must be retained. Proposals for more distant buildings and tall structures, including pylons and masts, will be carefully assessed in respect of their effect on the settings of Listed Buildings.

- 2.22 The study site almost entirely within a West Sussex County Council Archaeological Notification Area DWS8485 Multi-Period Site at the Disused Ford Airfield and Ford Open Prison, Ford. This area has an Amber alert with the following note recoded on the HER:

Consult with WSCC as archaeological fieldwork may be needed, possibly by condition. Sensitive area for Archaeology, with possibility of significant adverse archaeological impact, depending upon scale and exact location of development.

Guidance

Historic Environment Good Practice Advice In Planning Note Managing Significance in Decision-Taking in the Historic Environment (Historic England 2015)

- 2.23 The purpose of this document is to provide information to assist local authorities, planning and other consultants, owners, applicants and other interested parties in implementing historic environment policy in the NPPF and NPPG. It outlines a 6-stage process to the assembly and analysis of relevant information relating to heritage assets potentially affected by a proposed development.

- ✧ Understand the significance of the affected assets;
- ✧ Understand the impact of the proposal on that significance;
- ✧ Avoid, minimise and mitigate impact in a way that meets the objectives of the NPPF;
- ✧ Look for opportunities to better reveal or enhance significance
- ✧ Justify any harmful impacts in terms of the sustainable development objective of conserving significance and the need for change;
- ✧ Offset negative impacts on aspects of significance by enhancing others through recording, disseminating and archiving archaeological and historical interest of the important elements of the heritage assets affected.

Historic Environment Good Practice Advice In Planning Note 3 The Setting of Heritage Assets (Historic England 2015)

- 2.24 Historic England's Historic Environment Good Practice Advice in Planning Note 3 provides guidance on the management of change within the setting of heritage assets.

- 2.25 The document restates the definition of setting as outlined in Annex 2 of the NPPF. Setting is also described as being a separate term to curtilage, character and context; while it is largely a visual term, setting, and thus the way in which an asset is experienced, can also be affected by noise, vibration, odour and other factors. The document makes it clear that

setting is not a heritage asset, nor is it a heritage designation, though land within a setting may itself be designated. Its importance lies in what the setting contributes to the significance of a heritage asset.

2.26 The Good Practice Advice Note sets out a five-staged process for assessing the implications of proposed developments on setting:

1. Identification of heritage assets which are likely to be affected by proposals;
2. Assessment of whether and what contribution the setting makes to the significance of a heritage asset;
3. Assessing the effects of proposed development on the significance of a heritage asset;
4. Maximising enhancement and reduction of harm on the setting of heritage assets; and
5. Making and documenting the decision and monitoring outcomes

2.27 The guidance reiterates the NPPF in stating that where developments affecting the setting of heritage assets results in a level of harm to significance, this harm, whether substantial or less than substantial, should be weighed against the public benefits of the scheme.

3.0 Archaeological and Historical Background

3.1 The locations of sites mentioned in the text are shown on Fig. 2.

Non-Designated Heritage Assets

Prehistoric

- 3.2 There have been a number of archaeological investigations within the study site that have recorded prehistoric remains.
- 3.3 In 1999, a programme of archaeological work was undertaken in advance of, and during, the initial construction of a new wastewater treatment works for Southern Water (MWS6921 & EWS1149). Remains recorded were later Mesolithic worked flint, including microliths, serrated flakes, burins and debitage. A leaf-shaped arrowhead was suggestive of at least limited Neolithic activity in the area. A late Bronze Age enclosure was recorded with a late Iron Age cremation inserted into the enclosure. Numerous late Bronze Age pits and post holes and trackways were identified. A late Iron Age co-axial field system and a trackway was recorded orientated north-south/east-west (Place 2004). Other finds recorded from associated ground works within the study site were 5 late Neolithic/Bronze Age flakes and 7 burnt flints (MWS6980) and 9 flakes, 4 retouched tools, 1 core and further burnt flints (MWS6981).
- 3.4 Another programme of archaeological works was undertaken along the central part of the eastern site boundary (MWB9678, EWS716 & EWS717). Evaluation trenching revealed three late Bronze Age possible cremations, several probable prehistoric ditches were revealed which possibly relate to the Iron Age field system recorded a short distance to the north, an undated, possibly prehistoric, enclosure. The later archaeological excavation recovered a small assemblage of residual Mesolithic and Early Neolithic struck flint. A Late Bronze Age field system was recorded which contained placed deposits of pottery vessels and burnt material suggestive of at least an element of ritual activity. A number of late Bronze Age posts and pits were also recorded. Field system is considered to be part of the same field system revealed on the Southern water site excavations described in para 3.3 above.
- 3.5 The earliest remains recorded within the wider study area are an unspecified number of Palaeolithic palaeoliths in the River Arun (MWS6292).
- 3.6 A Neolithic stone axe and stone rubber have been recorded c. 500m to the north east of the site (MWS3221).
- 3.7 Archaeological works undertaken c. 450m to the south east of the study site have revealed a number of late Bronze Age pits, post holes, ditches and gullies producing pottery, worked flint, burnt stone and burnt clay (MWS6998), Bronze Age gullies and ditches (MWS6999 & 7001), and a prehistoric ditch (MWS7003).
- 3.8 A prehistoric flake and 5 fragments of burnt flint have been recorded c. 400m to the north of the study site (MWS6982).
- 3.9 The results of the archaeological investigations within and to the south east of the study site, are a clear indication that the site has high potential for Bronze Age and Iron Age remains. The evidence from the excavations within the site is primarily agricultural but given the apparent density of recorded remains, the presence associated settlement within the site is distinctly possible. Consequently, the study site is considered to have high potential for further prehistoric remains within the central eastern part of the site in particular, but further remains could be present elsewhere within the site.
- ##### *Late Iron Age/Roman*
- 3.10 The excavations for Southern Water revealed a series of late Iron Age/Roman features including 2 cremations, an enclosure, pits and a possible iron working shelter (MWS6291). Roman features recorded within the excavations within the site to the south of the Southern Water area comprised of field boundaries and a possible cremation deposit (MWS9678). Sherds of pottery from 3 separate vessels have also been recorded within the central southern part of the study site (MWS6683).
- 3.11 Further Roman boundary ditches have been recorded c. 450m to the south east of the study site (MWS7001).

- 3.12 As in the prehistoric periods, the results of the excavations within the site indicate that the site is known to contain Roman remains. The archaeological investigations have not revealed settlement remains, however, it is possible that such remains could be located elsewhere within the study site. Consequently, the study site is considered to have high potential for Roman remains.

Saxon

- 3.13 There are no Saxon remains recorded within the study site.
- 3.14 The only record of Saxon remains within the wider study area is of a ditch recorded c. 450m to the south of the study site that was considered by the excavators to be either prehistoric or possibly Saxon in date (MWS7003).
- 3.15 The site was located away from the nearby historic villages that may have had Saxon origins. Consequently, the site is considered to have low potential for Saxon remains.

