Ford energy from waste

FORD ENERGY RECOVERY FACILITY AND WASTE SORTING AND TRANSFER FACILITY, FORD CIRCULAR TECHNOLOGY PARK

ENVIRONMENTAL STATEMENT
TECHNICAL APPENDIX G: GROUND CONDITIONS AND THE WATER ENVIRONMENT

MARCH 2021

RAMBOLL Viridor GRUNDON

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FORD ENERGY RECOVERY FACILITY AND WASTE SORTING AND TRANSFER FACILITY, FORD CIRCULAR TECHNOLOGY PARK

GEOENVIRONMENTAL DESK STUDY

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FORD ENERGY RECOVERY FACILITY AND WASTE SORTING AND TRANSFER FACILITY, FORD CIRCULAR TECHNOLOGY PARK GEOENVIRONMENTAL DESK STUDY

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1. INTRODUCTION

1.1 Brief

Ford Energy from Waste (EfW) Limited, a joint venture between Grundon Waste Management Limited (Grundon) and Viridor Energy Limited (Viridor) (therein referred to as 'the applicants'), is proposing to build and operate a conventional energy recovery facility (ERF) at the site.

Grundon, the sole owner/ operator of the existing waste transfer station (WTS), is proposing to continue this operation in a new, purpose-built facility on site. Ramboll UK Limited (Ramboll) has been appointed by Ford EfW Ltd to undertake a geoenvironmental desk study to support the full planning application at the site, including the ERF and waste sorting and transfer facility (WSTF) and ancillary uses.

1.2 Objectives and Scope of Works

The scope of this study is as follows:

- Review desk-based information sources including site history, geology, hydrogeology, hydrology, environmental and regulatory information, radon and ground gas, and unexploded ordnance;
- Review any relevant previous site investigation reports;
- Establish a contaminated land conceptual site model and carry out Preliminary Risk Assessment in the context of the proposed development; and
- Provide recommendations for site investigation to inform the design and construction of the development.

This report does not cover any issues other than those related to contaminated land. For example, no geotechnical, ecological or archaeological studies are included within the scope of this report.

1.3 Limitations and Constraints

This report has been prepared for the Client and shall not be relied upon by any third party unless that party has been granted a contractual right to rely on this report for the purpose for which it was prepared. The findings and opinions in this report are based upon information derived from a variety of information sources. Ramboll has endeavoured to assess all information provided and believe these information sources to be reliable. Information from the public register was largely derived from the Envirocheck environmental database; information sources for this database include the Environment Agency (EA) and other statutory authorities.

This report includes summaries of information from external sources and cannot offer any guarantees or warranties for the completeness or accuracy of information relied upon. It should be noted that some aspects considered in this study are subject to change with time. Therefore, if the development is delayed or postponed for a significant period, a review should be completed to confirm that no changes have taken place, either at the site or within relevant legislation. Any substantial changes to the use of the site may require a reassessment of the implications of the risks identified. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site. This desk study constitutes a Preliminary Investigation under British Standard 10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites – Code of Practice'[1] and has utilised the guidance in 'Land Contamination: Risk Management' (LCRM),

[1] British Standards Institute (2011). BS10175:2011+A2: 2017 Investigation of Potentially Contaminated Sites – Code of Practice

published 8 October 2020 in its preparation[2]. A summary of legislative context and methodologies utilised within this report is presented as Appendix A.

2. SITE DETAILS

2.1 Site Setting

The site location and details of the site setting are provided in Table 2-1, and a site location plan is presented as Figure 1.

Table 2-1: Site Setting Details

Parameter		Details
Site location	Postcode	BN18 0HY
	Grid Reference	498968 103119
Area of site (ha[2])		6.72
General setting		The site boundary comprises a central, approximately rectangular portion (hereafter referred to as the 'rectangular portion'). The site boundary includes an access road to the southeast of the 'rectangular portion' constructed under planning permission reference WSCC/027/18/F (hereafter referred to as the 'south-eastern road'). As the south-eastern access road has been constructed under a separate planning permission (WSCC/027/18/F), it has not been considered within this assessment. The site is located within an area of predominantly agricultural land, with a sewage treatment works and area of sports pitches located to the south. A number of commercial and industrial estates are present in the area at a distance of approximately 500 m from the centre of the site, and the residential areas of Ford, Climping, Yapton and Her Majesty's (HM) Prison Ford are located beyond these. The Ford to Barnham Railway line is located more than 1 km to the north and the River Arun is located approximately 900 m to the east.
Current site use		The rectangular portion of the site is currently partially occupied by a waste transfer station (WTS) located in the centre, two vacant former hangar buildings located in the north of the rectangular portion and a large area of hardstanding that is partly occupied by containers and portacabins. The site is accessed via the new south-eastern road from Ford Road to the east of the site.
Current regulated activities on site		The WTS operates as a licenced waste management facility (Grundon Waste Management Ltd, Licence Ref 402696) and accepts household, commercial and industrial waste.
Topography		The topography of the site is generally flat. The topography in the vicinity of the site gently slopes down toward the north.
Land bounding site-use	North	The site is bounded to the north by agricultural land. Ford Lane Business Park and a number of farmhouses are located beyond the agricultural land at a distance of approximately 500 m from the centre of the site.
	South	The site is bounded to the south by a triangular area of sports pitches, with a sewage treatment works located beyond the sports pitches (approximately 20 m from the site boundary at its closest point). Ford Airfield (used as Ford Market) is located beyond the sewage treatment works, and a materials recovery facility (MRF) and Rudford Industrial Estate are located beyond this at a distance of approximately 500 m from the centre of the site. HM Prison Ford is located approximately 500 m to

[2] https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm

Parameter		Details
		the southeast. The residential village of Climping is located approximately 1 km to the south.
	East	The site is bounded to the east by agricultural land. The residential village of Ford is located beyond the agricultural land approximately 300 m east. Further agricultural land and the River Arun are located beyond the village of Ford.
	West	The site is bounded to the west by agricultural land. Ford Airfield Industrial Estate is located beyond the agricultural land at a distance of approximately 500 m. The town of Yapton is located beyond the industrial estate.

2.2 Proposed Development

Ford EfW Ltd propose to redevelop the site as a waste treatment facility comprising a WSTF and ERF. The buildings and ancillary structures to be constructed as part of the waste management facility are anticipated to occupy 40% of the site and are summarised as follows:

- WSTF;
- ERF, including;
  - Waste reception hall;
  - Incinerator Bottom Ash (IBA) storage area;
  - Boiler hall;
  - Turbine hall and heat station;
  - Water treatment plant and dirty water pit;
  - Admin and welfare block;
  - Bunker hall.
- Offices;
- Flue Gas Treatment (FGT) plant with stacks;
- Air Cooled Condenser (ACC) house;
- Pump houses;
- Fire tanks;
- Electricity substation; and
- Weighbridges.

The remaining 60% of the site will be occupied by external areas and is proposed to predominantly comprise hardstanding, with soft landscaping present at the margins of the site in landscape bunds. External areas of the site will include access roads and operational transport routes within the site, car and heavy goods vehicle (HGV) parking spaces, HGV washing areas ramps and pedestrian routes.

The dimensions of the proposed areas of the site at which ground levels will be lowered are provided in Table 2-2 below.

Table 2-2: Dimensions of the Proposed Areas of the Site at Which Ground Levels will be Lowered

	Width (m)	Length (m)	Finished Floor Level Depth below existing ground level (m)	Depth of Required Excavation Allowing for Foundation (mbgl)	Elevation of Base of Required Excavation Allowing for Foundation (mAOD)
Bunker Hall	30	40	3.0	4.0	2.5
Surface Water Pumping System	1.5	1.5	4.0	5.0	1.5

	Width (m)	Length (m)	Finished Floor Level Depth below existing ground level (m)	Depth of Required Excavation Allowing for Foundation (mbgl)	Elevation of Base of Required Excavation Allowing for Foundation (mAOD)
Reduced level dig	50	13	1.5	2.5	4.0

A proposed development plan showing the general layout of the proposed development is presented as Appendix B.

2.3 Site Walkover

A site walkover survey was undertaken by a Ramboll contaminated land consultant on 11 December 2019. The principal objectives of the walkover survey were to verify information collected as part of this desk-based assessment and collect additional information relating to land contamination that cannot be obtained through remote assessment. The items noted during the site walkover and discussed below are illustrated in Figure 2 and photographs taken during the site walkover are presented in Appendix C.

Buildings Onsite

Site Office and Weighbridge

The site office is a series of portacabins, with the weighbridge adjacent to the site. No wheel wash facilities were noted by the weighbridge (see Plate 1).

Unit 1 (Hangar 1)

The construction is steel frame with a corrugated cladding and a concrete floor. Currently, Hangar 1 is vacant, and no access was possible. A single-storey lean-to construction is located at the southern face of the hangar, which was formerly used as office space (see Plate 2 and Plate 3). On the western side of the hangar a bricked extension was noted which was formerly used as the sales office and was constructed in the 1980s.

Unit 2 (Hangar 2)

Hangar 2 is located to the east of Hangar 1 and is also a steel frame, cladded structure with a concrete floor. Currently, Hangar 2 is vacant, and no access was possible. There is a single storey lean-to building on the southern portion of the hangar (see Plate 4). On the northern side of Hangar 2 there are two separate, smaller single-storey buildings of brick construction. These are the former store and welfare offices (see Plate 5).

The Waste Transfer Building

The main waste building is located approximately south of Hangar 2 and is currently used as an area for storing incoming waste (see Plate 6). The construction is steel frame with corrugated cladding and a concrete floor. The main entrance of the waste transfer building is from the eastern side, where the lorries enter to drop the waste. No access was possible during the site walkover. In front of the entrance is the vehicle wash down area and where the waiting lorries park.

External Yard Area

The external yard area (see Plate 7) is covered with concrete (rough mix), with vegetation noted to be growing in between the cracks. Surrounding Hangar 1 and Hangar 2 disused rails were noted within the concrete (see Plate 8). The northern external yard is used for storing empty waste bins and waste containers (see Plate 9). The southern external yard areas are currently not being utilised (see Plate 10). A large earth stockpile was noted adjacent to the waste transfer building and several smaller mounds of earth were noted in relation to the construction of the new access road in the south-eastern corner of the site (see Plate 11). Currently, it is unknown when these stockpiles will be removed.

The external area to the east of the waste transfer building is surfaced by extensively vegetated undeveloped ground. Based on historical maps and desk studies (detailed as Sections 3.2 and 5.2 respectively) this area is understood to have been occupied by a travelling crane and a pit containing autoclaves. As such, the undeveloped ground to the west of the waste transfer building is understood to be Made Ground used to backfill the former autoclave pit.

Storage of Chemicals and Hazardous Substances

Underground Storage Tanks

During the site walkover two manhole covers were noted, possibly indicating the presence of an interceptor or underground storage tank adjacent to Hangar 2 (northern side) (see Plate 12). In addition, directly in front of the Hangar 2 bricked lean-to an empty hollow hole covered by loose vegetation was noted. Historical desk-based information suggests the possible presence of interceptors, slurry pits or underground storage tanks (UST) (see Section 5.2 and Appendix G) in the vicinity. Due to the overgrown vegetation and uncertainty of the depth and contents of the hole it was deemed unsafe to investigate further (see Plate 13).

On the southern side of Hangar 2 (between Hangar 2 and the waste transfer building), a drain cover with a black pipe and white cap was noted. This may indicate the presence, or historical presence, of an underground tank or interceptor (see Plate 14).

Above Ground Storage Tanks

Within the centre of the site a 5,600 litres (l) oil tank (serial number 33588) was observed. The tank is associated with refuelling of onsite vehicles (see Plate 15). A spill kit was present adjacent to the tank. The tank appeared to be in good condition with no evidence of leaks or spillage on the surrounding concrete.

An above ground storage tank was observed at the western face of Hangar 1. The tank was labelled as containing gas oil (Bund 4) and is a Titan ES2500B, plastic internally bunded tank with a capacity of 2,500 litres (l) (width 1,470 mm and height 1,550 mm). The tank sits on two concrete blocks/beams approximately one metre above the ground level above a concrete block which was free of staining (see Plate 16). Based on historical maps and desk studies, this tank is understood to have originally been located at the eastern-face of Hangar 1.

A bunded concrete slab was observed at the western face of Hangar 1. This is understood to have been occupied by a boiler house containing a 40,000 l storage tank (containing heating oil). The boiler house and 40,000 l tank were no longer present at the time of the site walkover. The surface of the concrete slab was darker than the surrounding concrete hardstanding, however it was unclear if this was due to oil staining (see Plate 17).

A concrete slab (raised approximately 0.3 m above the level of the surrounding concrete hardstanding) was observed to the southeast of the waste transfer building. This is understood to have been occupied by a boiler house containing a 60,000 l storage tank (containing heating oil). The boiler house and 60,000 l tank were no longer present at the time of the site walkover. The surface of the concrete slab was darker than the surrounding concrete hardstanding in places, however it was unclear if this was due to oil staining.

Other Chemical Storage

Adjacent to the oil tank located within the centre of the site an AdBlue (exhaust fluid) tank was noted for use by the lorries and onsite machinery. On the southern portion of Hangar 1 one oil tube was noted, however its contents were not identified (see Plate 18).

Stockpiled Waste

During the site walkover areas of stockpiled waste were recorded across site. The waste included old tyres, bikes, pipe work, metal cables, plastic, brick blocks and wooden planks (see Plate 19). Although no asbestos contaminating materials (ACMs) were noted within the stockpiled waste, there is the potential for ACM to be present onsite. Asbestos surveys undertaken in the buildings onsite in 2004 identified asbestos within the building fabric.

Emissions to Air

There was no evidence of any activities on site that would generate emissions to air that could be considered to present a significant environmental contamination risk to the ground. However, two disused metal piped chimneys were noted on Hangar 1 (see Plate 20).

Polychlorinated Biphenyls (PCBs)

Three electricity sub-stations were noted to be present on-site, one located on the western side of Hangar 1 and two located at Hangar 2 (northern and southern portion of the building). The age of the electricity sub-stations is unknown; however, it is likely to coincide with the construction of the Hangars. The ground in the immediate vicinity of the electrical substations was observed to be free of signs of staining or discolouration, however it is unclear if they are still in use due to the overgrown vegetation (see Plate 21 and Plate 22).

Former RAF Area (Offsite)

To the north of the main access road (approximately 50 m north from the site boundary) was the former RAF refuelling area used by Tarmac Limited (the previous owner) for storage.

The former RAF pumping station (which was located approximately 80 m north from the site boundary), which was noted to be a bricked bunker sunken into the ground and surrounded by concrete hardstanding (to the south) and scrub and woodland (to the north) (see Plate 23). It was noted that the bunker was filled with waste therefore access was not possible (see Plate 24).

3. CONSULTATIONS

The agencies, authorities, organisations and individuals which have been contacted and/or their records reviewed during the course of this study are listed in Table 3-1, together with a summary of the information obtained. Full responses from consultees and information received are included in Appendix D.

Table 3-1: Summary of Regulatory Consultations

Regulatory Authority	Request	Date of Consultation	Responses
Arun District Council Contaminated Land Department	Pertinent environmental information	20/01/2020	A response was received from the Arun District Council Contaminated Land Department on 8 April 2020. Arun District Council advised that as part of their Part IIA investigations the site has been classified as a prioritised site which has been occupied by a potentially contaminative use. However, currently no initial investigations in the form of desktop studies and/or site inspections have been undertaken. The Contaminated Land Department has also confirmed that if the site is brought forward for re-development, a condition will be recommended for the submission of a human health-based assessment. The Contaminated Land Department are also unaware of any historic or current landfills within 250 m radius of the site. The Contaminated Land Department are not aware of any radon related monitoring or protective methods being utilised within buildings located within a 100 m radius of the site. In addition, the department is not aware of any water supplies located within a two km radius of the site.
West Sussex County Council Trading Standards	Petroleum records information	20/01/2020	During a telephone conversation on 22 January 2020, the Trading Standards Department at West Sussex County Council advised that they had no records of current petroleum storage tanks on site. However, the department had one record of a disconnected tank which was present on site, however no details for this tank were available
Environment Agency	Pertinent environmental information	20/01/2020	A response received from the EA on 11 February 2020 is presented as Appendix D. The EA advised that, in addition to the publicly available information detailed in Section 3.1, they held records relating to a fire on site in 2002 relating to drums of aluminium powder (logged as National Incident Recording System (NIRS) 123701). This resulted in 'very minimal contamination to surface water'. Additionally, the EA advised of a single odour complaint relating to the site made by a local resident in July 2017. Further investigation by the EA identified the sewage treatment plant to the south of the site as the source of the odour. The EA were unable to provide further pertinent details relating to land contamination at the site.

