

Flood Risk Assessment

for

Insynch Energy Services

12MWe Gas Peaking Facility, Knowsley Industrial Estate

Project 6623

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Executive Summary

Insynch Energy are proposing to develop the Knowsley Industrial Estate site, off Acornfield Road, Kirkby, L33 7UZ. This level 1 Flood Risk Assessment (FRA) has been produced to accompany the planning application for the proposed development.

A small portion of the site (approximately 0.002ha) is within Flood Zone 3a and therefore at high risk of surface water flooding. The section of the site where the gas engines are to be located will provide minimum finished floor levels of at least 40.8m above ordnance datum (AOD) which are above modelled flood levels and predicted climate change impacts in accordance with Environment Agency guidance (based on a development lifespan of 20 years).

Surface water flooding into the site is high risk due to the topography of Acornfield Road draining into the site.

Flooding of the access and egress route off Acornfield Road is predicted but the site would not be routinely staffed and can be operated remotely during a flood event. In the event of flooding the plant will be subject to remote shut down/isolation.

This report concludes with recommendations for the site development and a residual flood risk register.

This Flood Risk Assessment (FRA) finds that the residual risk of flooding by river and surface water sources to the site and off-site is "low" under the condition that a suitable drainage management system is installed that can handle a design flood.

I Introduction

Stopford Energy & Environment has been instructed by Insynch Energy to prepare a flood risk assessment (FRA) report to accompany a planning application for the proposed construction of six 2 MWe natural gas-powered engines for a gas-peaking electric power generation facility on former Syntor Fine Chemicals works, Acornfield Road, Knowsley Industrial Estate, Kirkby.

The assessment has been undertaken in accordance with the requirements of the National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG).

2 Development Site and Location

2.1 Location

The site is located off Acornfield Road, Knowsley Industrial Estate, Kirkby, L33 7UZ. The central grid reference for the site is 343753, 399354. The proposed site is bounded by industrial units to the north, west and south and to the east by Acornfield Road. The proposed site is approximately 0.4882ha (see Figure 1) . Sensitive receptors include conservation areas such as Acornfield Plantation Local Nature Reserve (LNR), and local schools and residential areas to the west.

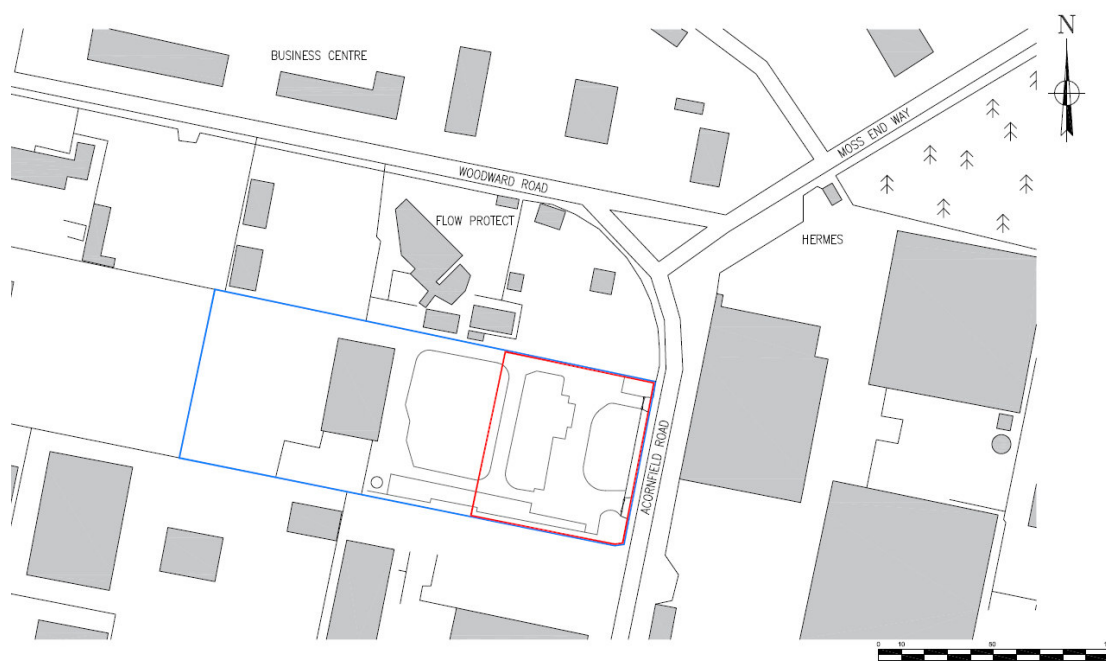


Figure 1: Location of the Acornfield gas-peaking site [ref.18].

2.2 Current Use

The site is vacant undeveloped brownfield land surrounded by industrial units within the Knowsley Industrial Estate. The site is a former oil/chemical works which ceased production in 2005 [ref.20].

2.3 Flood Zone

The site is located across both level 1 and level 2 flood zone areas (see Figure 2) according to information gathered by the Environment Agency (EA) [ref.2]. However, a small section (approx. 0.002 ha) of the north-eastern side of the site is in a flood zone 3 area, where the development meets Acornfield Road.