Medieval

- 3.16 The only record of Medieval remains within the study site is of a flagon handle toward the northern site boundary (MWS6981).
- 3.17 The parish church of St Mary, Climping, to the south east of the site, is Medieval in date (MWS3103). The deserted Medieval village of Climping lies to the east and south east of the church (MWS3371). This is a scheduled monument. Ford parish was separated out of Climping in the thirteenth century, and settlement has always been scattered.
- 3.18 Other Medieval remains recorded within the study area are a pit .500m to the south east in Climping (MWS6993) and a ditch/field boundary c. 450m to the south (MWS6999).
- 3.19 On the basis of the available evidence, the study site is considered to have low potential for Medieval remains.

Post-Medieval

- 3.20 The route of the Portsmouth to Arundel canal cuts east –west across the northern part of the study site (MWS5754).
- 3.21 There are a number of Post-Medieval remains recorded within the study area which have no bearing on the study site and therefore, will not be described in any detail in this report. In summary, these are, brickworks (MWS4711); a field boundary (MWS7001); two war memorials (MWS9178 & 9245); and a number of farms and barns (MWS9757, 10202, 10605 & 12220).
- 3.22 The 1805 Ordnance Surveyor's Drawing of the area shows a scattering of farm buildings around the perimeter of the site (Fig. 3).
- 3.23 The tithe maps for the parishes of Climping and Ford (drawn up in 1843 and 1839 respectively) both include the study site (Figs. 4 & 5). The northern portion of the site was located in Ford parish and was part of North Wood Farm, occupied at the time of the tithe survey by farmer Charles White, while the owner of the farm was the Governor's of Christ's Hospital. More of Charles White's farm lay in Climping parish, as shown on that parish's map. References 40 to 56 cover the approximate area which would later become the Ford Airfield. According to the corresponding apportionment records the landowners were as follows:

Field references

40 to 45, 48 to 56
46
47

Landowner

Christ's Hospital (Governors of)
Revd Owen Marden – Vicarial Glebe
Eton College (Provost and Fellows of)

- 3.24 Christ's Hospital acquired North Wood Farm in Ford/Climping in 1704 when William Garway esquire of Ford willed his lands in these parishes to the hospital. It contained approx. 190 acres. Eton College's ownership of land in the area is known to date back at least to the 1480s.
- 3.25 The 1879 first edition OS map shows the site as comprising of a number of fields at that time with canal at the northern end of the site being marked as disused (Fig. 6). By 1899, although the study site is shown as unchanged, the canal by that time was marked as dotted lines (Fig. 7).

- 3.26 Work began on Ford airfield in 1916, using the labour of German prisoners of war (MWS2412). It opened in 1917 with the American air force being the first to use the facility. Around 1920, the Ford Motor Company took over the site from the Air Ministry to manufacture planes, including the Ford Tri-motor. The military took back the site in 1937 to set up a training base for naval pilots. Then during the Second World War, the Royal Air Force took over the base, which was heavily damaged in a German air raid in August 1940. Following the war, the site was returned to the Admiralty, which continued to use it as a training station. The navy left in 1959 and in the 1960s the airfield was leased to Miles Aviation and Transport (R. & D.) Ltd which built replicas of historic aircraft. WWII and Cold War structures recorded on the HER within the study site include a anti-aircraft battery (MWS7120), a Royal Observer monitoring post (MWS7518), an air raid shelter (MWS8121) and a blister hanger (8137). Part of the northern end of the airfield became an industrial estate, with two large hangars converted for the manufacture of concrete blocks. The Rudford industrial estate, along the south-eastern edge of the site, was set up after 1969 and expanded in the 1980s.
- 3.27 The eastern part of the site became an open prison in 1961. Most of the buildings on the site today are adaptations of pre-1960 structures. There are six residential blocks, each bearing the name of a famous ship, linked by glazed corridors. There are also workshops which also appear to date from before 1960. The chapel opened on 22nd November 1989. Another modern building is a combined visits, reception and gatehouse complex.
- 3.28 The Aerodrome Board of the Royal Flying Corp produced a plan of the airfield at Ford in 1918, which showed the study site as blank with a series of military buildings immediately to the west of the site (Fig. 8).
- 3.29 The 1938 OS map shows no detail of the airfield (Fig. 9). The detail of the airfield can be seen clearly on a RAF 1946 vertical aerial photograph (Fig. 12). The layout of the airfield is first shown on the 1980 OS map (Fig. 11). By 1992, parts of the airfield layout had been lost and it is marked as disused (Fig. 12). Two grain storage buildings are shown on the northern end of the NW-SE orientated runway along with factory buildings either side of the former route of the canal.
- 3.30 The Southern Water treatment works are first shown on the 2006 OS map (Fig. 13).
- 3.31 Due to the site being agricultural land and part parkland through much of the Post-Medieval period, the study site is considered to have low potential for Post-Medieval remains and high potential for WWI and WWII related airfield remains.

Designated Heritage Assets

- 3.32 There are no designated heritage assets within the study site.
- 3.33 The scheduled deserted medieval village of Climping lies 500m+ to the south east of the study site. The study site is considered to lie beyond the setting of the scheduled monument.
- 3.34 There are five listed buildings within the study area. These are the Parish Church Of St Mary (Grade I) (DWS616), The Vicarage (grade II) (DWS617), Atherington House And Ford Place And Southdown House And The Lodge (grade II) (DWS947), Barn To The West Of Nos 1 And 2 Church Farm Cottage (grade II) (DWS618), and New House Farmhouse (grade II) (DWS604). The study site is considered to lie beyond the settings of all of these designated heritage assets. The only one that has some intervisibility with the study site is Atherington House where the industrial buildings at the northern end of the site can be seen from parts of the garden of the house. These buildings have a negative contribution to the significance of the house. The study site itself though is considered to be outside of the setting of the house.

4.0 Proposed Development and Predicted Impact on Heritage Assets

Site Conditions

- 4.1 The site comprises of arable land within which the concrete airfield runways still survive. There are a number of large buildings with the site, and the Southern water treatment works (Fig. 14).

The Proposed Development

- 4.2 The proposed development comprises up to 750 residential dwellings, including employment, community facilities and areas for sports pitches and open space.

Potential Archaeological Impacts

- 4.3 The assessment has established that archaeological investigations within the site have revealed prehistoric and roman remains in the central area of the site. It is consequently considered to have high potential for further such remains. Should such remains prove to be present, they are considered likely to be of no more than local significance. However, where the concrete hardstanding of the runways survive, it is likely that their construction will have removed any remains. The study site is also considered to have high potential for WWI and WWII airfield related remains which can be seen as cropmarks (Fig. 12). The site is considered to have low potential for remains of all other periods.
- 4.4 Should further remains be present on site, the construction of the proposed development would impact upon them. Due to this, archaeological evaluation will be required to support an application for the proposed development. Should the evaluation were to have positive results, a programme of archaeological mitigation works may be necessary. The scope of such works would depend on the nature of the results of the evaluation.

Potential Impacts on Designated Heritage Assets

- 4.5 The proposed development will have no impacts on the setting and significance of the designated heritage assets within the study area.