3.1 Site History

The detailed history of the site and environs have been determined with reference to the following:

i. Published literature and Ordnance Survey (OS) Maps dating from the 19th Century obtained as part of an Envirocheck report (provided in Appendix E);
ii. Historical aerial photographs viewed via Google Earth[3];
iii. Historical maps of Ford Aerodrome[4]; and
iv. BGS Geological Survey Historical Borehole Logs (Appendix F).

[3] https://www.google.co.uk/earth
[4] http://www.abct.org.uk/airfields/airfield-finder/ford-yapton

A plan of features identified from historical plans and aerial photography that are relevant to this assessment are presented as Figure 3.

The Site

The earliest historical record of 1876 showed the site to be undeveloped with the exception of the Chichester and Arundel Canal, which ran east to west through the centre of the site. The canal was noted to be disused by 1912, and the section of the canal located within the site was infilled by 1937.

A historical plan of Ford Airfield[4] indicates that the site was occupied by a portion of Ford Airfield in the 1940s, and may have included an underground air raid bunker, historical workshop, aircraft standings and an access road. The south-eastern portion of the south-eastern road was observed to follow a runway and access road since the 1940s. By 1992 the portion of runway currently occupied by the south-eastern road was removed and the existing access road was extended to occupy this location by 2000.

By 1974 the northern-half of the site was occupied by two hangar buildings associated with Ford Airfield. A circular tank was located in the north-western corner of the rectangular portion and two conveyors were located in the north-eastern part of the rectangular portion, to the east and south of Hangar 2. By 1984 the following features were present on the site:

- The building now used as the WTS was constructed to the south of Hangar 2;
- Access roads were present at the north-eastern corner and western side of the rectangular portion, both running east to west;
- A travelling crane and row of tanks (autoclaves) were located immediately to the east of the building now used as the WTS;
- An additional tank was located to the south of the building now used as the WTS;
- A hopper and conveyor were located between Hangar 1 and Hangar 2;
- An additional hopper and conveyors were located in the southern-half of the rectangular portion; and
- A gas governor was located immediately adjacent to the north-eastern corner of the rectangular portion, to the south of the access road.

Aerial photography taken between 1999 and 2010 indicates that in addition to the buildings listed above, the site surface was occupied by hardstanding, with containers located across the southern-half of the rectangular portion, and waste stockpile bays located around the hangars and WTS in the northern-half of the rectangular portion. Aerial photography from 2012 onwards shows all containers, stockpile bays, tanks and plant to have been removed from the site. Hardstanding in the area historically occupied by the travelling crane and row of tanks appears to have been removed by 2012. In 2018, the western portion of the rectangular portion was being used as a skip depot.

The site is understood to have been owned by Tarmac Limited prior to Grundon and was operated as a tarmacadam topblock plant. While the precise dates of operation of the site by Tarmac Limited are unknown, the tarmacadam topblock plant is anticipated to have been present as early as 1974. A review of historical desk-based information[10] indicates that the tarmacadam topblock plant was decommissioned in 2010.

The area surrounding the site generally comprised undeveloped agricultural land from 1876, with some farmhouses located approximately 60 m to the north of the site. By 1937, limited residential development was present in the vicinity of the site. This predominantly comprised farmhouses, in addition to the village of Burndell 600 m to the southwest (later becoming part of Yapton). A historical plan of Ford Airfield[4] indicates that approximately 50 m north from the site boundary a

former RAF refuelling area was present and a former RAF pumping station was present approximately 50 m north from the site boundary.

Ford Airfield was recorded to be present by 1962 (the hangars on site were constructed at a later date). This was identified as Ford Aerodrome by 1974 and the existing runways were present, however the aerodrome was noted as being disused at this time and portions of the runways to the east and west of the site had been removed. The farmhouse 60 m to the north of the site was replaced by an unidentified circular feature anticipated to have been related to Ford Airfield.

By 1980, disused filter beds were situated 500 m to the west of the site. HM Prison Ford was constructed approximately 500 m to the southeast. The residential villages of Ford, Climping and Yapton were generally constructed between 1962 and 1980. Between 1984 and 1992 grain stores were constructed on the remaining portion of the runway 150 m to the west of the site. Ford Airfield Industrial Estate was constructed 500 m to the west and Rudford Industrial Estate was constructed 800 m to the south. In 1999, a sewage treatment works was constructed to the south of the site. In 2012 a materials recovery facility (MRF) was constructed 500 m to the south.

No significant changes to the area surrounding the site were identified following 2012.

Envirocheck Report

A summary of the environmental search information obtained from the Envirocheck report is presented in Table 3-2. Only those records which are considered to be of significance with respect to geo-environmental risks to the site have been included. The data sheets provided within the report are included in Appendix E. All distances quoted are from the approximate centre of the rectangular portion of the site. As such, certain records recorded as being located less than 250 m off-site may be located within the site boundary. This has been specified where relevant.

Table 3-2: Summary of Significant Information from the Envirocheck Report

Data Type		Distance (m)				Comments
		On site	<250	250-500	500- 1000	
Contaminated land register enquiries		0	0	0	0	None
EA discharge consents		0	2	N/R	N/R	A trade discharge – mineral workings to an old/unknown river. This feature is located within the north-eastern part of the site and was revoked in January 1998. The nearest off-site feature is located 237 m to the south (down-hydraulic gradient) and as such is not anticipated to be of relevance to this assessment.
Integrated pollution prevention and control		0	0	3	0	The nearest recorded feature relates to a wastewater treatment plant 309 m to the south (down-hydraulic gradient) and as such is not anticipated to be of relevance to this assessment.
Local authority pollution prevention and control		0	1	0	N/R	The nearest record relates to a cement blending, packing, loading and use activity located southeast of Hangar 1 on site. The permit is dated October 1992 and has been revoked.
Pollution incidents		0	0	0	2	Two Category 3 – Minor Incidents occurred approximately between 850 m and 950 m east of the site. The nearest involved deposition of inert suspended solids in March 1994 in the River Arun, and the second relates to a sewage smell (with some dead fish noted) in a tributary of the River Arun in September 1995. No further information is provided. Due to the distance, age and Minor classification of these incidents, they are not anticipated to be of relevance to this assessment.
Prosecutions or enforcement actions		0	0	0	0	None
Recorded landfill sites		0	1	0	N/R	The nearest record relates to a bank east of Hangar 2 located on the eastern site boundary constructed from deposited waste including inert waste. Deposition took place between November 1985 and September 1986.
Licenced waste management facilities		0	1	2	4	The nearest feature relates to a WTS operated by Grundon, located on the site. Accepted waste includes household, commercial and industrial waste. The nearest off-site feature is located 340 m to the south and as such is not anticipated to be of relevance to this assessment.
Potentially infilled land		0	1	0	3	The nearest potentially infilled land is located 390 m to the north. This is located in a residential area with additional intervening residential properties between it and the site. This infilled land is anticipated to be related to the residential property (such as an infilled pond) and is not anticipated to be of relevance to this assessment.
Environmental permits	Part A(1)	0	0	0	0	None
	Part A(2)	0	0	0	0	None
	Part B	0	0	N/R	N/R	None

Data Type	Distance (m)				Comments
	On site	<250	250-500	500- 1000	
Control of Major Accident Hazard Sites (COMAH)	0	0	0	0	None
Fuel stations	0	0	0	0	None
Contemporary trade directory entries	0	0	8	N/R	The nearest active entries up-hydraulic gradient of the site include blinds retailer, 472 m north; precision engineers, 487 m north; and scrap metal merchants, 493 m west. Due to the nature of these entries and the distance from the site, they are not anticipated to present a risk to the site or the proposed development.
Points of interest – manufacturing and production	0	0	1	N/R	The nearest record relates to a road haulage service 478 m to the southwest. Due to the nature of this feature and the distance from the site, it is not anticipated to be of relevance to this assessment.
Registered radioactive substances	0	0	0	0	Information on certain radioactive substance authorisations is not publicly available.
Radon affected area (Y/N)	N	-	-	-	Envirocheck report notes the site to be in a Lower probability radon area (less than 1% of homes estimated to be at or above the Action Level).
Designated ecological sites	0	0	0	0	None

N/R Not relevant (where features have been identified, but are considered to be significantly beyond the distance to site where a pollutant linkage and an impact to the proposed development might be expected)

3.2 Unexploded Ordnance

A Zetica Unexploded Bomb (UXB) risk map for the site is presented in Appendix E. A review of the UXB map shows the site to be in an area where UXB risk is assessed as low; however, Ford Aerodrome is marked as a strategic bombing target during the Second World War. The airfield was attacked by the German Luftwaffe (Air Force) on 18 August 1940 and suffered heavy damage[4]. Given the site's historical use as a military airfield and the records of enemy action at the site, unexploded ordnance risks will need to be considered further in relation to future intrusive works and mitigation measures should be adopted through consultations with a specialist.

A detailed unexploded ordnance (UXO) risk assessment was undertaken by Fellows in 2018 for a site adjacent to the northwest, operated by Wates/Redrow[5]. This risk assessment identified a Medium risk for German air-dropped weapons at the site. The following measures were recommended to be undertaken for all intrusive works at the site;

i. A UXO watching brief to be provided to all site personnel;
ii. Provision of a UXO engineer to oversee intrusive ground investigation works, including the use of a down-hole magnetometer to determine the possible presence of UXO; and
iii. Provision of a down-hole magnetometer survey during piling or deep excavations, with CPT probing to be undertaken to a minimum depth of 10 mbgl where deep piling is required.

Based on the recommendations made by the Fellows (2018) UXO risk assessment, it is anticipated that a detailed UXO risk assessment will need to be undertaken for the site prior to commencement of intrusive works. Although, parts of the site have already been developed it would be prudent to undertake a detailed UXO risk assessment and initiate control measures as per the recommendations by Fellows as the degree and nature of works for the proposed development may be different from that already undertaken.

Underground Pipelines

The Linesearch database lists pipelines distributing crude oil and refined hydrocarbon products owned and/or operated by a number of UK pipeline operators, including BPA, BP, ConocoPhilips, Esso, Government Pipelines and Storage System, Sabic, Shell and Total. According to the LinesearchbeforeUdig (LSBUB) database, there are no records of underground pipelines on the site or within 250 m. The LSBUD database indicated that Southern Gas Network (SGN) and Scottish and Southern Electricity Networks (SSE) both have assets within the site.

Plans indicating the location of these services are presented in Appendix E. In addition, plans obtained by the client and presented to Ramboll indicate the presence of assets owned by Portsmouth Water, BT Openreach and Southern Water at the site. These plans have been included in Appendix E.

4. ENVIRONMENTAL SETTING

4.1 Geology and Hydrogeology

The solid and drift British Geological Survey (BGS) map (Sheet 317 and Sheet 322, Chichester and Bognor)[6] indicates that the site is underlain by superficial deposits of River Terrace Deposits (sand,

[5] Fellows (2018). Detailed Unexploded Ordnance Risk Assessment, Ref 2078
[6] British Geological Survey (1996). England and Wales Sheet 317 & 322, Chichester and Bognor Solid and Drift Geology, 1:50,000 series

silt and clay), which is in turn underlain by bedrock of the Lewes Nodular Chalk Formation (chalk). Made Ground is present across the site.

A review of historical borehole logs from in the vicinity of the site was undertaken using the BGS Geology of Britain Viewer. The following borehole logs were reviewed and are presented as Appendix F:

- SU90SE18 – 85 m south of the rectangular portion of the site boundary at 5.5 m Above Ordnance Datum (mAOD);
- SU90SE37 – 375 m east of the rectangular portion of the site boundary at 3.4 mAOD; and
- SU90SE16 – 480 m north of the rectangular portion of the site boundary at 4.6 mAOD.

A summary of ground conditions in the area of the site as described within the historical borehole logs is presented as Table 4-1.

Table 4-1: Summary of Ground Conditions Identified by BGS Borehole Logs

Stratum	Description	Depth to Base (mbgl)	Proven Thickness (m)
Made Ground	"Made up ground" OR Soil OR Brown soil	0.2 to 0.6	0.2 to 0.6
River Terrace Deposits	Sandy clay and gravel OR Clay, silty, reddish brown, with angular to well-rounded flint pebbles and gastropod shell fragments	1.1 to 6.4	0.9 to 5.8
Lewes Nodular Chalk Formation	Clay/chalk marl OR Chalk, rubbly, with matrix of olive silt and fine sand and some rounded flint pebbles to 5.5 m, greyish white, with nodular flints	>30	>23.6

According to the Department for the Environment, Food and Rural Affairs (DEFRA)[7], the River Terrace Deposits are classified as a Secondary A Aquifer. The Lewes Nodular Chalk Formation is classified as a Principal Aquifer.

Principal Aquifers contain layers of rock or superficial deposits that have high intergranular or fracture permeability – meaning that they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. The EA's Catchment Data Explorer[8] indicates that groundwater beneath the site forms part of the Littlehampton Anticline (West) (understood to relate to the Principal Aquifer of the Lewes Nodular Chalk Formation).

The EA classifies the Littlehampton Anticline (West) as being of 'Poor' quantitative quality and 'Good' chemical quality with an overall 'Poor' quality in 2016 under the Water Framework Directive (WFD) scheme.

Historical boreholes on site recorded groundwater levels ranging from 2.0 mbgl (1.4 mAOD) at SU90SE37, 4.21 mbgl (0.39 mAOD) at SU90SE16 and 5.87 mbgl (-0.37 mAOD) at SU90SE18. Due to the limited detail provided in the historical logs for SU90SE37 and the significantly elevated groundwater level presented for the location in relation to the other historical boreholes, the elevated groundwater level is not anticipated to be representative of the groundwater table and has been discounted from calculation of hydraulic gradient in the vicinity of the site. Historical groundwater levels in SU90SE16 and SU90SE18 indicate that groundwater is shallower in the southeast than in the northwest. This is consistent with the location of the River Arun to the east of the site.

[7] https://magic.defra.gov.uk/MagicMap.aspx
[8] http://environment.data.gov.uk/catchment-planning/

Groundwater level monitoring was undertaken at the site between July 2015 and February 2020 by Enzygo Limited (Enzygo), Grundon and Ramboll. The details of the groundwater level monitoring are summarised in Section 5.4.

4.1.1 he site is not located within a groundwater Source Protection Zone (SPZ)[7]. The site is not located within a Nitrate Vulnerable Zone (NVZ) or Drinking Water Protected Area (DWPA), however the River Arun located approximately 900 m to the east is classified as a surface water DWPA and is linked to a Special Protected Area (SPA) and a Special Area of Conservation (SAC)[7]. The SPA and SAC are 10 km upstream from the site and are not considered to be relevant to this study.

According to the Coal Authority, the site is not located in a Coal Mining Affected Area. The BGS has stated that the site is located in an area where there is no hazard from other (non-coal) mining activities. There are licenced groundwater abstractions at seven locations within 2 km of the site, as detailed in Table 4-2. All distances quoted are from the approximate centre of the rectangular portion of the site.