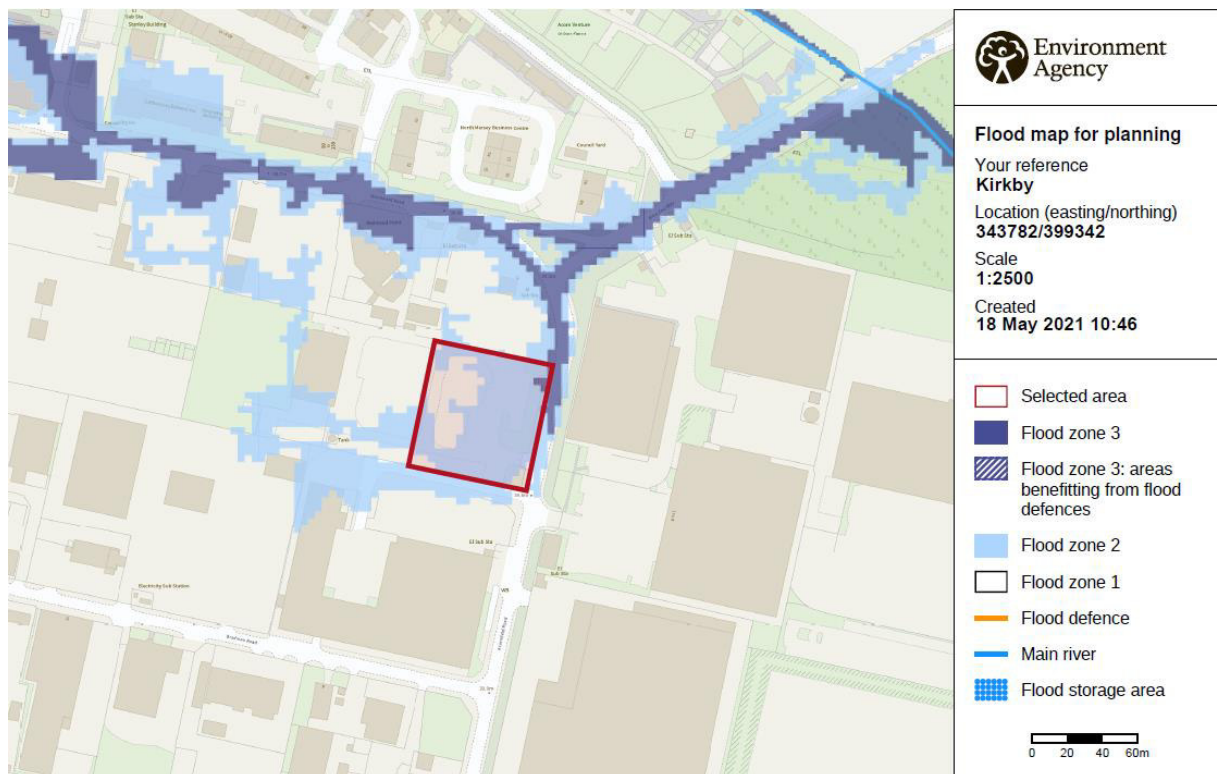


Figure 2: Environment Agency flood map for planning [ref.2].

3 Development Proposals

3.1 Development Proposals

A proposed site plan is provided in Appendix I.

It is proposed that the vacant land be used to build a gas-peaking facility, including:

- Six 2 MWe class gas engines (Figure 3) (Appendix I) housed within container units measuring 12 x 3 x 3 m, 9.04 m tallest point from ground level, mounted on 1,250 mm tall steel frames.
- Gas engines located within a raised bunded area.
- Security cabin.
- Three parking spaces.
- Refurbished security fencing and gates.
- Utilisation of existing site drainage network, hardstanding, and access to Acornfield Road.

The facility will be compliant with the operational requirements specified for Medium Combustion Plant/Specified Generator installations and will be regulated by the Environment Agency in line with the requirements of the Environmental Permitting Regulations (England and Wales), 2016.

It is proposed that the final floor levels of the gas engines will be min. 300mm above Environment Agency estimated surface water flood depths of 900mm (flood zone 3).