5.0 Summary and Conclusions

- 5.1 This assessment considers the potential effects on the historic environment of the proposed development of Ford Airfield, West Sussex.
- 5.2 The assessment has established that archaeological investigations within the site have recorded prehistoric and Roman remains. The site is also known to contain WWI and WWII airfield related remains. It is consequently considered to have high potential for remains for all three of these periods. The site is considered to have low potential for remains of all other archaeological periods. The site encompasses the whole of a West Sussex County Council Archaeological Notification Area (DWS8485).
- 5.3 Should remains be present within the site, they are considered unlikely to be of more than local significance. Consequently, archaeology is not a development/design constraint. However, it would a positive benefit if the design of the new development could be informed by and reflect the previous use of the site as an airfield in some way.
- 5.4 It is anticipated that an archaeological evaluation will be required in pre-determination of a future planning application. Should the evaluation have positive results, further mitigation archaeological investigation may be necessary.
- 5.5 The proposed development is considered to have a negligible effect on the setting and significance of designated heritage assets within the study area.

Sources

General

National Heritage List for England (NHLE)
West Sussex Historic Environment Record
West Sussex Record Office
National Archive
Pastscape

Cartographic

1805 Ordnance Survey Surveyors Plan
1839 Ford Tithe Map
1843 Climping Tithe Map
1879 OS 1:10,000 Scale Map
1899 OS 1:10,000 Scale Map
1913 OS 1:10,000 Scale Map
1913 OS 1:10,000 Scale Map
1932 OS 1:10,000 Scale Map
1938 OS 1:10,000 Scale Map
1962 OS 1:10,000 Scale Map
1962 OS 1:10,000 Scale Map
1977 OS 1:10,000 Scale Map
1980 OS 1:10,000 Scale Map
1992 OS 1:10,000 Scale Map
2006 OS 1:10,000 Scale Map
2015 OS 1:10,000 Scale Map

Bibliographic

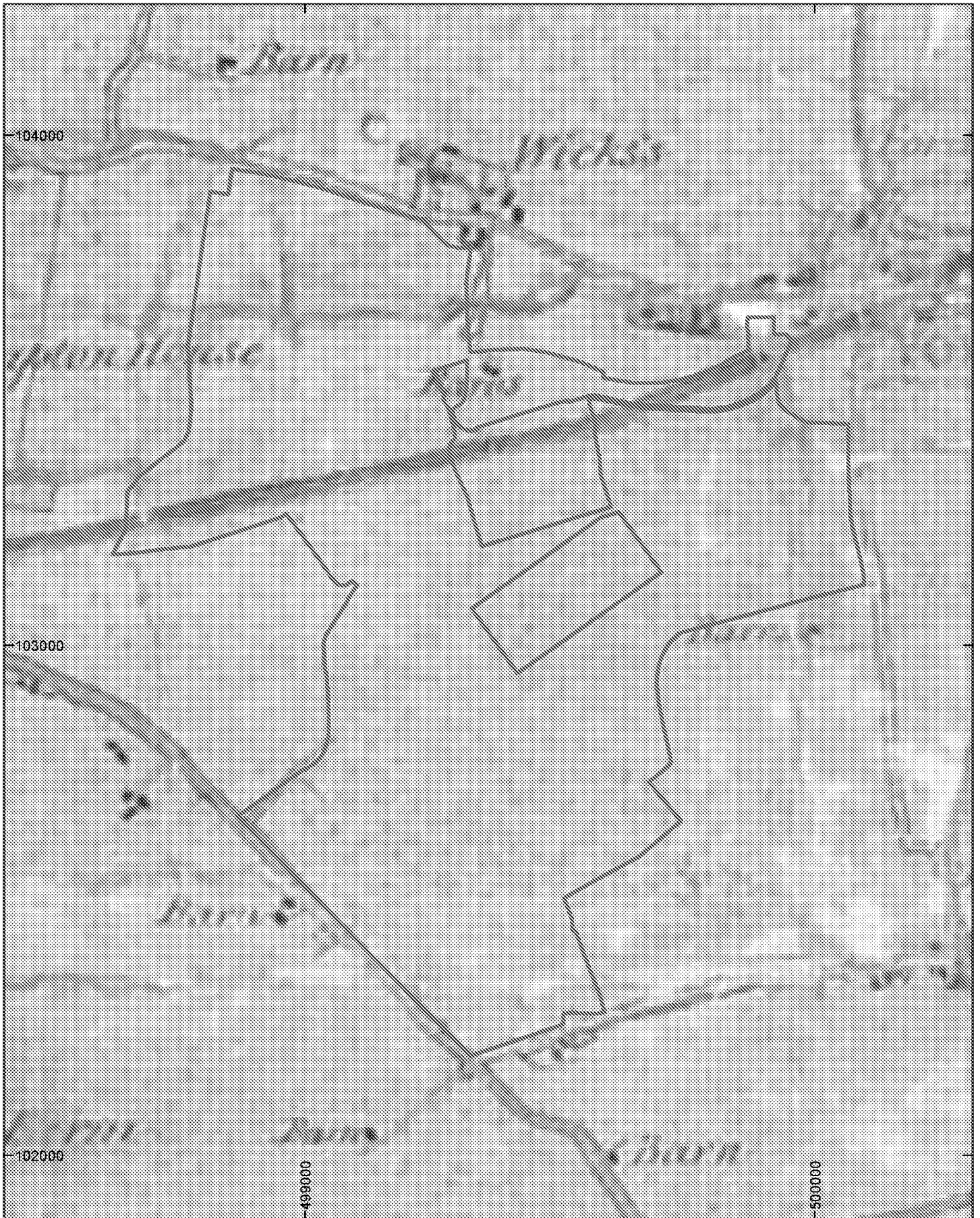
C. Place, *Excavations at Ford Airfield, Yapton, West Sussex*, 1999, 2004

"Climping", *A History of the County of Sussex: Volume 5 Part 1, Arundel Rape: South-Western Part, Including Arundel*. 1997

"Ford", *A History of the County of Sussex: Volume 5 Part 1, Arundel Rape: South-Western Part, Including Arundel*. 1997

Archival Material

Royal Flying Corps plan and papers for aerodrome at Ford [Ref: MP 1704]
Three photographs of Ford Airfield 1928 [Ref: PH 7377-7379]
Aerial photographs of Ford Airfield c1946-1960 [Ref: APH 98]
Sussex County Council photographs of Ford Airfield 1976 [Ref: WDC/PL23/1/197]
Aran Gazette clipping dated 15 August 1980 [Ref: MP 6904]
Valuation Office survey map [Ref: IR 124/9/484 & IR 124/9/488]
Ministry of Agriculture and Fisheries National Farm Survey map [Ref: MAF 73/42/62]



Legend

 Site boundary

1:10,000 at A4

0  250m

Title:
Fig. 3: 1805 Ordnance Survey Map
Address:
Land at Ford Airfield



orion.