Table 4-2: Summary of Licensed Groundwater Abstractions

Licence Holder	Distance from Site	Abstraction Source	Purpose of Abstraction
Tarmac Ltd	On site	Groundwater	Construction: process water
Tarmac Heavy Building Materials Ltd	On site	Groundwater	Construction: process water
Mr A Langmead	586 m north	Groundwater	General farming and domestic
Mr R Hague	600 m northeast	Groundwater	Agriculture
Keith Langmead Ltd	886 m northeast	Groundwater	Spray irrigation - direct
Mr A C Langmead	886 m northwest	Groundwater	Spray irrigation - storage
Mr A Clay	1681 m west	Groundwater	Agriculture: horticultural watering

While no end dates were supplied for the groundwater abstraction licences listed above, it is noted that the abstractions location on site (located to southeast of Hangar 2) were associated with the historical owner of the site (Tarmac Limited) and as such are unlikely to still be operational. It is uncertain if the Tarmac Limited abstraction boreholes have been decommissioned and as such a preferential pathway to groundwater may exist if decommissioning was not undertaken.

All other abstractions were located up- or cross-hydraulic gradient from the site and are therefore not anticipated to be relevant to this assessment, with the exception of R Hague, 600 m to the northeast of the site. Due to the distance of this abstraction from the site and the use of the abstraction for agricultural purposes, the risk to this abstraction location is anticipated to be low.

The groundwater abstractions recorded within 2 km of the site all relate to non-potable uses as summarised in Table 4-2. There may be the potential for smaller (unlicensed) abstractions to be present in the vicinity of the site. Where private water supplies are for drinking water, SPZs typically extend around such private supplies to a 50 m radius.

4.2 Hydrology

The nearest surface water feature to the site is a drain located approximately 350 m to the east of the rectangular portion. The nearest major surface watercourse is the River Arun located approximately 900 m east of the site at its nearest point. The River Arun generally flows towards the south and enters the English Channel 3.7 km to the southeast. The EA currently classifies the River

Arun as being of 'Moderate' ecological quality and 'Good' chemical quality with an overall 'Moderate' quality in 2016 under the WFD classification scheme[8].

There are licenced surface water abstractions at nine locations within 2 km of the site, as detailed in Table 4-3. All distances quoted are from the approximate centre of the rectangular portion of the site.

Table 4-3: Summary of Licensed Surface Water Abstractions

Licence Holder	Distance from Site	Abstraction Source	Purpose of Abstraction
Keith Langmead Ltd	1336 m northeast	Surface water	Spray Irrigation - Storage
Keith Langmead Ltd	1336 m northeast	Surface water	Spray Irrigation - Storage
A C Langmead Ltd	1336 m northwest	Surface water	Spray Irrigation - Storage
T Luckin and Sons	1560 m north	Surface water	Spray Irrigation - Direct
T Luckin and Sons	1560 m north	Surface water	Spray Irrigation - Direct
Messrs T Luckin and Son	1560 m north	Surface water	Spray Irrigation
Adviserate T/A Southdown Flowers	1796 m northwest	Surface water	Spray Irrigation
T Luckin and Son	1839 m northeast	Surface water	Spray Irrigation - Direct
J A Longhurst	1968 m northeast	Surface water	Spray Irrigation

According to the EA, the site is located within Flood Zone 1 (low probability of flooding)[9]. This zone comprises land assessed as having a less than 1-in-1000 annual probability of river or sea flooding (<0.1% in any year).

A summary of the Geological and Hydrogeological is provided in Table 4-4 and a summary of the surface water bodies is presented in Table 4-5.

[9] https://flood-map-for-planning.service.gov.uk/

Table 4-4: Geological and Hydrogeological Summary

Geological Strata	Details	Approximate Thickness (m)	Aquifer Status				Groundwater Body - WFD	WFD Status - Chemical		Protection		
			Designation	Vulnerability	Local Information Available	Soluble Rock Risk		Current Cycle	Objective	SPZ	DrWPA	NVZ
Made Ground (MG)	Brown soil	0.2 to 0.6	Unclassified	Unclassified	No	No	No	N/A	N/A	N/A	N/A	N/A
River Terrace Deposits	Sandy clay and gravel or clay with flint pebbles and gastropod shell fragments	0.9 to 5.8	Secondary A	Medium	No	No	No	N/A	N/A	N/A	N/A	N/A
Lewes Nodular Chalk Formation	Clay/Chalk marl and weathered chalk with flint pebbles	>23.6	Principal	High	No	Yes	GB40701G504900	2016	Poor	No	Yes	Yes

Table 4-5: Surface Waterbodies

Location	Name of River / Stream	Waterbody	Operational Catchment	Management Catchment	Waterbody Type	WFD Status - Chemical		WFD Status - Ecological		Linked Protected Area
						Current Cycle	Objective	Current Cycle	Objective	
900 m east of site	River Arun	Arun	Arun Lower Transitional and Coastal (TraC)	South East TraC	Transitional	2016	Good	2016	Moderate	Yes

5. PREVIOUS STUDIES

The site has been the subject of several previous phases of desk-based assessment and ground investigation, which have been reviewed as part of this Geoenvironmental Desk Study. The reports reviewed included the following:

* Golder Associates (2012) Former Tarmac Topblock Site, Ford, Arundel, West Sussex BN18 0HY Phase 1 Environmental Assessment (Ref 12514190632.500/B.O)[10];
* Enzygo (2015) Geoenvironmental Report (Ref CRM.049.009.GE.R001A)[11]; and
* Enzygo (2018) Factual Report (Ref CRM.049.009.GE.R.002 A)[12].

5.1 Golder Associates (2012) Phase 1 Environmental Assessment

A Phase 1 desk-based geoenvironmental assessment was undertaken by Golder Associates in September 2012 on behalf of Grundon. In addition to a review of available records from the UK regulatory authority database, Golder Associates carried out a site walkover to identify site features that could potentially impact ground conditions. The historical and environmental setting identified by Golder Associates generally agreed with those detailed in Sections 3 and 4 of this report. Additionally, Golder Associates identified a number of potential areas of concern based on their site walkover.

A summary of potential areas of concern (PAOC) for the site produced by Golder Associates is replicated in Table 5-1. A plan indicating the locations of the PAOCs and other site features identified by Golder Associates is presented in Appendix G.

Table 5-1: Summary of PAOCs Identified by Golder Associates (2012)

PAOC	Name	Contaminant of Concern	Location
1	Former gas oil tank (60,000 l)	Gas oil	3
2	Above ground storage tank previously containing gas oil (2,500 l)	Hydrocarbons	12
3	Former oil stores	Hydrocarbons	11
4	Aerated block plant containing soluble oil, mould oil storage vessels, and oil store, PFA silo and anhydrite silo	Soluble oil, mould oil, oil store, PFA, aluminium and anhydrite silo	8
5	Sub-station adjacent to Hangar 2	PCBs	16
6	Manhole covers possibly indicating presence of interceptor or slurry pit	Hydrocarbons	18
7	Sub-station adjacent to aerated block plant	PCBs	16
8	Infilled slurry pit and hydrochloric acid (HCL) store and delivery point	Various	4
9	Former autoclaves	Various	5
10	Former gas oil tank (40,000 l)	Gas oil	7

[10] Golder Associates (2012) Former Tarmac Topblock Site, Ford, Arundel, West Sussex BN18 0HY Phase 1 Environmental Assessment (Ref 12514190632.500/BO)

[11] Enzygo (2015) Geoenvironmental Report (Ref CRM.049.009.GE.R001A)

[12] Enzygo (2018) Factual Report (Ref CRM.049.009.GE.R.002 A)

PAOC	Name	Contaminant of Concern	Location
11	Historic landfill	Various	2
12	Former RAF refuelling area	Aviation fuel	1
13	Pallet storage area and possible former RAF bunker	Unknown	6
14	Previous location of above-ground storage tank previously containing gas oil (2,500 l)	Hydrocarbons	13

5.2 Enzygo (2015) Geoenvironmental Report

An intrusive ground investigation and Phase 2 geoenvironmental report was undertaken by Enzygo Limited (Enzygo) in September 2015 on behalf of Grundon[11]. The geoenvironmental report included a review of the 2012 Golder Associates Phase 1 Environmental Assessment[10], which was used to produce a preliminary ground investigation and to inform the design of the intrusive ground investigation.

Additionally, the ground investigation was undertaken only on the rectangular portion of the site and did not investigate the the RAF refuelling area (located 80 m north of the site boundary) was identified by the Golder Associates (2012) geoenvironmental assessment. A second, supplementary ground investigation was undertaken by Enzygo in 2018 for geotechnical purposes, which also included three rounds of gas and groundwater level monitoring undertaken in January and February 2018.

The 2015 ground investigation comprised advancement of eight boreholes (BH1 to BH8) to a depth of 10 mbgl and excavation of 15 trial pits (TP1 to TP15) to a maximum of 3.3 mbgl. An additional nine boreholes (BH101 to BH109) were advanced during the 2018 ground investigation. Gas and groundwater monitoring standpipes were installed in boreholes BH1, BH2, BH6A, BH7 and BH8, and in BH101 to BH108.

Gas and groundwater level monitoring was undertaken on four return visits in July and August 2015, and on three return visits in January and February 2018. The exploratory hole location plans prepared by Enzygo for the 2015 and 2018 ground investigations are presented in Appendix G.

Representative soil and groundwater samples from the 2015 ground investigation were sent to a chemical testing laboratory and screened for metals, pH, sulphate, cyanide, phenols, speciated polycyclic aromatic hydrocarbons (PAH), banded total petroleum hydrocarbons (TPH), organic carbon, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCBs) and asbestos.

No soil or groundwater samples were subjected to chemical testing as part of the 2018 ground investigation.

Ground conditions were generally in line with the anticipated ground conditions detailed in Section 4. A summary of ground and groundwater conditions identified by Enzygo in the 2015 and 2018 ground investigations is replicated in Table 5-2.

Table 5-2: Summary of Ground Conditions Encountered by Enzygo.

Strata		Summary Description	Depth to Top of Strata (mbgl)	Thickness (m)
Made Ground	General Made Ground	Made Ground (concrete 120 mm to 250 mm thick) over lean concrete (150 mm to 200 mm) over black ashy sandy fine angular gravel.	Ground level (0.0)	0.15 to 2.0
	Made Ground Backfilled slurry pit (TP12, TP13 and TP14)	Large concrete blocks (300 mm+ square), rebar, cable in a sandy gravel matrix over large concrete blocks with abundant 6 mm rebar in grey sandy gravelly size concrete matrix black sandy gravelly clay with brick fragments.		0.65 to 1.2
	Made Ground backfilled pit (TP15)	Dark grey sandy gravelly topsoil with brick and concrete fragments over large concrete blocks with rebar, metal pipe, brick in a topsoil matrix		In excess of 1.5
	Made Ground (demolished autoclaves (TP9, TP10 and TP11)	Large concrete blocks (300 mm+ square), rebar, pieces of plastic, wire metal roots, wood fragments in a sandy matrix. Slight discernible hydrocarbon odour over firm brown, grey and black sandy gravelly clay over concrete lean mix.		2.1 to 3.0
Superficial Deposits	River Terrace Deposits	Firm locally soft orange brown sandy clay over medium dense orange brown and yellow brown slightly clayey slightly gravelly medium sand and gravel. Gravel is medium to coarse rounded flint.	0.15 to 2.0	1.0 to 3.8
Bedrock	Lewes Nodular Chalk	Structureless chalk composed of sub-angular to rounded medium to coarse gravel size light brown highly weathered weak fragments with subrounded cobble size weathered weak fragments. Some matrix of soft light brown clayey sand size fragments	2.3 to 4.5	In excess of 18.2
Groundwater	-	Seepages within Made Ground at 1.4 mbgl. Water strike at depths between 5.5 mbgl and 9.0 mbgl during ground investigations. Hydraulic gradient generally appears to be towards the east to southeast.	N/A	N/A

Enzygo carried out groundwater monitoring on four return visits in July and August 2015 in the monitoring standpipes installed during the 2015 ground investigation. Groundwater levels recorded during this period were found to range from 5.31 mbgl (1.41 mAOD) in the south-western corner of the site at BH2 to 5.8 mbgl (0.87 mAOD) at BH8 at the eastern boundary of the site. Groundwater levels recorded during this period indicated a hydraulic gradient towards the east of the site.

Enzygo assessed the potential risk to human health at the site by comparing the results of soil chemical testing with generic assessment criteria (GAC) for a commercial land use, derived from the

Contaminated Land Exposure Assessment (CLEA)[13] and Soil Guideline Values (SGV) published by Land Quality Management and the Chartered Institute of Environmental Health (LQM/CIEH).

No contaminants were found to exceed the relevant GAC in the soil samples subjected to testing. Asbestos was not detected in the samples tested. As such, the risk to human health was generally considered to be low and was dismissed by Enzygo. Organic contaminants were noted by Enzygo to be present in soils at elevated concentrations. Although no human health GACs were exceeded by organic contaminants, organic contaminants have the potential to infiltrate into drinking water supply pipes and thereby present a risk to human health. Additionally, elevated sulphate concentrations recorded by Enzygo were noted to have the potential to impact buried concrete structures.

Enzygo assessed the potential risk to controlled water receptors at the site by comparing the results of groundwater chemical testing with GACs derived from the freshwater Environmental Quality Standards (EQS), UK Drinking Water Values (DWV) and World Health Organisation (WHO) values for drinking water[14]. A summary of the exceedances of the relevant GACs for contaminants identified by Enzygo is replicated in Table 5-3. The locations of the boreholes in which these exceedances were recorded are presented in Appendix G.

Table 5-3: Summary of Elevated Groundwater Contaminants Identified by Enzygo (2015).

Contaminant	EQS (µg/l) (Enzygo)	DWV (µg/l) (Enzygo)	WHO Values (µg/l) (Enzygo)	Groundwater GACs	Location and Groundwater Level	Concentration (µg/l)
Anthracene	0.02	N/A	N/A	0.01 (minimum reporting value)	BH2, 5.63 mbgl (1.09 mAOD)	0.07
					BH6, 5.8 mbgl (0.87 mAOD)	0.03
					BH7, 5.76 mbgl (0.84 mAOD)	6.26
					BH8, 5.77 mbgl (0.72 mAOD)	1.74
Fluoranthene	0.02	N/A	N/A	0.075 (General Quality of GW Body)	BH2, 5.63 mbgl (1.09 mAOD)	0.03
					BH6, 5.8 mbgl (0.87 mAOD)	0.08
					BH7, 5.76 mbgl (0.84 mAOD)	27
					BH8, 5.77 mbgl (0.72 mAOD)	12.4
Benzo(a) pyrene	0.03	N/A	0.01	0.00005 (minimum reporting value)	BH2, 5.63 mbgl (1.09 mAOD)	0.25
					BH6, 5.8 mbgl (0.87 mAOD)	0.05
					BH7, 5.76 mbgl (0.84 mAOD)	18.5
					BH8, 5.77 mbgl (0.72 mAOD)	9.59
TPH C8 to C10	20	N/A	10	300 (CL:AIRE[14])	BH2, 5.63 mbgl (1.09 mAOD)	30

[13] Environment Agency (2008) Updated technical background to the CLEA model SC050021_SR3

[14] CL:AIRE (2017). Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological assessment methodologies

Contaminant	EQS (µg/l) (Enzygo)	DWV (µg/l) (Enzygo)	WHO Values (µg/l) (Enzygo)	Groundwater GACs	Location and Groundwater Level	Concentration (µg/l)
					BH7, 5.76 mbgl (0.84 mAOD)	33.3
					BH8, 5.77 mbgl (0.72 mAOD)	23.6

* All GAC values obtained from Enzygo (2015)[11] geoenvironmental report. It is noted that the GACs utilised by Enzygo do not match with the existing EQS, DWS or WHO values for these contaminants

Enzygo concluded that the spike in contamination at BH7 (located next to a former fuel Above Storage Tank (AST) suggested a historical leakage, though no evidence of spillage was observed on the hardstanding at the time of the ground investigation. Enzygo also concluded that as concentrations decreased significantly towards the site boundaries (contaminant concentrations at BH8 at the eastern boundary of the site were approximately half the concentrations at BH7, and significantly lower at BH6 in the south-eastern corner), the risk to surface water receptors could be dismissed. As the fuel AST located near BH7 was no longer present and no evidence of spillage could be seen on the site hardstanding, the organic contaminant impact was considered by Enzygo to be a residual risk.

It is noted that Enzygo did not screen groundwater samples against GACs for sensitive groundwater receptors, despite the presence of elevated contaminant concentrations in the Chalk and the significant distance to the nearest potential surface water receptors. Additionally, it is noted that the GAC values provided by Enzygo differ from the current EQS, DWV or WHO values for these contaminants. As such, GACs derived from General Quality of Groundwater Body, minimum reporting values for hazardous substances and specific GACs for petroleum hydrocarbons[14] have been included in Table 5-3. It is noted that the groundwater GACs for anthracene and benzo(a)pyrene are more conservative than those used by Enzygo, and as such potential PAH impact in groundwater may be more extensive than reported. This will be taken account of as part of the design of additional ground investigation work as detailed in the recommendations.

It is noted that the Enzygo ground investigations did not undertake chemical testing of soil leachate samples. Therefore, leachate testing is proposed to be undertaken during further ground investigations at the site.

Seven rounds of ground gas monitoring undertaken by Enzygo on a weekly basis in July and August 2015 and in January and February 2018 did not identify significant concentrations of ground gas and no flow was detected. No significant sources of ground gas were identified by the Golders (2012) desk study. As such, Enzygo classified the site as CS1 and dismissed the risk to human health and buildings from ground gas.

It is noted that Enzygo did not carry out ground gas monitoring during a period of falling atmospheric pressure in accordance with BS 8576:2013[15] and CIRIA C665[16]. As such, the classification of CS1 may not be representative of the worst-case scenario for ground gas generation at the site. Therefore, additional ground gas monitoring (during falling and raising atmospheric pressures) is proposed to be undertaken during further ground investigations at the site.

In summary, the conceptual site model prepared by Enzygo and revised based on the results of the ground investigation dismissed all risks to human health and controlled surface water receptors, with the exception of risk to human health from infiltration of organic contaminants into drinking water

[15] British Standards Institute (2013) BS 8576: 2013 Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs)

[16] CIRIA (2007). C665 Assessing risks posed by hazardous ground gases to buildings

supply pipes and risk to buildings and structures from aggressive ground conditions. These were identified as Moderate risk. Enzygo did not screen groundwater samples against current GACs relevant to groundwater. The risks identified by Enzygo's revised version of the conceptual model are taken into consideration by Ramboll's conceptual site model (presented as Section 6).

5.3 Groundwater Level Monitoring

In addition to the gas and groundwater monitoring visits undertaken by Enzygo (2015), Grundon Waste Management Ltd carried out groundwater level monitoring visits between 2018 and November 2020. Ramboll also carried out a groundwater monitoring visit on 18 February 2020 immediately following Storm Dennis (15 February 2020), in order to observe the impacts of winter rain infiltration on groundwater level at the site.

Groundwater elevations were monitored at the site during the period 2015 to 2020; since 2018 this has been at approximately monthly intervals. The highest recorded groundwater elevation event during this monitoring period occurred on 11 March 2020, when the elevation of the groundwater table was recorded to be approximately 3.5 mAOD[17] in the area of the site which is proposed to be subject to lowering of ground levels; to the west groundwater levels were recorded at up to 4.5 mAOD, and to the east at up to 3.0 mAOD [18]. Groundwater was broadly within the Chalk and granular River Terrace Deposits.

Allowing for groundwater level to rise higher than that recorded on 11 March 2020, a worst-case expected groundwater elevation of 4 mAOD (2.5 mbgl) in the area of the site proposed for ground level lowering.

From review of the BGS hydrogeology map[19], the groundwater level in the Chalk would be expected to be in the region of 0 mAOD to 5 mAOD at the site, with groundwater flow towards the southeast at a shallow hydraulic gradient of approximately 0.0014, towards the River Arun and the coast. The BGS data concurs with the groundwater monitoring data obtained from boreholes at the site. Full groundwater monitoring data obtained at the site between 2015 and 2020 is presented as Appendix H.

6. PRELIMINARY CONTAMINATION RISK EVALUATION

6.1 Conceptual Site Model

The information presented in the previous sections of this report has been collated and evaluated to develop a conceptual site model for the site in accordance with CLR 11[20].

Potential pollutant linkages are identified using the source-pathway-receptor framework detailed in Appendix A. An assessment of the potential significance of each linkage is then made by consideration of the likely magnitude and mobility of the source, the sensitivity of the receptor and nature of the migration/exposure pathways between them.

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17 Ground levels of boreholes were not surveyed by Enzygo, therefore groundwater elevation data recorded by monitoring these boreholes has been estimated based on assumed ground elevations of the boreholes derived from a survey drawing of the site dated June

18 BH105 and BH106 were installed with piezometers at c. 20m depth in the Chalk. Depths to the base of the monitoring points were measured in November 2020 by a Ramboll consultant at BH105 and found to be 13 mAOD suggesting that the bottom part of the well was blocked and this resulted in shallow depth to water in the well which was atypical of the wider groundwater regime. The same is likely to apply at BH106 which is similarly installed and was flooded hence no measurements were made from this monitoring point. Groundwater level monitoring data from BH105 and BH106 has therefore been discounted.

19 BGS (1984) Hydrogeological Map of the Area Between Cambridge and Maidenhead

20 EA / DEFRA (2004). Contaminated Land Report 11: Model Procedures for the Management of Land Contamination

This qualitative hazard assessment has then been undertaken in accordance with CLEA land use definitions. Further details of which are provided in Appendix A including definition of risk categories.

Potential Sources

The potential contamination sources are summarised in Table 6-1.

Table 6-1: Summary of Potential Sources

Source	Key Potential Contaminants
On-site	
Made Ground associated with historical site uses (Chichester Canal infill, Ford Airfield, Tarmac Topblock manufacture)	Heavy metals, asbestos, total petroleum hydrocarbons (TPH), phenols, polycyclic aromatic hydrocarbons (PAH), ground gas, sulphate, sulphide, glycols
Former boiler house and associated former gas oil tank (60,000 l), PAH groundwater impact identified by Enzygo (2015)	TPH, PAH, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs)
Existing above ground storage tanks (2,500 l tank formerly containing gas oil, 5,600 l tank noted to be present by Ramboll in 2019)	TPH, PAH, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs)
Former oil stores, former gas oil tank (40,000 l), former location of gas oil tank (2,500 l)	TPH, PAH, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs)
Aerated block plant containing soluble oil, mould oil storage vessels and oil store, PFA silo and anhydrite silo	TPH, PAH, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pulverised fuel ash (PFA), sulphate
Electricity substations	PCBs
Infilled slurry pit, HCL store and delivery point	Heavy metals, asbestos, TPH, PAH, ground gas, low pH conditions
Former autoclave pit (and Made Ground infill)	Heavy metals, asbestos, TPH, PAH, ground gas
Possible UST or interceptor	TPH, PAH, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs)
Historical landfill	Heavy metals, asbestos, TPH, PAH, ground gas, low pH conditions
Waste storage and stockpiled waste	Heavy metals, asbestos, TPH, PAH, VOCs, acids, ground gas
Asbestos in fabric of buildings	Asbestos recorded in historic asbestos surveys
Off-site	
Former RAF refuelling area	TPH, PAH, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), glycols
Pallet storage area and possible former RAF bunker	Heavy metals, asbestos, TPH, PAH, ground gas
Agricultural land	Herbicides and pesticides
Sewage works	Heavy metals, faecal coliforms, pathogens

Based on the results of the Enzygo (2015) ground investigation, many of the potential contaminant sources above are not anticipated to impact the ground conditions at the site, and can be considered to present a significantly lower risk to sensitive receptors at and around the site. Table 6-2 presents a refined summary of potential sources based on existing ground investigation data.

Table 6-2: Summary of Impacts to Ground Conditions (Based on Enzygo 2015 Ground Investigation and 2018 to 2020 Groundwater Monitoring)

Source	Comment
Soil impacts	The Enzygo (2015) ground investigation did not identify asbestos in the 24 soil samples subjected to testing. It is noted that the potential remains for asbestos to be present in Made Ground at locations not targeted by the ground investigation. Asbestos was noted to be present within the fabric of buildings at the site. No contaminant was found to exceed the human health GACs for a commercial land use in the 24 soil samples subjected to testing. As such, the risk to human health was anticipated to be low. Elevated organic contaminant concentrations were recorded in some of the soil samples, suggesting that there may be some risk to drinking water supply pipes placed in Made Ground.
Groundwater impacts	Exceedances of the controlled water GACs for PAH and TPH were recorded in the Chalk. The highest concentrations of each contaminant were recorded at the location of the former boiler room and 60,000 l oil tank (BH7). Concentrations of each contaminant reduced by approximately half by the site boundary to the east, with significantly lower concentrations identified at the south-eastern corner of the site boundary. As such, the risk to the surface water receptors located at a significant distance from the site was anticipated to be low. Enzygo did not assess risk to groundwater beneath the site. No soil leachate testing was undertaken as part of the 2015 ground investigation. As such, there may be the potential for contaminants in soil to become mobilised and impact groundwater through potential soft landscaped areas. Given the proposed excavations at the site (the deepest is approximately 5 mbgl), dewatering will be required and there will be the potential for contaminants to migrate towards the excavation and enter the chalk aquifer underlying the site.
Ground gas and vapour impacts	The Enzygo (2015) ground investigation carried out ground gas monitoring on seven return visits and classified the site as CS1 based on the results of gas monitoring. As such, the risk to human health and buildings from ground gas at the site and surrounding properties was anticipated to be low. Presence of volatiles (Volatile Organic Compounds (VOCs)) in soil and groundwater may pose a risk to human health via vapour inhalation. The Enzygo (2015) ground investigation did not carry out ground gas monitoring during a period of falling atmospheric pressure. As such, the classification of CS1 may not be representative of the worst-case scenario for ground gas generation at the site. Therefore, further ground gas monitoring should be undertaken during rising and falling atmospheric pressures.

Potential Receptors

The specific receptors that could potentially be affected by contamination hazards at the site are summarised in Table 6-3.

Table 6-3: Summary of Potential Receptors

Receptor	Comments
On-site	
Future site staff	Future staff of the proposed ERF and WSTF and parking area
Construction/maintenance workers	Workers involved in redevelopment, construction and future maintenance work
Buildings and structures	Building materials used below ground (e.g. foundations, drainage structures, water supply pipes) may be impacted by aggressive ground conditions and water supply pipes may be impacted by TPH contaminated soils or groundwater

Receptor	Comments
Secondary A Aquifer of River Terrace Deposits	Permeable superficial deposits anticipated to be present beneath the site. May form a source for unlicensed water supplies in the area of the site
Principal Aquifer of the Lewes Nodular Chalk Formation	Principal Aquifer underlying the River Terrace Deposits. No potable groundwater abstractions have been recorded in the vicinity of the site and the site is not located in a groundwater source protection zone
Off-site	
Future residential site users	Proposed residential properties to be constructed adjacent to northwest of site
Surface Water (River Arun)	River Arun, 900 m to the east of the site

Potential Pathways

In order for potential contaminants to pose a risk to the identified receptors there has to be a viable pathway for the contaminant. The potential pathways are summarised in Table 6-4.

Table 6-4: Summary of Potential Pathways

Receptor	Pathway	Comments
Human health	Direct contact with contaminated soils	The pathway to future site staff is expected to be minimised by the presence of concrete foundations and hardstanding beneath the proposed buildings and external areas of the site. The proposed development is anticipated to include areas of soft landscaping; however as the site is proposed for a commercial land use, the risk of exposure of future site staff to contaminants in soil is anticipated to be low. Construction and future maintenance workers have the potential to come into contact with soil and groundwater during site enabling works and activities.
Human health	Inhalation and ingestion of dusts/fibres and inhalation of gas and vapours	The pathway to future site staff is expected to be minimised by the presence of concrete foundations and hardstanding beneath the proposed buildings and external areas of the site. The proposed development is not currently understood to include areas of soft landscaping, and as such no additional risk of exposure to contaminated soil in soft landscaping is expected. Construction and future maintenance workers to accidental ingestion and inhalation of dust, fibres, vapour and ground gases.
Human health	Accumulation of asphyxiating/explosive gases in confined spaces	Confined spaces on the site are expected to consist of above-ground industrial workspace, and a waste bunker with a depth of approximately 2 mbgl. Above-ground workspace is anticipated to be well ventilated with a low risk to site staff, however there may be increased risk to site staff required to enter the waste bunker. Construction and maintenance workers may be exposed to accumulation of harmful vapour and ground gases if working in confined spaces such as the waste bunker or excavations and utility spaces.
Human health	Permeation of contaminants into drinking water pipes and subsequent human consumption	The Enzygo ground investigation identified a potential risk to human health from infiltration of organic contaminants into drinking water supply pipes and risk to buildings and structures from aggressive ground conditions. This may occur where water supply pipes are laid in soils that contain certain contaminants at concentrations high enough to allow their permeation through the pipes.

Receptor	Pathway	Comments
Human health	Uptake of contaminants via root uptake and subsequent ingestion of affected plants and soil attached to plants	The proposed development comprises an entirely industrial/commercial land use and is not expected to feature growth of plants for human consumption. As such, no exposure to contaminants via root uptake and consumption of plants is anticipated. Proposed residential properties to the northwest of the site may include private gardens with root uptake by plants meant for human consumption. Hydraulic gradient is anticipated to be towards the southeast and east, and as such the residential properties are anticipated to be up-hydraulic gradient of the site. Perched water was recorded at 1.4 mbgl on the site, with the groundwater table recorded at a minimum depth of 2.45 mbgl (4.27 mAOD) on site (at BH2) during groundwater monitoring visits. As such, contaminant migration from the site is anticipated to be significantly below the maximum root depth of plants intended for consumption.
Secondary A and Principal Aquifers	Leaching and vertical migration of contaminants to groundwater	The site is directly underlain by predominantly granular Made Ground, which is in turn directly underlain by the Secondary Aquifer of the River Terrace Deposits and the Principal Aquifer of the Lewes Nodular Chalk Formation. The upper River Terrace Deposits comprise a predominantly cohesive layer up to 4.35 m thick across the site which may have the potential to act as an aquitard, however historical groundwater monitoring carried out by Enzygo suggests that this has not formed a barrier to contaminant migration. PAH and TPH impacts have been identified in groundwater at the site within the Chalk. The highest concentrations have all been identified at the location of the former boiler house and 60,000 l tank, with concentrations declining significantly towards the site boundaries. The expected source of the contamination has been removed at the time of writing of this report. Concrete foundations and hardstanding beneath buildings and external spaces on the site are anticipated to be present across the majority of the site surface. Currently, the surface waters are proposed to discharge via separators, however the specifics of the layout/locations and sizes of the separators will be designed post-planning consent. In the event that drainage to natural ground is proposed, there may be pathways for rainfall infiltration, leaching and contaminant migration into natural ground and groundwater. It should be noted that no soakaways have been proposed for the site. Dewatering of the proposed excavations on site will interact with shallow groundwater (in both the River Terrace Deposits and the Chalk) and there is the potential for contaminants present in groundwater to migrate towards the excavation through the cone of depression and potentially down into the Chalk. In addition, the cone of depression could potentially increase the area of PAH impacted groundwater beneath the site and could potentially increase the requirement for contaminated groundwater to be sent off-site for disposal.
	Migration of contaminants through dewatering of excavations	During the dewatering of excavations, the drawdown of the water table may mobilise contaminants towards the dewatering area.
	Migration of contaminants via	There may be preferential pathways for vertical leaching and contaminant migration in the event that piled foundations form part of

Receptor	Pathway	Comments
	preferential pathways (i.e. piled foundation, piles constructed around the area to be dewatered and the wells drilled to pump water from and drinking water supply pipes).	the development. It is noted that the River Terrace Deposits include a predominantly cohesive layer up to 4.35 m thick across the site, which may form an aquitard through which preferential pathways may be introduced by piling and excavations, however organic contaminants (TPH and PAH) are already present in groundwater, suggesting that this has not formed a barrier to contaminant migration. This suggests that hydraulic continuity may already exist between Made Ground and the Chalk, in which case the *additional* risk due to preferential pathways would be limited.
Water environment	Migration of contaminants via surface runoff and within groundwater to surface water courses	The River Arun is located a significant distance from the site boundary, and contaminant concentrations in groundwater were observed to significantly decrease towards the site boundaries. As such, the risk to surface water receptors from groundwater contamination originating at the site is anticipated to be low.
Buildings and structures (construction materials)	Damage to building materials or services through direct contact with contaminated soil/groundwater	Aggressive ground conditions or contaminants such as hydrocarbons may affect subsurface construction materials such as foundations or drainage structures. Low pH values which may occur due to migration of acidic contaminants (such as those stored in the former HCL store) may also affect subsurface construction materials.