Legend

 Site boundary

1:10,000 at A4

0  250m

Title:
Fig. 4: 1839 Ford Tithe Map
Address:
Land at Ford Airfield



orion.

104000

103000

102000

499000

500000

Legend

 Site boundary

1:10,000 at A4

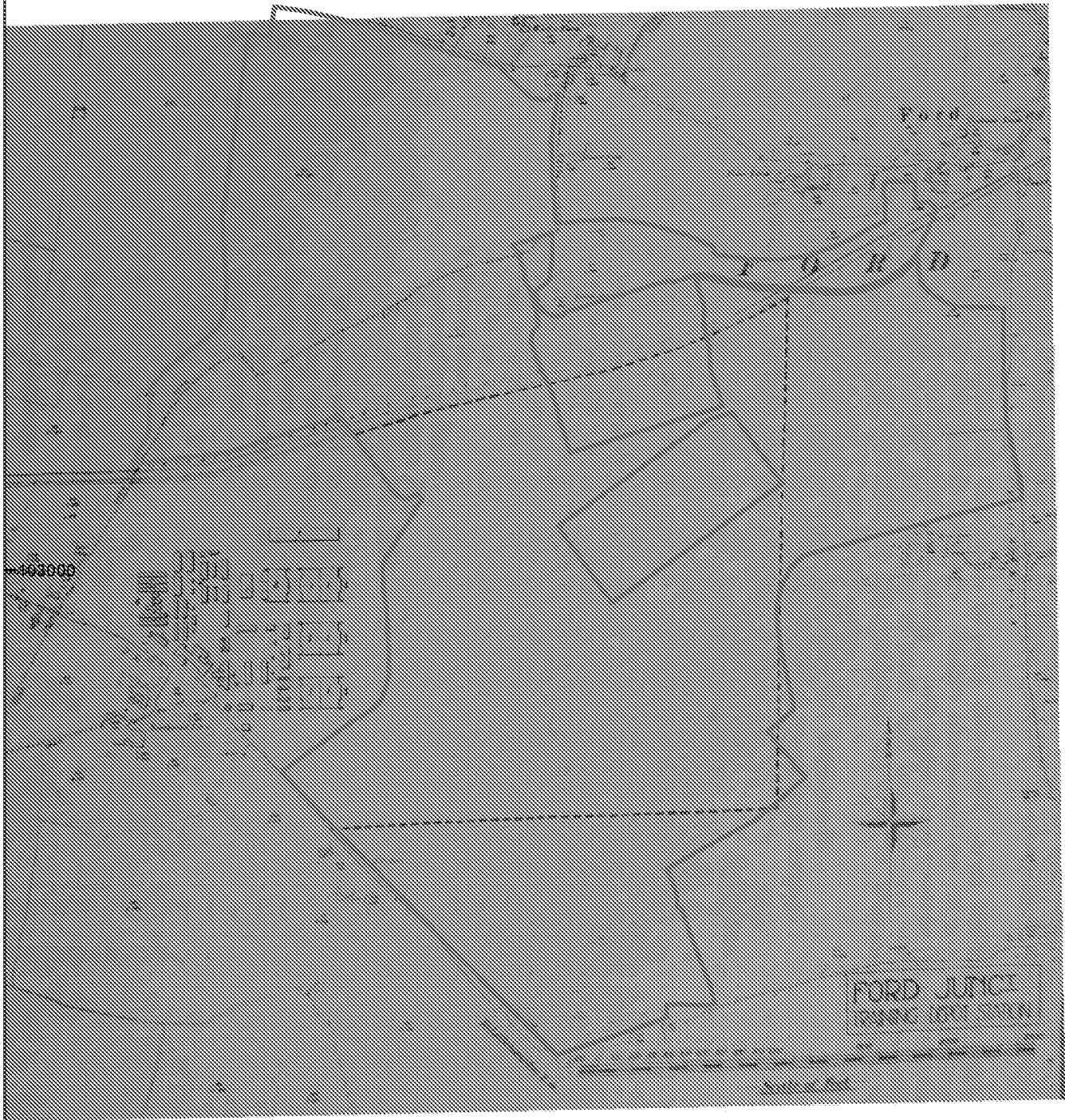
0 250m

Title:
Fig. 5: 1843 Climping Tithe Map
Address:
Land at Ford Airfield



orion.

104000



102000

499000

500000

Legend

 Site boundary

1:10,000 at A4

0 250m

Title
Fig. 8: 1918 Royal Flying Corps Plan
Address:
Land at Ford Airfield



orion.