6.2 Qualitative Risk Assessment

The pollutant linkages and risk ratings associated with the proposed development as assessed following interpretation of the results of the ground investigation are summarised in Table 6-5.

Table 6-5: Preliminary Qualitative Risk Assessment

Hazard	Pathway	Potential Receptor	Potential Consequence	Probability of Risk	Level of Risk
On-site sources – historical and existing Made Ground, former and existing gas oil storage tanks, aerated block plant and storage vessels, electricity substations, slurry pit and HCL, former autoclave pit, historical landfill, waste storage, asbestos in buildings Heavy metals, asbestos, TPH, phenols, PAH, sulphate, sulphide, glycols, VOCs, SVOCs, PCBs, low pH conditions, ground gas.	Dermal contact/ingestion of soils/dust/inhalation of dusts	Future site staff	Mild	Unlikely	Very low
		Construction/maintenance workers	Mild	Low likelihood	Low
		Adjacent residential site users	Medium	Unlikely	Low
	Inhalation of asbestos fibres	Future site staff	Medium	Unlikely	Low
		Construction/maintenance workers	Medium	Low likelihood	Moderate/low
		Adjacent residential site users	Medium	Unlikely	Low
	Accumulation and inhalation of gas/vapours in confined spaces	Future site staff	Medium	Low likelihood	Moderate/low
		Construction/maintenance workers	Medium	Low likelihood	Moderate/low
		Buildings and structures (internal spaces)	Medium	Low likelihood	Moderate/low
		Adjacent residential site users	Medium	Unlikely	Low
	Permeation of contaminants into drinking water pipes	Future site staff via water supply pipes	Medium	Likely	Moderate
	Leaching and vertical migration of contaminants in groundwater	Secondary A aquifer (River Terrace Deposits	Medium	Low likelihood	Moderate/low
		Principal aquifer (Lewes Nodular Chalk Formation)	Medium	Low likelihood	Moderate/low
		Surface water course (ditch and River Arun)	Medium	Unlikely	Low
	Migration of contaminants through dewatering of excavations: during the dewatering of excavations the drawdown of the water table may mobilise contaminants towards the dewatering area.	Secondary A aquifer (River Terrace Deposits	Medium	Likely	Moderate
		Principal aquifer (Lewes Nodular Chalk Formation)	Medium	Likely	Moderate
		Surface water course (ditch and River Arun)	Medium	Unlikely	Low

Hazard	Pathway	Potential Receptor	Potential Consequence	Probability of Risk	Level of Risk
	Impact on surface water body (ditch and River Arun) – increased flow from proposed groundwater abstraction	Surface water course (ditch)	Medium	Low likelihood	Moderate/low
		Surface water course (River Arun)	Medium	Unlikely	Low
	Contaminant migration via surface runoff	Surface water course (ditch and River Arun)	Medium	Unlikely	Low
	Migration of contaminants via preferential pathways (i.e. piled foundation, piles constructed around the area to be dewatered and the wells drilled to pump water from and drinking water supply pipes).	Secondary A aquifer (River Terrace Deposits)	Medium	Likely	Moderate
		Principal aquifer (Lewes Nodular Chalk Formation)	Medium	Likely	Moderate
	Damage to building materials or services through direct contact with contaminated soil/groundwater	Buildings and structures (construction materials)	Mild	Low likelihood	Low
Off-site sources – agricultural land, sewage works, including former RAF refuelling area and possible former RAF bunker Heavy metals, faecal coliforms, pathogens	Leaching and vertical migration of contaminants onto site in soils and groundwater	Secondary A aquifer (River Terrace Deposits	Medium	Unlikely	Low
		Principal aquifer (Lewes Nodular Chalk Formation)	Medium	Unlikely	Low
	Accumulation and inhalation of gas and vapours	Future site staff	Medium	Unlikely	Low
		Construction/maintenance workers	Medium	Unlikely	Low
		Buildings and structures (internal spaces)	Medium	Unlikely	Low

Notes
Assessment completed assuming site in current condition. Should site levels be significantly altered during development, a reassessment would be required
Assessment completed assuming no remediation/mitigation in place
Should the development proposals alter significantly a review of this risk assessment may be required, in particular if new areas of soft landscaping are required
Given the use of appropriate personal protective equipment (PPE) and on-site health and safety precautions, risk to site development workers would be reduced to low

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Ford EfW Ltd, Grundon and Viridor (the applicants) propose to construct an ERF and WSTF at the site, comprising process buildings (with integrated welfare and offices), ancillary buildings and structures, access roads and vehicle parking spaces.

This Geoenvironmental Desk Study has been prepared in support of a planning application for the proposed development. The site has historically been used as an RAF airfield and a tarmacadam topblock manufacturing plant (Tarmac Limited).

Most recently the site has been partially in use as a waste transfer station (WTS), with the northern portion of the site occupied by former RAF hangars and currently disused. Historical ground investigation information indicates the site to be underlain by Made Ground, River Terrace Deposits and Lewes Nodular Chalk Formation.

The nearest surface water feature to the site is the River Arun, 900m to the east. The site is not located in a groundwater source protection zone (SPZ) and no potable groundwater abstractions have been identified in the vicinity of the site.

Based on the review of all the available sources, the following data gaps have been identified as follows:

- Limited ground investigation has been undertaken in the north-western portion of the site;
- The potential for the predominantly cohesive layer of the River Terrace Deposits to form an aquitard which may limit mobilisation of contaminants to groundwater and through which piling/bunker excavation may form a preferential pathway is uncertain;
- Soil leachate testing has not been undertaken as part of the historical ground investigation at the site; leaching and vertical migration of contaminants onto site in soils and groundwater;
- Ground gas monitoring has not been undertaken during a period of falling atmospheric pressure (and as such may not be representative of worst-case ground gas scenario on site).

In addition to the data gaps identified above, the following contaminant risks have been identified at the site which require further ground investigation:

- Moderate risk to future site staff from infiltration of organic contaminants into drinking water supply pipes beneath the site;
- Moderate/low risk to future site staff and construction workers from accumulation of ground gas/volatile vapours in buildings and enclosed spaces;
- Moderate/low risk to construction and future maintenance workers from asbestos fibres in Made Ground;
- Moderate risk of further mobilisation of contaminants in the River Terrace Deposits and Lewes Nodular Chalk Formation at the Enzygo (2015) ground investigation location BH7 in the event that significant dewatering is required in the proposed bunker hall excavation or that other construction activities interfere with groundwater conditions.

The above data gaps and risks are proposed to be investigated during ground investigation post planning which can be secured by an appropriately worded planning condition.

The Enzygo (2015) ground investigation also identified a moderate/low risk to building and construction materials from aggressive ground conditions at the site.

7.2 Recommendations

It is recommended that a ground investigation be designed and undertaken in accordance with BS5930:2015+A1:2020[21] and BS10175:2011 + A2:2017[22]. The proposed ground investigation should verify the existing conceptual site model and include a programme of sampling and monitoring to fill in the data gaps identified above. It is recommended that this ground investigation should comprise the scope set out below, be undertaken post planning and be secured through an appropriately worded planning condition. The works could be combined with any geotechnical ground investigation needed:

- Advancement of shallow boreholes (anticipated to be maximum 10 m depth) to provide information on gas and groundwater conditions in the northwest of the site and in locations where existing wells are found to be unsuitable for monitoring purposes;
- Advancement of deep boreholes (depth to be confirmed) to provide information on ground, ground gas and groundwater conditions in relation to anticipated piles forming part of foundation design):
- A series of machine-dug trial pits excavated to 1 m to 2 m into the natural ground across the site;
- Geoenvironmental testing of soil and groundwater samples obtained from the ground investigation, to include testing of soil samples as soil leachate and WAC testing. Groundwater analysis and historical data to be reviewed against current GACs;
- The hydrogeological properties of the aquifer require testing and investigation;
- Falling head/soakaway testing to be undertaken in the natural ground in the trial pits to confirm the permeability of the River Terrace Deposits;
- Six rounds of ground gas monitoring to be undertaken over a period of three months, with at least one round to be undertaken during a period of falling atmospheric pressure; and
- A programme of long-term groundwater monitoring to be undertaken in line with the piling works programme and excavation and construction of the waste bunker.

The results of the ground investigation should be reported in a geo-environmental interpretative report. This report should include an assessment of the risk to drinking water supply pipes from organic contaminants in accordance with the UK Water Industry Regulations (UKWIR)[23] and an assessment of soil leachate data against appropriate GACs for groundwater.

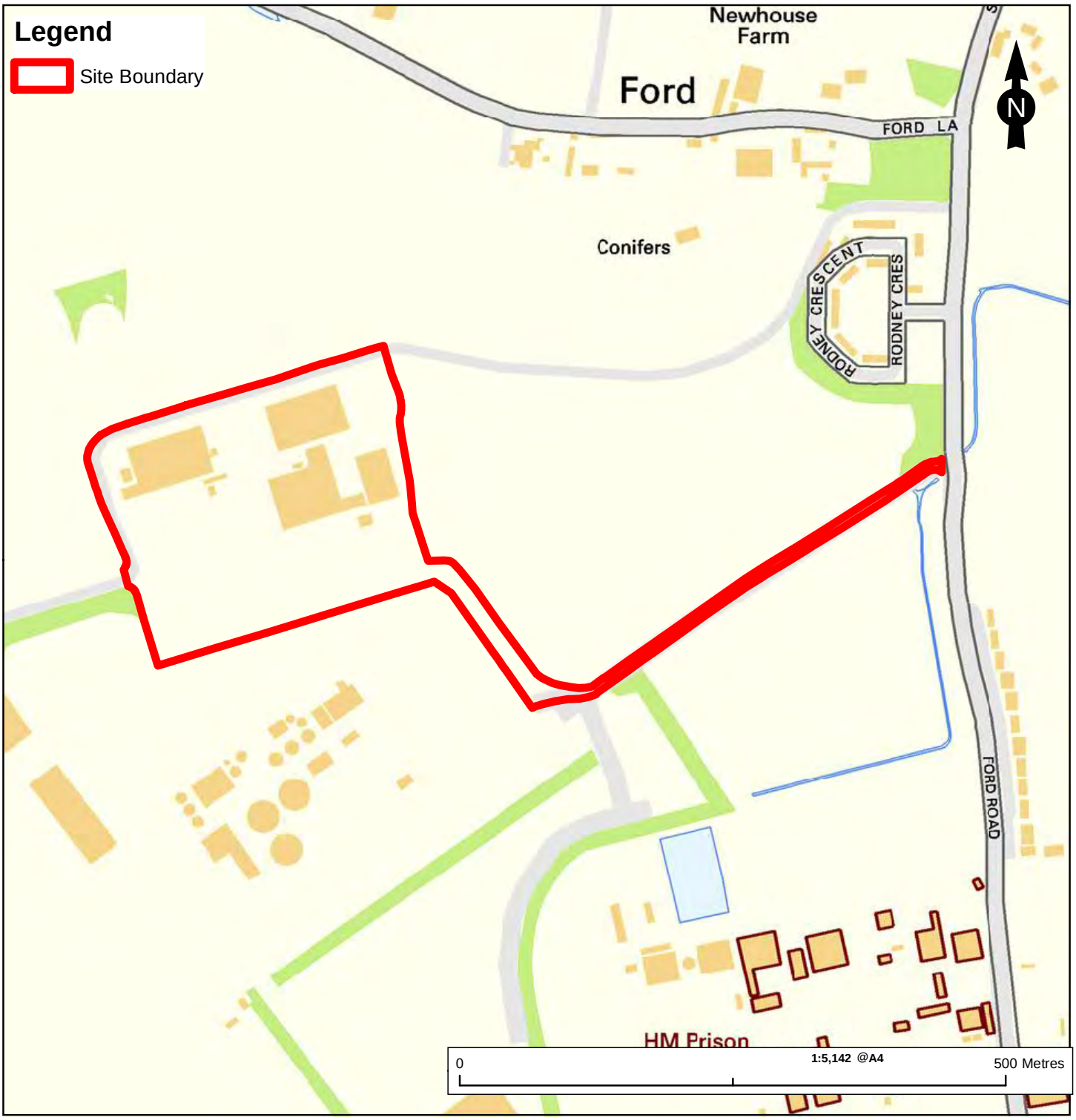
A detailed UXO risk assessment specific to the site should be undertaken in advance of intrusive works being undertaken.

[21] British Standards Institute (2015) BS 5930:2015+A1:2020 Code of Practice for Ground Investigation

[22] British Standards Institute (2013) BS 10175: 2011+A2: 2017 Investigation of Potentially Contaminated Sites – Code of Practice

[23] UKWIR (2010 and 2014 Update); Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites 10/WM/03/21