Legend

 Site boundary

1:10,000 at A4

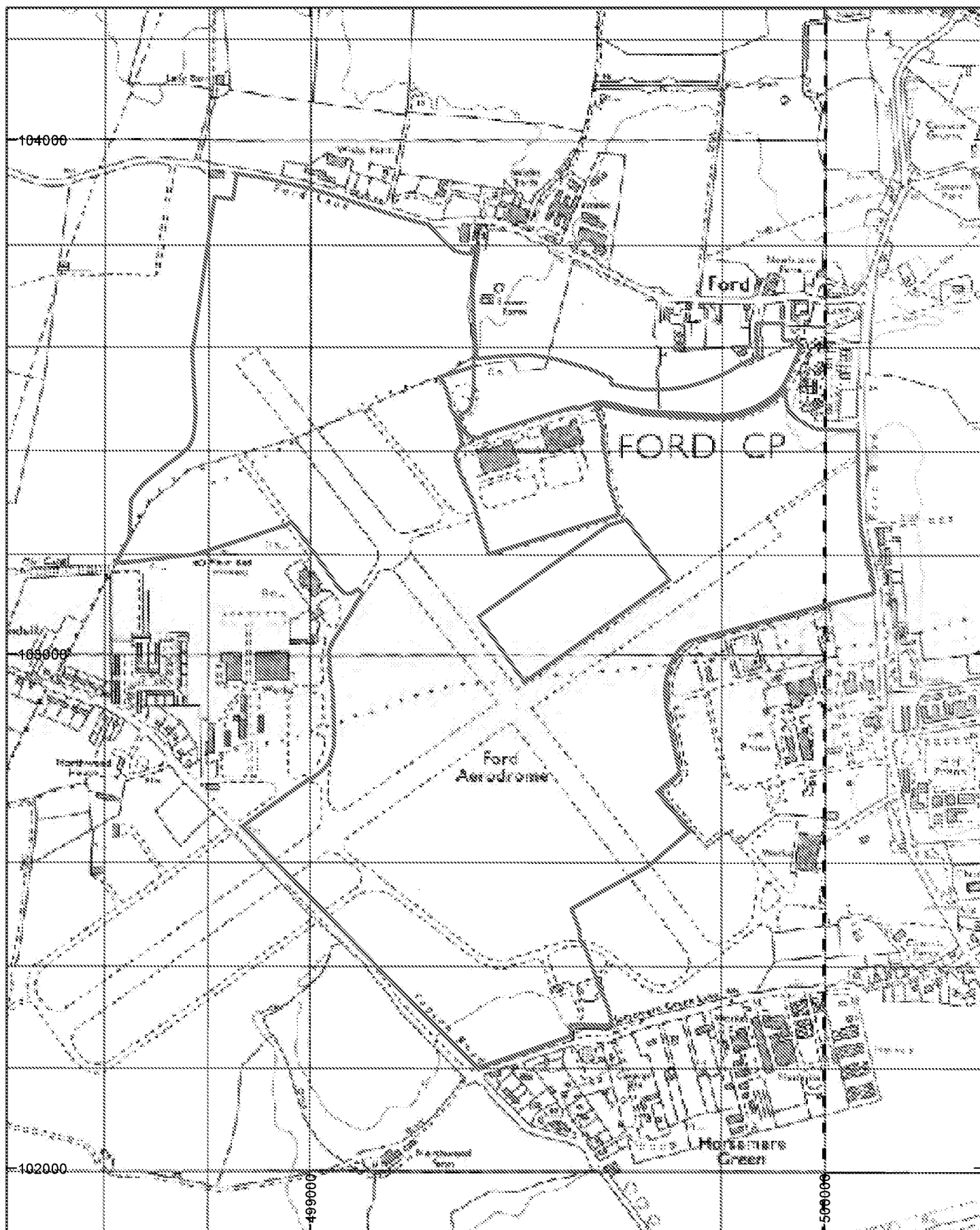
0 250m



Title:
Fig. 10: 1946 RAF Vertical Aerial Photograph
Address:
Land at Ford Airfield



orion.



Legend

Site boundary

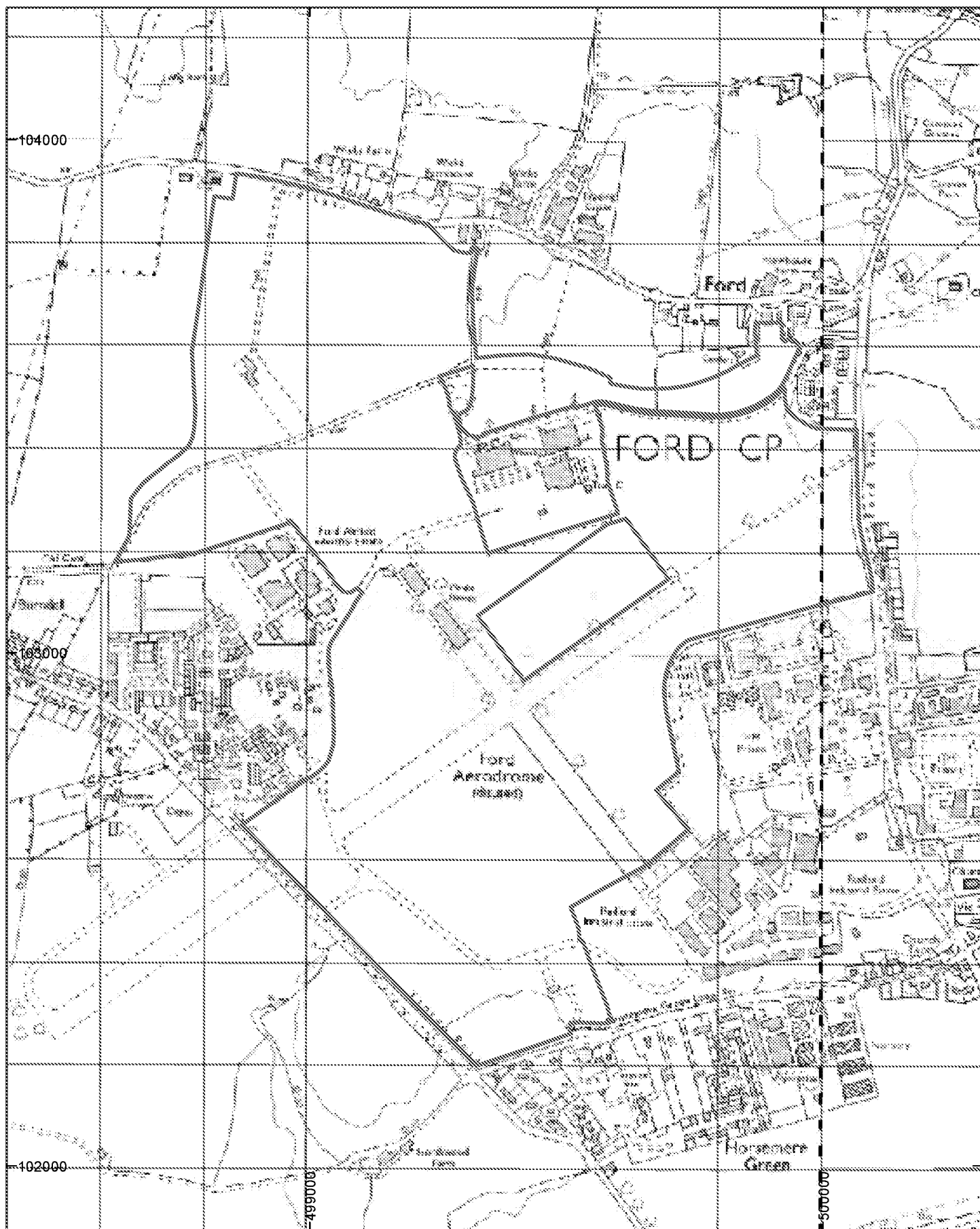
1:10,000 at A4

0 250m

Title:
Fig. 11: 1980 OS 1:10,000 Scale Map
Address:
Land at Ford Airfield



orion.



Legend

 Site boundary

1:10,000 at A4

0 250m

Title:
Fig. 12: 1992 OS 1:10,000 Scale Map
Address:
Land at Ford Airfield



orion.

104000



102000

499000

500000

Legend

 Site boundary

1:10,000 at A4

0 250m

Title:
Fig. 14: Aerial View of Study Site (from Google Earth)
Address:
Land at Ford Airfield



orion.

APPENDIX 4

GEOPHYSICAL SURVEY REPORT (MAGNITUDE SURVEYS, SEPT 2018)



**magnitude
surveys**

**Geophysical Survey Report
of
Land at Ford Airfield,
West Sussex**

**For
Orion Heritage**

On Behalf Of

Wates Developments & Redrow Homes

Magnitude Surveys Ref: MSSU354

September 2018



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Version	Purpose/Revision	Author	Interpretation/Figures	Approved By	Date Issued
Draft 1.0	Initial Draft to Line Manager	Rob Legg Amedeo Viccari	Rob Legg Freddie Salmon Marta Fortuny	Finnegan Pope-carter BSc MSc FGS	05 September 2018
Draft 1.1	Corrections, draft sent to client	Freddie Salmon Marta Fortuny	Freddie Salmon Marta Fortuny	Finnegan Pope-Carter BSc MSc FGS	07 September 2018
Final 2.0	Final Draft	N/A	N/A	Finnegan Pope-Carter BSc MSc FGS	10 September 2018

Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 105ha area of land at Ford Airfield, West Sussex. A fluxgate magnetometer survey was successfully completed across the site, revealing numerous anomalies of diverse origins. The geophysical results are dominated by the remains and associated debris of the WWI and WWII Ford Airfield, including runways, hangars and tie-down areas. The disused Portsmouth to Arundel canal has been identified, as have a number of former field boundaries, footpaths and sites of Post-Medieval farm buildings; these are all well-correlated with multiple historic maps. Furthermore, four different previously unrecorded areas of archaeological activity have been identified, expanding the archaeological understanding of the area. These are likely to be Prehistoric to Romano-British in date. They are in appearance not associated to each other; however, it is feasible more recent military usage of the fields may have truncated a larger settlement area. Limited modern and natural activity has also been identified.

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Figure 22:	Magnetic Greyscale (Areas 9, 10 and 11)	1:2,000 @ A3
Figure 23:	Magnetic Interpretation (Areas 9, 10 and 11)	1:2,000 @ A3
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1. Introduction

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by Orion Heritage on behalf of Wates Developments & Redrow Homes to undertake a geophysical survey on a c.105ha area of land at Ford Airfield, Arundel, West Sussex (SU 99314 03086).
- 1.2. The geophysical survey comprised quad-towed, cart-mounted fluxgate magnetometer survey.
- 1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David et al., 2008), the Chartered Institute for Archaeologists (CIfA, 2014) and the European Archaeological Council (Schmidt et al., 2015).
- 1.4. The survey commenced on 13 August 2018 and took 9 working days to complete.

2. Quality Assurance

- 2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society of Archaeological Prospection).
- 2.2. Director Graeme Attwood is a Member of CIfA, as well as the Secretary of GeoSIG, the CIfA Geophysics Special Interest Group. Director Finnegan Pope-Carter is a Fellow of the London Geological Society, the chartered UK body for geophysicists and geologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group. Director Chrys Harris has a PhD in archaeological geophysics from the University of Bradford and is the Vice-Chair of the International Society for Archaeological Prospection.
- 2.3. All MS managers have relevant degree qualifications to archaeology or geophysics. All MS field and office staff have relevant archaeology or geophysics degrees and/or field experience.

3. Objectives

- 3.1. The geophysical survey aimed to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The site is located at Ford, 4.9km southwest of Arundel, West Sussex (Figure 1). Survey was undertaken on a large area of mainly arable, flat land. At the time of survey the site was under stubble. Individual fields were intersected by a runway and industrial units. To the North Ford Lane runs West-East. Along the South-Western boundary the B2233 borders site. (Figure 2).

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Arable field, under stubble at the time of survey, with mostly flat topography.	To the North the survey area was bordered by a roadway and a small industrial block. To the East a trackway bounds site, linking the main road to the haulage yard to the South-East. All boundaries except the southern are lined with trees and hedges, possible wire fencing within.
2	Arable field, under stubble at the time of survey, with mostly flat topography.	To the North of site the area is bounded by a roadway. Trees and hedges line the South, East and Western boundaries. Heavy goods vehicles were active immediately adjacent to the southern boundary at the time of survey.
3	Arable field, under stubble at the time of survey with mostly flat topography.	The area was bounded by a hedgerow in the north, west, and southeast, a metal fence to the southwest, open to the road in the southeast, a stone wall was present in the northeast. A public right of way runs across the area aligned sub N-S, and across the western half aligned sub E-W.
4	Arable field, under stubble at the time of survey with flat topography.	The area was bounded to the south and east by a roadway, trees in the west, and garden fencing to the north. A manhole cover was noted in the south of the site.
5	Arable field, under stubble at the time of survey with mostly flat topography.	The area was bounded to the north by a roadway, to the south and northwest by hedgerows, trees to the east, and a metal fence to the southwest. A manhole cover was noted to the northwest.
6	Arable field, under stubble at the time of survey with flat topography.	The area was bounded by metal fencing in the northwest and southwest, hedgerows in the west and northeast, and was open to the bordering roadway in the southeast and east. Three boreholes were present in the area, one in the southwest corner, and two in the north of the eastern half.
7	Arable field, rolled at the time of survey with flat topography.	The area was bounded by trees in the north, west, and south west, metal fencing in the southeast, and a grass verge in the east. A public footpath ran along the northern boundary of the area.
8	Arable field, rolled at the time of survey with flat topography.	The area was bounded by hedgerows with metal fence in the north, south, and west, and bounded by trees in the east. A borehole was present in the southwest of the field.
9	Arable field, under stubble at the time of survey, mostly flat topography with a slight downward slop to the North.	A roadway was noted to the West, with a hedge line boundary. To the South and East metal fencing and a runway border.

10	Arable field, under stubble at the time of survey, with mostly flat topography.	Bordered by runways to the North-West and North East. Metal fencing makes up the majority of the perimeter to the survey area. Survey pegs, Boreholes and burnt ground were noted within the survey area at the time of survey.
11	Arable field, under stubble at the time of survey, with mostly flat topography.	To the South-West a roadway borders the site. Hedge Rows make up the majority of the site's perimeter. A Hangar was noted to the East.
12	High thistles and grass were noted at the time of survey	At the time of survey this area was un-surveyable.

4.3. The underlying geology comprises an undifferentiated chalk formation, combining: the Lewis Nodular, Seaford, Newhaven, Culver and Portsdown chalk formations. Superficial deposits comprise mainly of river terrace deposits, such as silts and muds. To the North, in areas 4 and 8 coarse grained raised beach deposits, sands and gravels are noted (British Geological Survey, 2018).

4.4. The soils consist of freely draining, slightly acidic loamy soil (Soilscapes, 2018).

5. Archaeological Background

- 5.1. The following section provides a brief overview of the archaeological background of the site and its surrounding landscape, summarising information provided in a heritage desk-based assessment by Orion (2015).
- 5.2. The site falls within a West Sussex County Council Archaeological Notification Area (DWS8485). A number of heritage assets have been identified within survey areas: Five late Neolithic/Bronze Age flakes and 7 burnt flints (MWS6980) were recorded to the centre of Area 5. Sherds of three separate vessels (MWS6683) of Late Iron Age/Roman period have been recorded to the centre of Area 10. A Medieval flagon handle (MWS6981) was identified to the southeast of Area 3. Lower Farm (MSW12220), a Post-Medieval farm building is depicted to the west of Area 3 in historic maps (see Figure 6). Fordground Barn (MWS10605), a Post-Medieval barn is depicted to the southwest of Area 3 in historic maps (see Figure 6). The route of the Post-Medieval Portsmouth to Arundel canal (MWS5754) runs on a west-east orientation across the centre of the site. Ford Airfield (MWS2412) was opened in 1917, remaining in military usage during both World Wars. Multiple WWII and Cold War structures have been recorded, including a blister hangar (MWS8137) recorded to the east of Area 11 and an anti-aircraft battery (MWS7129) recorded to the centre-north of Area 5.
- 5.3. Intense and multiperiod activity of prehistoric date has been recorded adjacent to the centre-southeast of the survey area, including: Late Mesolithic lithic industry (MWS6921), Late Iron Age cremations and co-axial field system, trackways, pits and post-holes (EWS1149); three late Bronze Age unurned cremations (MWS9678); several prehistoric ditches (EWS717); a possible Iron Age field system and enclosure (EWS717); Late Bronze Age field system with evidences of ritual activity. Further prehistoric activity is recorded within the site's wider environs, such as Neolithic stone axe (MWS3221) recovered c.550m to the northeast of the site; a number of Late Bronze Age pits, ditches and gullies with associated material (MWS6998, MWS6999, MWS7001 and MWS7003) were recovered c.450m to the southeast of the site.
- 5.4. Within the same area of intense prehistoric activity, late Iron Age/Roman features were recovered, including two cremations, enclosure, pits and a possible iron working shelter (MWS6291). More Roman boundary ditches (MWS7001) have been recorded c.450m southeast of site.
- 5.5. Saxon activity is limited to a ditch-feature (MWS7003) recorded c.450m south of the site, though a prehistoric origin has also been considered likely.
- 5.6. Medieval pit (MWS6993) and ditch/field boundary (MWS6999) were recorded 500m southeast and 450m south respectively of site.
- 5.7. The area remained as agricultural enclosed fields during Post-Medieval period as recorded in historic maps, with a number of field boundaries and footpaths being removed before the construction of the airfield. Details of the airfield can be seen on a RAF vertical aerial photograph made in 1946.