FIGURES



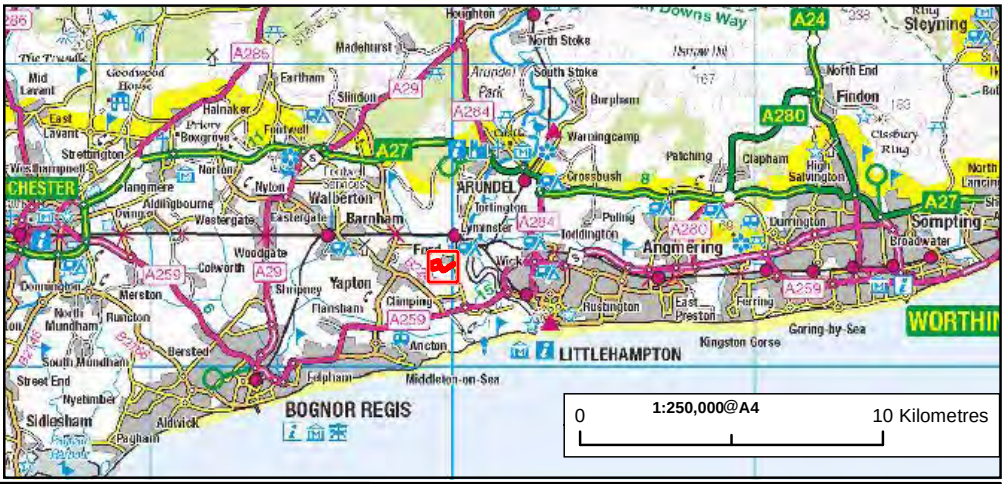
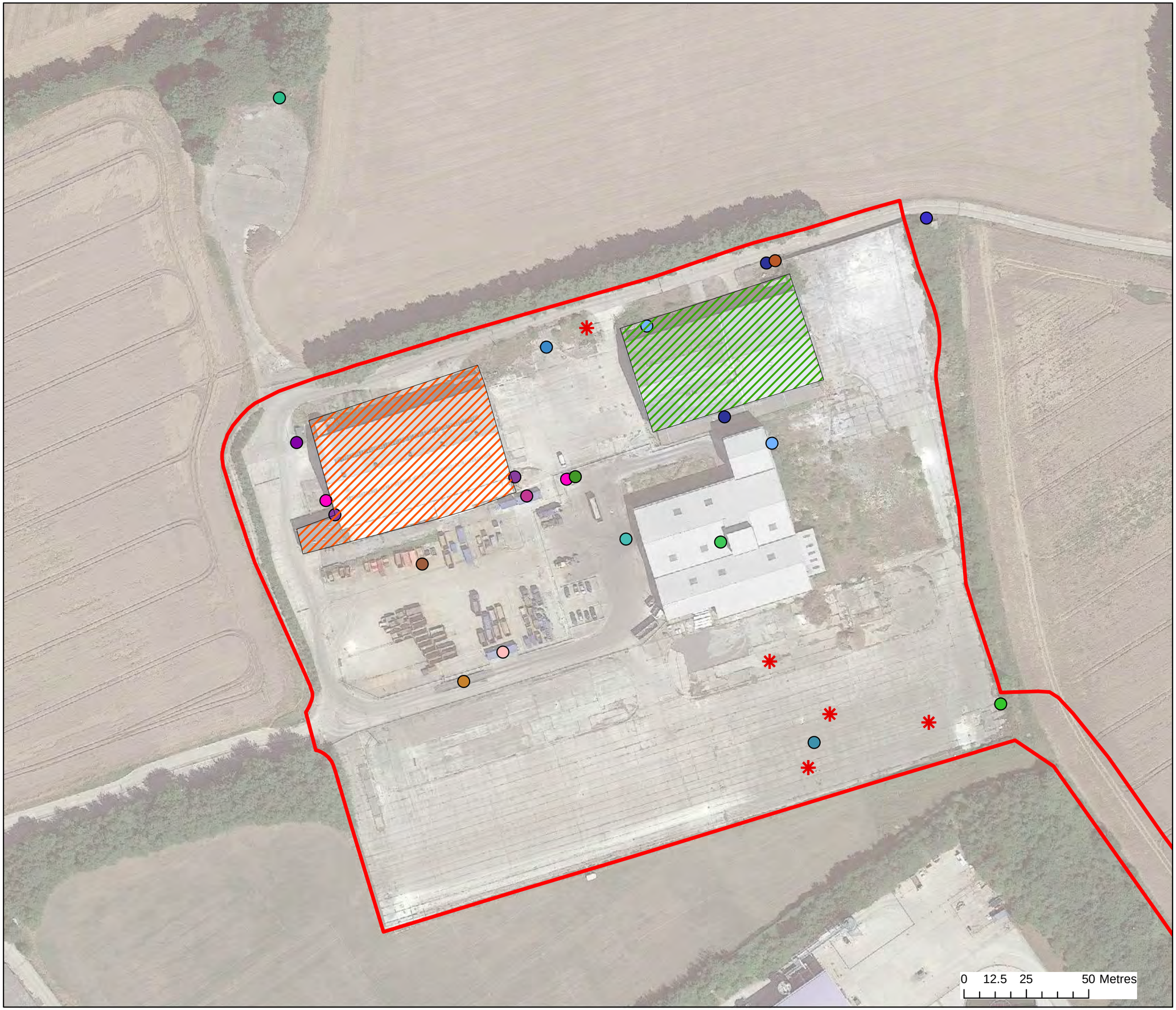


Figure Title: Figure 1: Site Location	Project Name: Ford Energy Recovery Facility and Waste Sorting and Transfer Facility, Ford Circular Technology Park	Date: February 2021	
		Scale: As shown	
Project Number: 1620007830	Client: Ford Energy from Waste (EfW) Limited, a joint venture between Grundon Waste Management Limited (Grundon) and Viridor Energy Limited (Viridor).	Issue: 01	Prepared By: BK & BH



Legend

- Site boundary
- Hanger 1
- Hanger 2
- Adblue storage
- Chimmey
- Deep hole
- Earth bund
- Electricity sub station
- Flytipped waste
- Former RAF refuelling pumping station
- Gas Governor
- New access road
- Porta Cabins
- Possibly a UST or interceptor
- Potential historic sub station
- Tank
- Toliet Cabins
- Wash down area
- Waste bin storage area
- Waste bins and containers
- Waste transfer building
- Weighbridge

N

Drawn at A3
1:1,400

Client
Ford Energy from Waste (EfW) Limited, a joint venture between Grundon Waste Management Limited (Grundon) and Viridor Energy Limited (Viridor).

Project Title
Ford Energy Recovery Facility and Waste Sorting and Transfer Facility, Ford Circular Technology Park

Project Number
1620007830

Figure Title
Site Walkover Feature Plan

RAMBOLL

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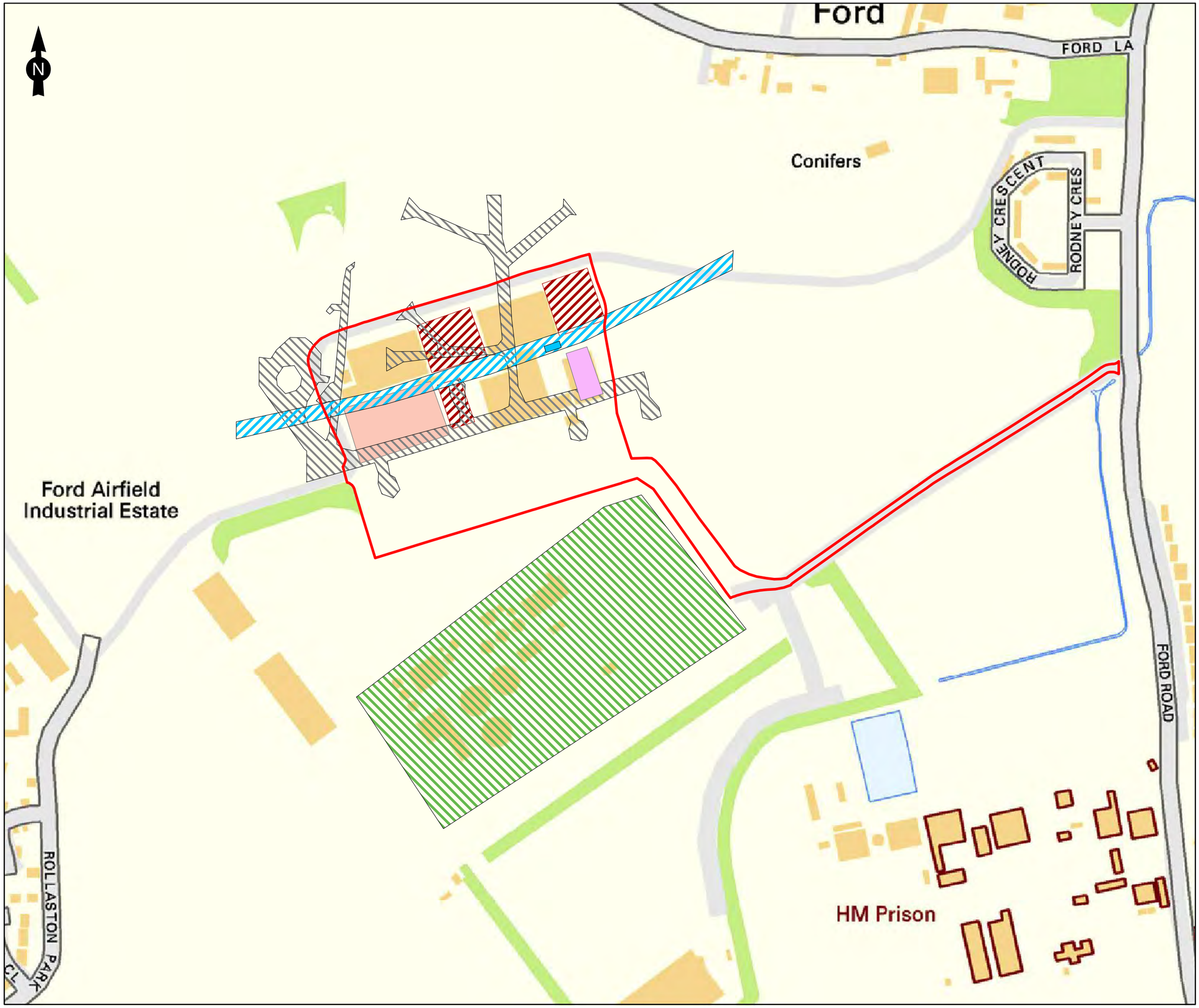
Date	Prepared By
February 2021	BH
Figure No.	**Revision**
Figure 2	01



Legend

- Site Boundary
- Airfield Building (Unlabelled)
- Canal
- Tank
- Conveyor
- Electricity Substation
- Ford Airfield Industrial Estate
- Gas Governor
- Grain Stores
- Hoppers and Conveyors
- Materials Recovery Facility
- Observation Post
- Prison
- Roads and Aircraft Standings
- Sewage Works
- Skip Depot
- Stockpile Bay
- Tanks (Autoclaves)
- Travelling Crane
- Water Tank

Notes.
Includes historical site features identified from historical maps and aerial photography. Boundaries of site features are indicative.

Colour Drawing

Figure Title
Pertinent Historical Features

Project Name
Ford Energy Recovery Facility and Waste Sorting and Transfer Facility, Ford Circular Technology Park

Project Number	Figure No.
1620007830	2
Date **February 2021**	Prepared By BK
Scale 1:3,500 @A3	Issue -

Client
Ford Energy from Waste (EfW) Limited, a joint venture between Grundon Waste Management Limited (Grundon) and Viridor Energy Limited (Viridor).

RAMBOLL

APPENDIX A
LEGISLATIVE CONTEXT AND METHODOLOGIES

LEGISLATIVE CONTEXT

England

The regime for contaminated land was set out in Part 2A (ss.78A-78YC) of the Environmental Protection Act 1990 (EPA), as inserted by S.57 of The Environment Act 1995 and came into effect in England on 1st April 2000 as The Contaminated Land (England) Regulations 2000 (SI 2000/227). These regulations were subsequently revoked with the provision of The Contaminated Land (England) Regulations 2006 (SI 2006/1380) (as amended), which came into force in August 2006, and consolidated the previous regulations and amendments. Revised statutory guidance ("the Guidance") for local authorities on how to implement the regime, including the decision-making process on whether land is contaminated land in the legal sense, has been published by Defra and entered into force in April 2012.

Under Part 2A of the EPA Section 78A(2), "contaminated land" is defined as "land which appears… to be in such a condition, by reason of substances in, on or under the land, that –

a) significant harm is being caused or there is a significant possibility of such harm being caused ; or b) significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused".

"Significant harm" is defined in the Guidance on risk based criteria and must be the result of one or more relevant 'contaminant linkages' relating to the land. The presence of a contaminant linkage relies on the Source-Pathway-Receptor concept, where all three factors must be present and potentially or actually linked for a potential risk to exist. Under the Guidance, a 'significant contaminant linkage' is one which gives rise to a level of risk sufficient to justify a piece of land being determined as contaminated land. Should the authority consider that there is an unacceptably high probability, supported by robust science-based evidence that significant harm would occur if no action is taken to stop it, the land should be deemed a Category 1: Human Health. Land should be placed into Category 2 if the authority concludes, on the basis that there is a strong case for considering that the risks from the land are of sufficient concern, that the land poses a significant possibility of significant harm. Both Category 1 and Category 2 cases would be capable of being determined as contaminated land under Part 2A on the grounds of significant possibility of significant harm to human health. If the legal test for significant possibility of significant harm is not met, the authority should place the land into Category 3. If the local authority considers that there is no risk or that the level of risk posed is low, the land should be placed into Category 4.

For six common contaminants (benzo(a)pyrene, cadmium, arsenic, benzene, hexavalent chromium and lead), a set of screening values have been developed and endorsed for use by Defra (the Category 4 Screening Levels, or C4SLs) that describe a level of risk just below the Category 3/4 boundary set in the Statutory Guidance, i.e. where concentrations are below the C4SL, there is no risk or the level of risk is acceptably low.

The pollution of controlled waters is defined in Section 78A(9) of the Act as "the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter". The new Guidance stresses that the Part 2A regime is designed to identify and deal with 'significant pollution' and not lesser levels of pollution. As with human health risk, Categories 1 and 2 comprise land where the local authority considers that a significant possibility of significant pollution of controlled waters exists and Categories 3 and 4 comprises cases where the authority considers that a significant possibility of such pollution does not exist. The local authority should be satisfied that a substance is continuing to enter controlled waters or is likely to enter controlled waters.

Risk Assessment Framework

"Significant harm" or "significant pollution of controlled waters" is defined in the Guidance on risk-based criteria and must be the result of one or more relevant 'contaminant linkages' relating to the land.

The presence of a contaminant linkage relies on the Source-Pathway-Receptor concept, where all three factors must be present and potentially or actually linked for a potential risk to exist. For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- A source - a substance that is capable of causing pollution or harm;
- A receptor - something which could be adversely affected by the contaminant; and
- A pathway - a route by which the contaminant can reach the receptor.

If one of these elements is absent there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

The Land Contamination: Risk Management[1] (LCRM) provides the technical framework for structured decision making about land contamination. LCRM advocates a phased approach, commencing with Stage 1 Risk Assessment comprising:

- Preliminary Risk Assessment (PRA) – desk study and qualitative assessment to develop of an outline Conceptual Site Model (CSM);
- Generic Quantitative Risk Assessment (GQRA) – an estimation of risk through assessment of contaminant concentrations against generic assessment criteria; and
- Detailed Quantitative Risk Assessment (DQRA) – an estimation of risk through detailed site-specific risk assessment and development of site-specific assessment criteria (SSAC) and site-specific risk assessment.

Each stage of assessment is focussed upon the development and refinement of a conceptual site model, which identifies Source-Pathway-Receptor linkages. The conceptual site model has been developed with consideration to guidance including BS EN ISO 21365:2020 Soil quality – Conceptual site models for potentially contaminated sites.

[1] Land Contamination: Risk Management (LCRM), published by the Environment Agency on 8 October 2020

RISK ESTIMATION

An assessment of environmental risks is made for each potential pollutant linkage identified.

Risk estimation has been completed in accordance with the guidance provided in:

- NHBC and Environment Agency 2008. Guidance for the Safe Development of Housing on Land Affected by Contamination. R&D Publication 66: 2008.

The following is taken directly from NHBC/EA 2008. The key to the classification is that the designation of risk is based upon the consideration of both:

- the magnitude of the potential consequence (i.e. severity) [takes into account both the potential severity of the hazard and the sensitivity of the receptor]; and
- the magnitude of probability (i.e. likelihood) [takes into account both the presence of the hazard and receptor and the integrity of the pathway].

Table 1: Classification of Consequence (after NHBC/EA 2008)

Category	Definition
Severe	Highly elevated concentrations likely to result in "significant harm" to human health as defined by the EPA 1990, Part 2A, if exposure occurs. Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population. Catastrophic damage to crops, buildings or property.
Medium	Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs. Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Significant damage to crops, buildings or property.
Mild	Exposure to human health unlikely to lead to "significant harm". Equivalent to EA Category 3 pollution incident including minimal or short-lived effect on water quality; marginal effect on amenity value, agriculture or commerce. Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population. Minor damage to crops, buildings or property.
Minor	No measurable effect on humans. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.

* For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given below.

Table 2: Classification of Probability (after NHBC/EA 2008)

Category	Definition
High Likelihood	There is pollutant linkage and an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.
Likely	There is pollutant linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low Likelihood	There is pollutant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a long period such an event would take place and is less likely in the shorter term.
Unlikely	There is pollutant linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard.

Table 3: The Classification of Risk (after NHBC/EA 2008)

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very high	High	Moderate	Low
	Likely	High	Moderate	Moderate/Low	Low
	Low Likelihood	Moderate	Moderate/ Low	Low	Very low
	Unlikely	Moderate/ Low	Low	Very low	Very low

Very high risk

There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without remediation action OR there is evidence that severe harm to a designated receptor is already occurring. Realisation of that risk is likely to present a substantial liability to be site owner/or occupier. Investigation is required as a matter of urgency and remediation works likely to follow in the short-term.

High risk

Harm is likely to arise to a designated receptor from an identified hazard at the site without remediation action. Realisation of the risk is likely to present a substantial liability to the site owner/or occupier. Investigation is required as a matter of urgency to clarify the risk. Remediation works may be necessary in the short-term and are likely over the longer term.