6. Methodology

6.1. Data Collection

6.1.1. Geophysical prospection comprised the magnetic method as described in the following table.

6.1.2. Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic	Bartington Instruments Grad-13 Digital Three-Axis Gradiometer	1m	200Hz reprojected to 0.125m

6.1.3. The magnetic data were collected using MS' bespoke quad-towed cart system GNSS-positioned system.

6.1.3.1. MS' cart system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.3.2. Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing and visualisation to be monitored in real-time as fieldwork was ongoing.

6.1.3.3. A navigation system was integrated with the RTK GPS, which was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing.

6.2. Data Processing

6.2.1. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to Historic England's standards for "raw or minimally processed data" (see sect 4.2 in David et al., 2008: 11).

6.2.2. Sensor Calibration – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen et al. (2003).

6.2.3. Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

6.2.4. Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

6.2.5. Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.3. Data Visualisation and Interpretation

6.3.1. This report presents the gradient of the sensors' total field data as greyscale images, as well as the total field data from the upper and/or lower sensors. The gradient of the sensors minimises external interferences and reduces the blown-out responses from ferrous and other high contrast material. However, the contrast of weak or ephemeral anomalies can be reduced through the process of calculating the gradient. Consequently, some features can be clearer in the respective gradient or total field datasets. Multiple greyscale images at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plots. XY trace plots visualise the magnitude and form of the geophysical response, aiding in anomaly interpretation.

6.3.2. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street maps, satellite imagery, historic maps, LiDAR data, and soil and geology maps. Google Earth (2018) was consulted as well, to compare the results with recent land usages.

7. Results

7.1. Qualification

7.1.1. Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports as well as reports of further work in order to constantly improve our knowledge and service.

7.2. Discussion

7.2.1. The geophysical results are presented in consideration with satellite imagery (Figure 5) and historic maps (Figure 6).

7.2.2. The fluxgate magnetometer survey has responded well to the survey area's environment. The majority of the geophysical data is characterised by a rather magnetically enhanced ferrous-type anomalies, mostly caused by the military usage of the site as an active airfield during both World Wars and by **modern** underground services, fencing along the edges and spreads of ferrous responses on or near the surface likely caused by nearby housing and roads.

7.2.3. At the time of survey, the site was mainly occupied with agricultural activity; however, a small industrial estate and airfield were also situated within the site. Historic evidence shows the site was used as an **airfield** during both world wars, the extents of the runways and tie down areas have since been changed; however, large areas of magnetically enhanced material extending from the modern-day runways are visible. The width and

orientation of these responses correlates directly to the extant airfield (Figure 5). The geophysical data has also recorded previously unmapped airfield features: anomalies which exhibit similar responses of clusters of greater density of ferrous anomalies (best visible in the XY traces) but that weren't recorded in historic evidence of the airfield, have been also classified as 'Airfield' related structures.

7.2.4. Anomalies of probable and possible **archaeological** origin have been detected across four different areas, further enlarging the archaeological register of the site's wider environs (see 5. Archaeological Background). Considering the abundance of archaeological heritage assets of Late Prehistoric to Roman date recorded within the site itself and the immediate surrounding, in conjunction with the characteristic responses exhibited in the geophysical data, it has been considered the anomalies identified as archaeological in origin are likely to be of Late Prehistory to Romano-British period. Based on the geophysical data, these clusters of archaeological activity aren't joined or related to each other. However, Group 2 and Group 3, c.350m apart and with airfield features running between them, might have been related since they exhibit similar responses (right turns, double ditches, trackway features, linearity) and magnetic strength. It is feasible a larger settlement area might have been truncated by modern and military usage of the site. Furthermore, Group 4 has been identified in the same location as sherds of three separate vessels (MWS6683) of Late Iron Age/Roman period had been previously recorded to the centre of Area 10.

7.2.5. Historic mapping (Figure 6) shows a former **canal** extending through the centre of site along an E-W alignment. This feature has since been drained and backfilled. At the time of survey this portion of the site was under agricultural control with no visible evidence of historic excavation or backfill. The results show a strong, broad linear response extending along the same line as the canal route.

7.2.6. **Agricultural** activity is also evident across the site and reflect the agricultural usage of the site during Post-Medieval times. historic and modern usages. Strong linear features have been identified corresponding directly to former field boundaries and adjoining footpaths. Clusters of highly magnetic responses have been related to the former Lower Farm and former Fordground Barn as well as a now infilled pond; these had previously been recorded as heritage assets on site (5. Archaeological Background) and have been well-correlated with feature denoted on historic maps (see Figure 6).

7.3. Interpretation

7.3.1. General Statements

- 7.3.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.
- 7.3.1.2. **Undetermined** – Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes, although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally not ferrous in nature.
- 7.3.1.3. **Ferrous (Discrete/Spread)** – Discrete ferrous-like, dipolar anomalies are likely to be the result of modern metallic disturbance on or near the ground surface. A ferrous spread refers to a concentrated deposition of these discrete, dipolar anomalies. Broad dipolar ferrous responses from modern metallic features, such as fences, gates, neighbouring buildings and services, may mask any weaker underlying archaeological anomalies should they be present.