Moderate risk

It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild. Further investigative work is normally required to

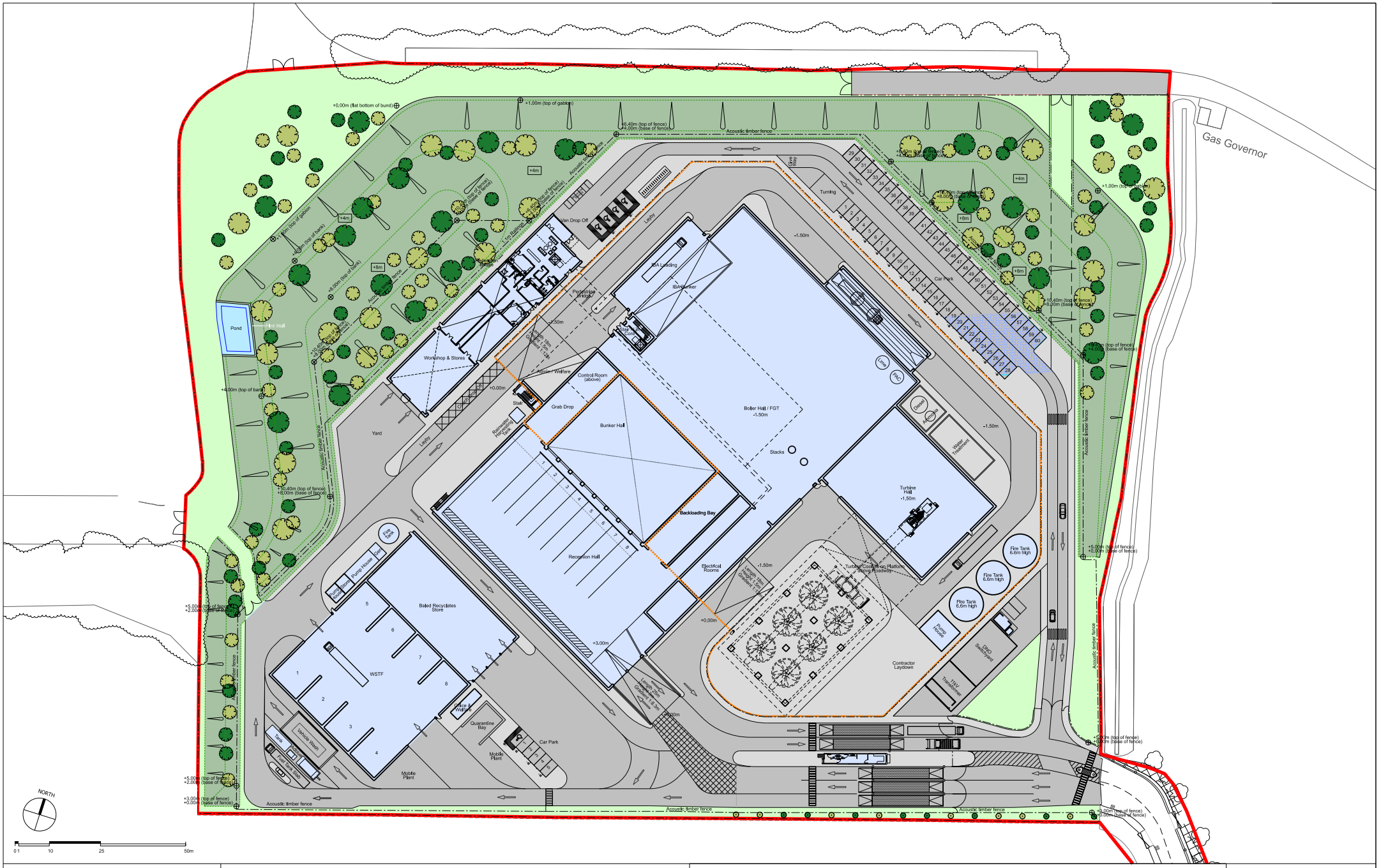
clarify the risk and to determine the potential liability to site owner/occupier. Some remediation works may be required in the longer term.

Low risk
It is possible that harm could arise to a designated receptor from identified hazard, but it is likely at worst, that this harm if realised would normally be mild. It is unlikely that the site owner/or occupier would face substantial liabilities from such a risk. Further investigative work (which is likely to be limited) to clarify the risk may be required. Any subsequent remediation works are likely to be relatively limited.

Very low risk
It is a low possibility that harm could arise to a designated receptor, but it is likely at worst, that this harm if realised would normally be mild or minor.

No potential risk
There is no potential risk if no pollution linkage has been established.

APPENDIX B
PROPOSED DEVELOPMENT PLAN



NOTE

1. THIS DRAWING IS COPYRIGHT GSDA LTD.
2. THE CONTRACTOR MUST NOT SCALE FROM THE DRAWING ALL DIMENSIONS TO BE TAKEN FROM DIMENSION STRINGS.
3. WHERE ANY DISCREPANCIES ARE FOUND BETWEEN DIMENSIONS THESE MUST BE BROUGHT TO THE ATTENTION OF THE ARCHITECTS FOR RESOLUTION.
4. WHERE DISCREPANCIES EXIST BETWEEN REFERENCE OR ASSEMBLY DRAWINGS & DETAIL DRAWINGS, THE LATTER TAKE PREFERENCE.

Key

- Planning Application Boundary
- -1.5m Lowered Area
- Extent of bunding
- Fencing Line
- Pastel Blue Block Paving Symbolising Path of Old Canal
- Indicative Landscaping

PROJECT	FORD CIRCULAR TECHNOLOGY PARK
DRAWING	Proposed Site Layout

FOR PLANNING		-	21/03/16	Issued for planning	
1:500@A1 SCALE	21/03/16 DATE				
1404 PL106 DWG. NO.	- REVISION				

GSDA
GARRY STEWART DESIGN ASSOCIATES
Highlands House, Office 300A, 165 The Broadway, Wimbledon, London, SW19 1NE
T. 020 8544 8085

APPENDIX C
SITE WALKOVER PHOTOS

Photo 1. Site entrance, weighbridge and site office (centre of plate). It should be noted that since the time of the site visit this is no longer the site entrance.

Photo 2. Hangar 1

Title: Photographic Log	Client: Ford Energy from Waste Limited
Site: Ford Circular Technology Park	Date: 25 February 2020

Photo 3. Hangar 1, facing southwards

Photo 4. Hangar 2

Title: Photographic Log	Client: Ford Energy from Waste Limited
Site: Ford Circular Technology Park	Date: 25 February 2020

Photo 5. Smaller single storey bricked building on the northern side of Hangar 2

Photo 6. Main waste building

Title: Photographic Log	Client: Ford Energy from Waste Limited
Site: Ford Circular Technology Park	Date: 25 February 2020

Photo 7. Yard area, facing northwards

Photo 8. Old rails

Title: Photographic Log	Client: Ford Energy from Waste Limited
Site: Ford Circular Technology Park	Date: 25 February 2020

Photo 9. Northern external yard is used for storing empty waste bins and waste containers.

Photo 10. Southern external yard areas are currently not being utilised

Title: Photographic Log	Client: Ford Energy from Waste Limited
Site: Ford Circular Technology Park	Date: 25 February 2020

Photo 11. Earth stockpile

Photo 12. Cover Possibly Indicating the Presence of an Interceptor or Underground Storage Tank Adjacent to Hangar 2

Title: Photographic Log	Client: Ford Energy from Waste Limited
Site: Ford Circular Technology Park	Date: 25 February 2020

Photo 13. Cover Possibly Indicating the Presence of an Interceptor or Underground Storage Tank Adjacent to Hangar 2

Photo 14. Cover Possibly Indicating the Presence of an Interceptor or Underground Storage Tank Adjacent to Hangar 2

Title: Photographic Log	Client: Ford Energy from Waste Limited
Site: Ford Circular Technology Park	Date: 25 February 2020

Photo 15. 5,600l Oil Tank

Photo 16. 2,500l Gas Oil Tank

Title: Photographic Log	Client: Ford Energy from Waste Limited
Site: Ford Circular Technology Park	Date: 25 February 2020

Photo 17. Former Location of 40,000 l Tank Containing Heating Oil (now Occupied by Green Bin)

Photo 18. AdBlue Tank

Title: Photographic Log	Client: Ford Energy from Waste Limited
Site: Ford Circular Technology Park	Date: 25 February 2020

Photo 19. Fly Tipped Waste

Photo 20. Disused Metal Piped Chimney

Title: Photographic Log	Client: Ford Energy from Waste Limited
Site: Ford Circular Technology Park	Date: 25 February 2020

Photo 21. Electricity Sub-station (Hangar 1)

Photo 22. Electricity Sub-station (Hangar 2)

Title: Photographic Log	Client: Ford Energy from Waste Limited
Site: Ford Circular Technology Park	Date: 25 February 2020

Photo 23. RAF Pumping Station/Bunker

Photo 24. RAF Pumping Station/Bunker Filled with Fly Tipped Waste

APPENDIX D
REGULATORY CONSULTATIONS

Jane Evans

From: SSD Enquiries <SSDEnquiries@environment-agency.gov.uk>
Sent: 11 February 2020 13:32
To: Brian Kerr
Subject: 200211 SSD158231 Environmental Search Request - Ford Circular Technology Park, BN18 0HY

Dear Brian,

Thank you for your email of 20/1/2020.

Please see the below comments in blue from our technical team.

This information is supplied subject to the notice which can be viewed via the following link: http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/.

Please get in touch if you have any further queries or contact us within two months if you would like us to review the information we have sent.

Kind regards,

Customers & Engagement Team
Environment Agency | Solent and South Downs Area | Pevensey Office | Coast Road | Pevensey Bay | East Sussex | BN24 6ND
email: ssdenquiries@environment-agency.gov.uk

From: Brian Kerr [mailto:brian.kerr@ramboll.co.uk]
Sent: 20 January 2020 17:50
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Cc: Tom Smith <thomas.smith@ramboll.co.uk>; Chara Sifaki <chara.sifaki@ramboll.co.uk>
Subject: REF 200121/BM01 Environmental Search Request - Ford Circular Technology Park, BN18 0HY

Dear Sir/Madam,

Ramboll has been commissioned to undertake an environmental review of the above referenced site (a plan is presented below). We would therefore be grateful if you could search your records for this site. We would be grateful if you could provide any information on the site, specifically on any of the following:

- Any records of contamination/pollution incidents on the site;

The only record of contamination we hold relates to a fire (logged as NIRS 123701) on site in 2002 of drums of aluminium powder. Only very minimal contamination to surface water recorded. We suggest that you also contact the Local Authority as they may hold other records.

- Any records of landfill/Made Ground;

We do not hold any records on Made ground.
We do not hold records of landfill other than these links: https://data.gov.uk/dataset/17edf94f-6de3-4034-b66b-004ebd0dd010/historic-landfill-sites , https://data.gov.uk/dataset/ad695596-d71d-4cbb-8e32-99108371c0ee/permitted-waste-sites-authorised-landfill-site-boundaries

- Any records of complaints about the site e.g. odour, noise, nuisance;

We have only ever received one complaint (odour) naming Grundons which arrived via West Sussex County Council, from a resident in Rodney Close in July 2017. The source of this smell was eventually identified as the Southern Water waste water treatment facility on the same site.

- Details of licenses related to historical landfill in the vicinity of the site;

We are unable to provide any information as we no longer hold the records for these sites. We recommend that you contact the Environmental Health / Environmental Protection Department at your local authority for further advice and

information. They are the lead regulator for these sites and are responsible for the inspection of contaminated land in their area, which includes historic landfill sites.

- Details of any designations related to the site or immediately surrounding area;

Please see the flowing link it will have all the relevant information:
https://www.gov.uk/government/organisations/natural-england

- Are there any records of ground investigations at the site or its immediate surroundings which the EA hold?

We do not hold any information on ground investigations, please contact the Local Authority. You may also find this link useful: http://www.bgs.ac.uk/data/boreholescans/home.html

- The geological stratigraphy underlying the site;

Please see the flowing link http://www.bgs.ac.uk/ (the borehole data base may be particularly useful).

- Any details on the hydrogeology of the site; and

Please see the flowing link: http://www.bgs.ac.uk/ (the borehole logs may be useful)

- Any available details pertaining to the ponds/reservoirs/other surface water bodies proximate to the site.

We do not hold any relevant information.

Please can you inform me of any charge as soon as possible for the above work and an estimate of the length of time it will take to respond. In the meantime, if you have any queries, please do not hesitate to contact me.

Kind regards,

Brian Kerr

Kind regards
Brian Kerr

Consultant
1621784 - E&H - Southampton

M +447773 645 796
brian.kerr@ramboll.co.uk

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Ramboll
Carlton House
Ringwood Road
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SO40 7HT
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APPENDIX E
ONLINE CONSULTATIONS AND SERVICE PLANS

Geology 1:50,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	MGR	Made Ground (Undivided)	Artificial Deposit	Not Supplied - Holocene

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Not Supplied - Holocene
	RTDU	River Terrace Deposits (Undifferentiated)	Sand, Silt and Clay	Not Supplied - Quaternary
	RBD1	Raised Beach Deposits, 1	Sand and Gravel	Not Supplied - Quaternary
	RMD	Raised Marine Deposits	Clay, Silt, Sand and Gravel	Not Supplied - Quaternary
	HEAD	Head	Gravel, Sand, Silt and Clay	Not Supplied - Quaternary

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	LC	London Clay Formation	Clay, Silt and Sand	Not Supplied - Ypresian
	LMBE	Lambeth Group	Clay, Silt and Sand	Not Supplied - Thanetian
	LPCK	Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation (Undifferentiated)	Chalk	Not Supplied - Turonian

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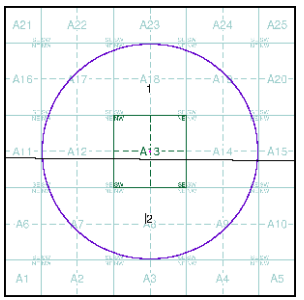
Geology 1:50,000 Maps

This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.
The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

Map ID:	**2**	**Map ID:**	**1**
Map Sheet No:	**332**	**Map Sheet No:**	**317**
Map Name:	**Chichester and I**	**Map Name:**	**Chichester and I**
Map Date:	**1996**	**Map Date:**	**1996**
Bedrock Geology:	**Available**	**Bedrock Geology:**	**Available**
Superficial Geology:	**Available**	**Superficial Geology:**	**Available**
Artificial Geology:	**Available**	**Artificial Geology:**	**Available**
Faults:	**Not Supplied**	**Faults:**	**Not Supplied**
Landslip:	**Available**	**Landslip:**	**Available**
Rock Segments:	**Not Supplied**	**Rock Segments:**	**Not Supplied**

Geology 1:50,000 Maps - Slice A



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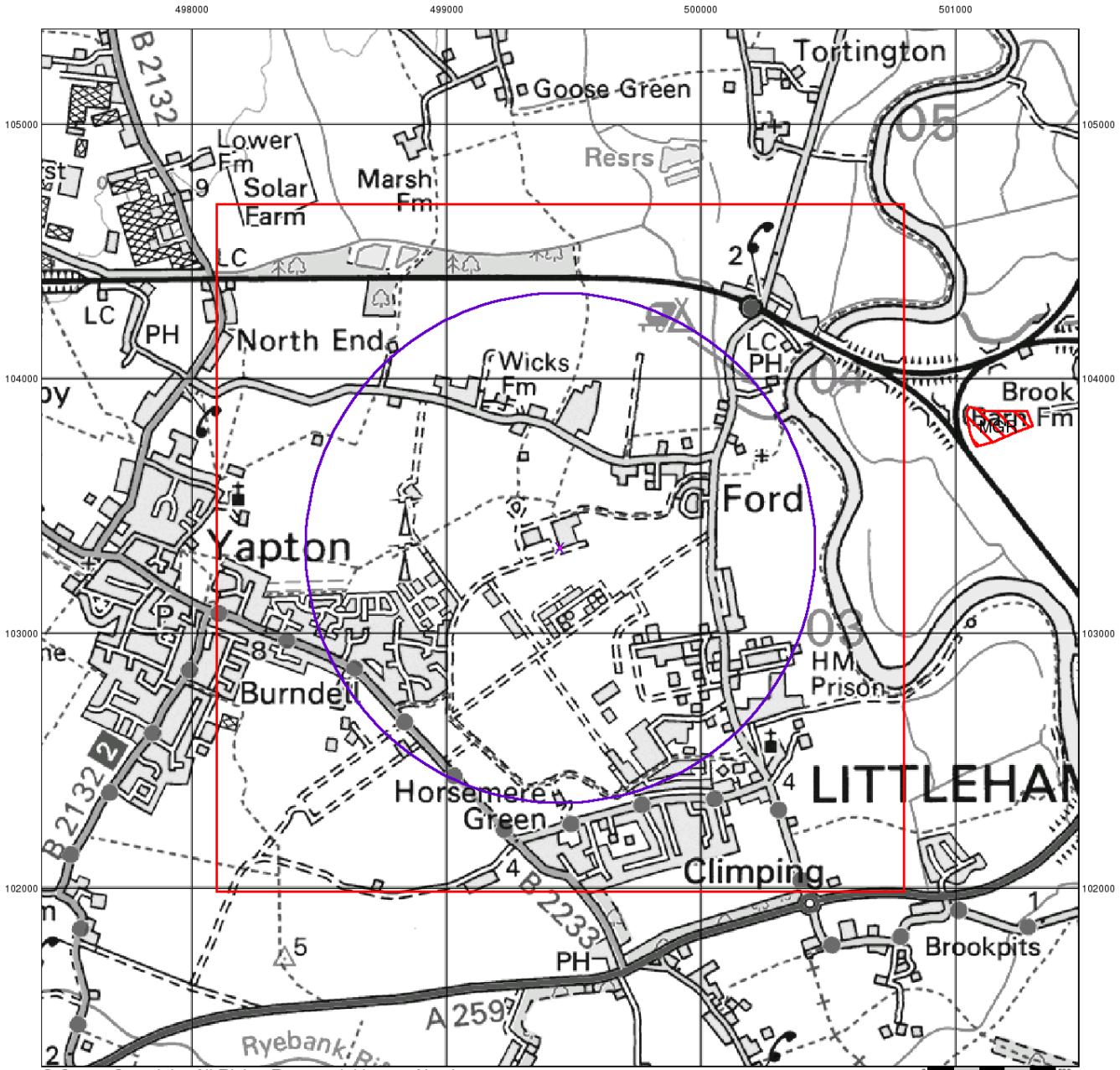
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details:

Site at, Arundel, West Sussex



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Artificial Ground and Landslip

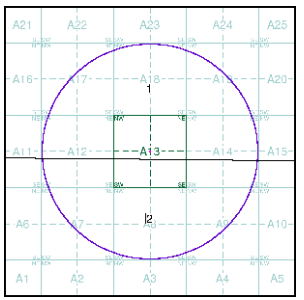
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.
- Worked ground - areas where the ground has been cut away such as quarries and road cuttings.
- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.
- Landscaped ground - areas where the surface has been reshaped.
- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.

Artificial Ground and Landslip Map - Slice A



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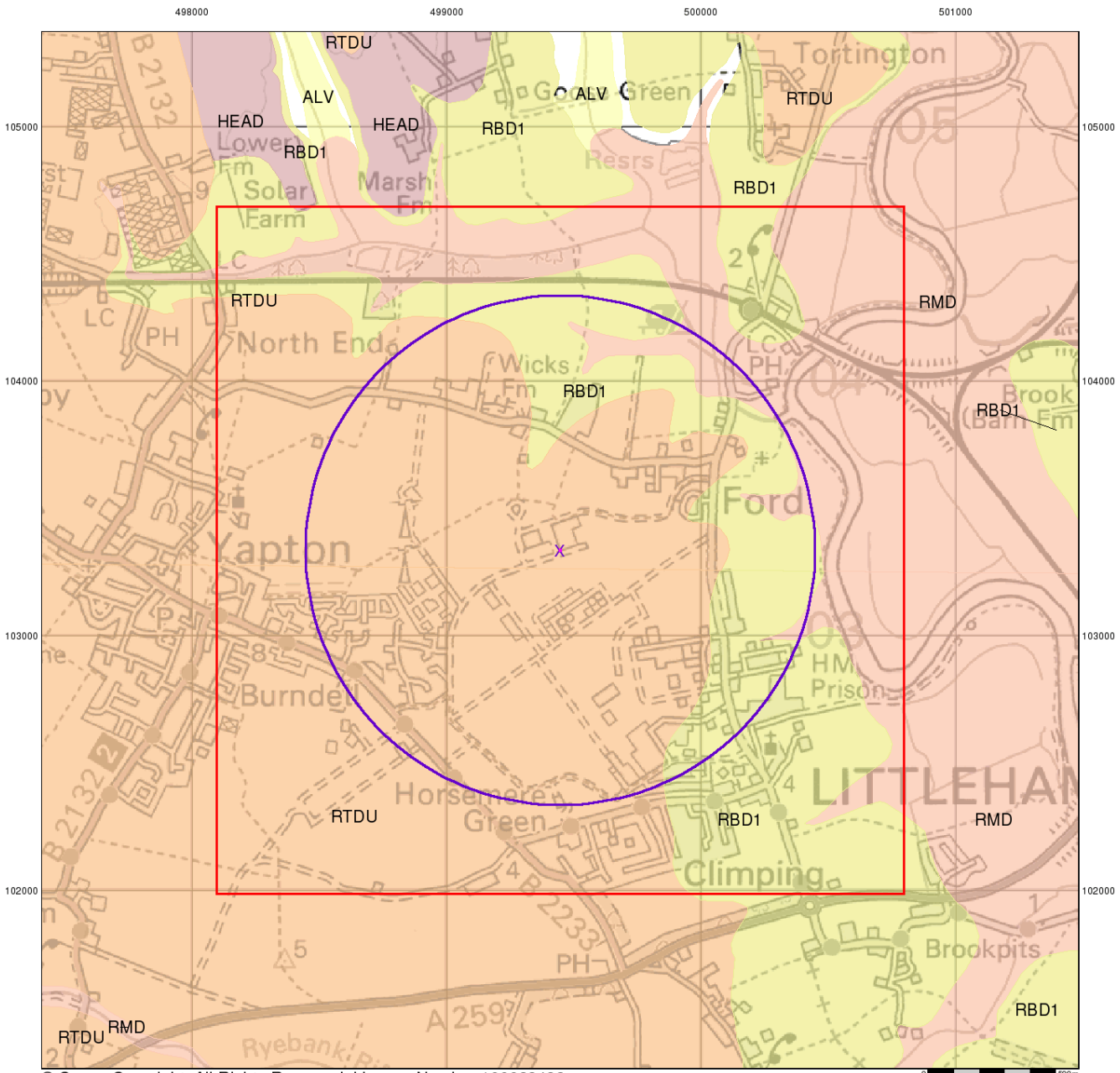
Search Buffer (m):	1000

Site Details:

Site at, Arundel, West Sussex

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



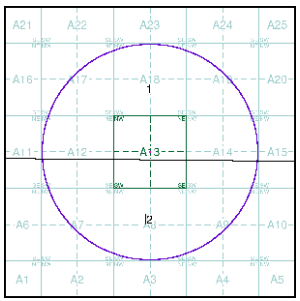
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



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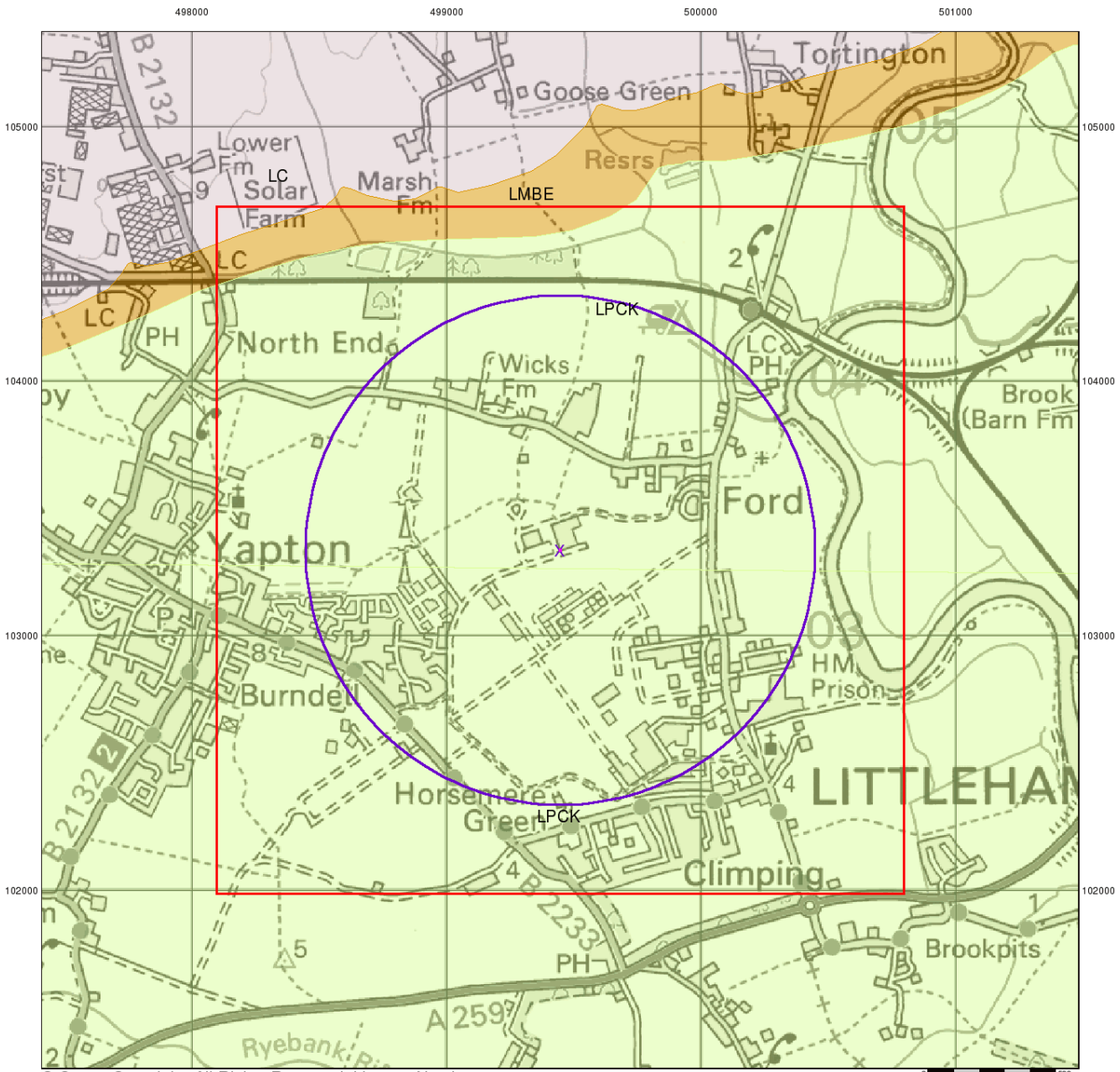


Bedrock and Faults

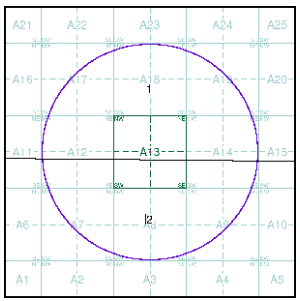
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



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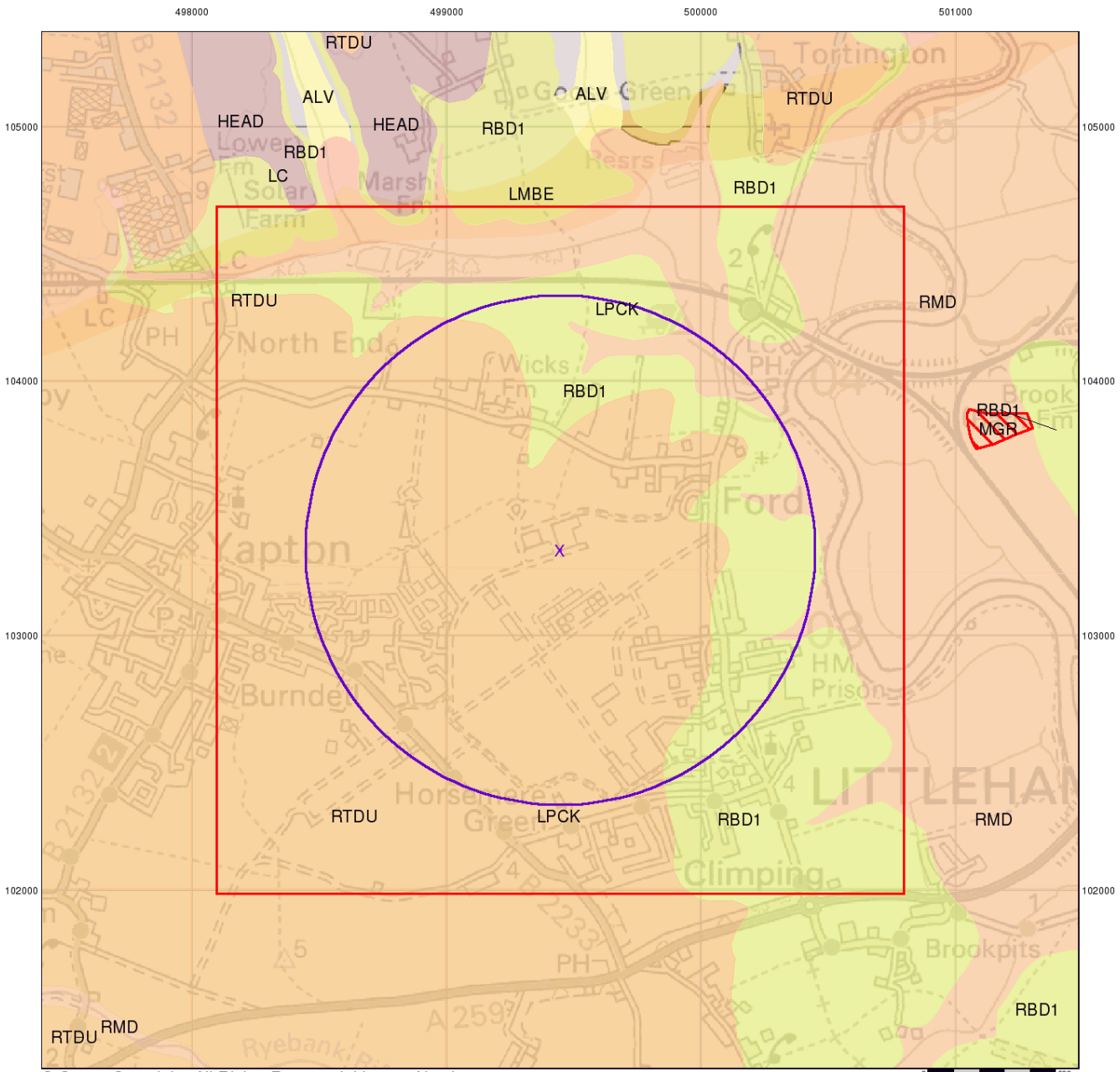

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Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

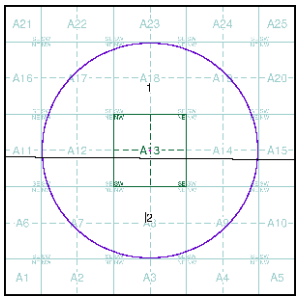
Additional Information

More information on 1:50,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

British Geological Survey
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Telephone: 0115 936 3143
Fax: 0115 936 3276
email: enquiries@bgs.ac.uk
website: www.bgs.ac.uk

Combined Geology Map - Slice A



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