7.3.2. Magnetic Results - Specific Anomalies

- 7.3.2.1. **Archaeology Probable (Group 1)** – Within Area 1 there are several linear features which have been interpreted as possible archaeology occupying an area of c. 0.4ha. A configuration of weaker linear anomalies on a NW-SE alignment appear to define a distinct archaeological area, possibly containing internal subdivisions. Four strong responses on a NE-SW orientation seem to be connected with the weaker responses, suggesting a correlation between the strong and weak responses.
- 7.3.2.2. **Archaeology Probable (Group 2)** – Proximal to the eastern boundary of Area 1, a complex of linear features has been identified as probable archaeology. The form, location and strength of these responses is endemic of archaeological presence. Linear responses of varying strength form within a double-ditch like feature, measuring approximately 114m x 130m. Numerous, internal subdivisions are present within the feature along with a possible trackway, along a NW-SE alignment proximal to the eastern boundary of Area 1 measuring c. 59m. The relatively quiet, undisturbed response produced by this anomaly distinguishes itself from the surrounding, contemporary features.
- 7.3.2.3. **Archaeology Probable (Group 3)** – To the south of Area 2, a rectilinear configuration of strong and weak responses c. 55m x 60m has been identified. The longest features merge creating a 90-degree corner on the NE side of the anomaly. This type of strong, negative magnetic response is typical of stone features or removed earthworks.

- 7.3.2.4. **Archaeology Probable (Group 4)** – A curvilinear response has been identified towards the centre of Area 10. Compared to the feature noted to the North in Area 1, this has a more curvilinear form. Measuring approximately 115m x 56m and oriented in a general N-S alignment. To the South the features has been truncated by a modern service line.
- 7.3.2.5. **Archaeology Possible (Group 5)** – To the north of Area 11, a complex of linear features has been identified as possible archaeology. Due to the weak response, it has not been possible to classify these features as probable archaeology. However, these anomalies are located c. 184m SW from Group 4, highlighting the archaeological potential of these features.
- 7.3.2.6. **Airfield** – A number of responses have been classified as being associated with the airfield. The majority of them had been mapped; furthermore, a number of anomalies don't appear on historic mapping or aerial photographic records (see Section 5.2). Despite this, due to their juxtaposition with the mapped airfield features and exhibiting a similar type of response, an airfield origin has also been considered. There are a few particularly distinct responses. One of the most identifiable is runways, characterised by large delimited rectangular spreads of ferrous-type responses which are located in Areas 2, 5, 6 and 9. These features range in width from c. 50m at the largest, to c. 13m. Large spreads, located in Area 6 and 7, have been identified with tie-down areas which are characterised by circular internal structuring. Other anomalies have been associated to hangars, located mainly in Areas 1, 2 and 5, exhibit as clusters of highly magnetic responses. The rest of the anomalies classified as 'Airfield' have been identified with remnant debris due to the lack of structural elements.
- 7.3.2.7. **Canal** – Several strong, linear anomalies have been identified in Areas 4, 5 and 6 which are associated with a Post-Medieval canal (see Section 5.2). The Post-Medieval feature runs across the three areas on a NE-SW alignment, the canal ranges in width from c. 30m at the largest, to c. 4.9m. The magnetic response of the canal is strong and clear in Areas 4 and 6. On the other hand, the anomaly has a weaker response in Area 5, which is likely to be connected to the presence of significant ferrous responses in the area.
- 7.3.2.8. **Agricultural (Former Field Boundaries/Footpaths/ Ploughing)** – Several anomalies appear to reflect historical agricultural field boundaries identifiable in historic OS maps (see Section 5.7). Other agricultural activities can be identified through weak linear anomalies located in several areas reflecting past or present ploughing features.
- 7.3.2.9. **Agricultural (Farm/Barn/Pond)** – Two strong anomalies have been identified in Area 3. The two rounded features are within the locations of two ponds identified in historic OS map. These agricultural anomalies have a circumference of c. 17m x 32m the southernmost, and c. 18m x 28m the northernmost. Another small pond is located in Area 10 which is in line with a field boundary,

it has a circumference of c. 18m x 6m. Other agricultural activities are identifiable through spread responses which are related with possible demolishing residuals of a Post-Medieval farm and barn identified on historical maps (see Section 5.2).

- 7.3.2.10. **Natural** – Throughout the site a number of weaker, natural, responses have been identified. Characterised as such these features don't show a correlation to one-another or surrounding features mapped on historic mapping or more contemporary cartographic sources. Variations in size, irregular form and reduced signal strength to surrounding features indicate a natural origin. To the north of area 3, numerous natural trends and broader responses have been identified. Considering the general depositional superficial geology of the site (see 4.3) and the mismatch in feature alignment, possible fluvial or flooding instances could produce similar responses.
- 7.3.2.11. **Undetermined** – There are several strong linear anomalies that have been identified in area 1 and 3 on a NW-SE alignment. Though these features appear to have the characteristics of field boundaries, their alignment is different from the agricultural features recorded in the area and these anomalies do not appear on historic maps. The linear feature that runs across area 1 is in proximity of several archaeological features (Group 2). However, due to the different response is not possible to relate the linear feature with the archaeological anomalies located on the eastern side of area 1. Other strong and weak anomalies have been recorded in area 8, 10 and 11. These features appear to be defined by linear anomalies, possibly reflecting human activities.
- 7.3.2.12. **Ferrous (Strong/Service)** – Throughout the site large areas of ferrous disturbance have been identified. Primarily situated around the borders of individual survey areas, these sorts of responses are often endemic of modern-day perimeter fencing or off-site activity. To the south of area 10 a large concentration of service lines truncates a grouping of archaeology (Group 4) along an E-W alignment. With the construction and subsequent partial demolition of the airfield within site it is possible these ferrous disturbances may supersede weaker, more ephemeral archaeological responses nearby. Various other agricultural, undetermined features have also been truncated by modern services.
- 7.3.2.13. **Ferrous (Spread)** Categorised areas of ferrous (spread) features represent a higher concentration of individual ferrous responses. To the west of area 9 site is dominated by these ferrous (spread) responses, likely produced by the destruction of the historic airfield extent and installation of service lines present nearby.

8. Conclusions

- 8.1. A fluxgate magnetometer survey has been successfully completed across the site at Ford Airfield. The survey has responded well to the conditions of the survey area, despite its former usage as an airfield. The results demonstrate that many airfield features, such as runways and tie-down areas, are significantly recorded throughout the survey area. Several anomalies have also been mapped as airfield features; however, due to the lack of structural features has not been possible to identify their specific purpose.
- 8.2. Anomalies identified as probable archaeology on the Sites comprise linear, rectilinear and curvilinear responses which form three distinct groups. The geophysical results from Area 1 support the existence of archaeological features with multiple sub-divisions and a possible trackway, Group 1 and 2. Rectilinear configuration, Group 3, is probably related to a stone feature according to its magnetic response. In the central part of Area 10, it has been recorded as a curvilinear anomaly, Group 4. Additionally, it has been possible to identify features that have been interpreted as possible archaeology, Group 5. Overall, these archaeological responses demonstrate the intensive occupation of Ford Airfield.
- 8.3. Agricultural activities have been identified in the form of field boundaries, historic and modern ploughing, and debris of a farm and barn which are recorded on historic OS map. The results have also demonstrated the presence of a canal which runs through site.
- 8.4. The survey area encompasses different types of anomalies, which have been identified with ferrous and natural responses. In addition, it has been possible to identify a canal which was recorded on historic OS map.

9. Archiving

- 9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.
- 9.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to the any dictated time embargoes.

10. Copyright

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