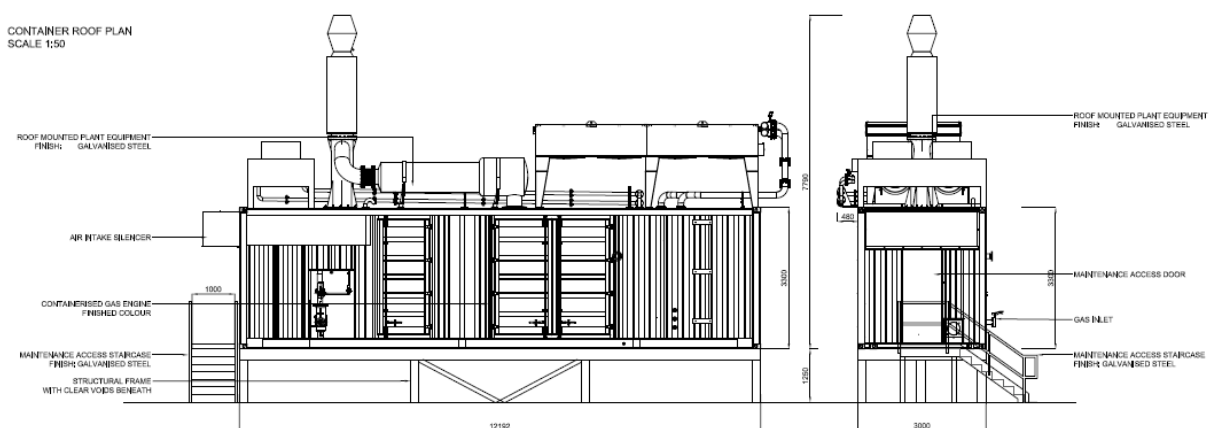


Figure 3: Proposed 2 MWe natural gas engines and associated equipment housed within a container unit, mounted on a frame [ref. 19].

3.2 Vulnerability Classification

Based on the vulnerability classification in Table 2 of the guidance [ref.3], PPG defines the development as 'General Industry' and classifies this use as 'Less Vulnerable.' Table 3 of the PPG considers this an appropriate use within Flood Zone 3.

3.3 Lifetime of Development

The proposed lifetime of the development is 20 years.

4 Sequential Test

The Sequential Test steers development preferentially towards Flood Zone 1 (Low Risk), considering Flood Zone 2 (Medium Risk) and then Flood Zone 3 (High Risk) only if land cannot be identified as available for development in zones at lower risk from flooding. [ref.3]. Within each flood zone, surface water and other sources of flooding also need to be taken into account in applying the sequential approach to the location of development.

The proposed application area is allocated for Class B1, B2, B8 development within the Local Plan for the Knowsley Industrial Estate [ref.14], which was informed by the Knowsley Strategic Flood Risk Assessment (SFRA) [ref.7]. In accordance with paragraph 162 of the NPPF, 'Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again.' It is therefore considered that the Sequential and Exception Tests need not be revisited, nevertheless element two of the Exception Test, that the proposed development will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall [3], is addressed within this FRA.

5 Climate Change

As the effects of climate change are being realised it becomes increasingly important to reduce and mitigate flood risk. It is essential that new developments are safe from flooding and incorporate strategies to reduce risk to ensure sustainable economic growth. Kirkby falls under the governorship of Knowsley Metropolitan Borough Council (MBC). In the borough the main issues associated with flooding have been caused by culverted watercourses from the River Alt outflow. Highway flooding due to this reason has occurred during extreme rainfall periods in 2000, 2005, 2008, 2010, 2011 and 2012. Internal flooding to one property in 2011 and to two properties in 2012 also occurred due to this [ref.4].

5.1 Peak River Flow

The site is situated in the North-West river basin district [ref.5]. However, the risk of fluvial flooding is low from the unnamed stream to the northwest of the site (see Figure 14) and, as this is not a major river (catchment 30-50 km²) peak river flow allowances do not apply. Allowances for peak rainfall intensity are therefore used in this FRA for surface water management (Section 5.2).

However, as the site has a life expectancy of 20 years, changes to peak river flow allowances for climate change (North-West) were reviewed for up to 2041 [ref.6] (see Table 1). As the site is classified as 'less vulnerable' the central and higher central allowances would be used if the proposed site was in the flood risk zone of a major river.

Table 1: Peak river flow allowances for the North-West river basin district (based on 1961 to 1990 baseline) [ref.6].

<i>Allowance Category</i>	<i>Total potential change anticipated for the '2050s' (2040 to 2069)</i>
<i>Higher central</i>	30%
<i>Central</i>	25%

5.2 Peak Rainfall

Rainfall allowances can be used to provide a more accurate estimation for fluvial uplifts in small 'flashy' catchments. Small watercourses are impacted because of the high volume of runoff relative to their channel capacity. Increases in rainfall intensity due to climate change are likely to result in an increase in the severity and frequency of flooding incidents on small watercourses. Rainfall allowances should also be applied when considering surface water flooding and drainage assessments.

Increased rainfall affects river levels and land and urban drainage systems. The EA also has predictions for anticipated changes in peak rainfall intensity in small catchments (less than 5 km²), or urbanised drainage catchments (see Table 2). For flood risk assessments both the central and upper end allowances are assessed to understand the range of impact.

The modelled potential change for the Central allowance category for 2040-2069 is 10%, compared to a 20% increase modelled in the Upper End allowance category.

The site developer has reported to Stopford that the on-site drainage system is of a state and capacity to ensure there is no increase in the rate of runoff discharged from the site for the Upper End allowance so that during high periods of rainfall and high river levels, backup does not occur.

Table 2: Peak rainfall intensity allowance in small catchments (less than 5km²) or urban drainage catchments (based on a 1961 to 1990 baseline) [ref.6].

<i>Allowance</i>	<i>Total potential change anticipated for the '2050s' (2040 to 2069)</i>
<i>Upper end</i>	20%
<i>Central</i>	10%

6 Site Specific Flood Risk

There are five key types of flooding which are identified in the Local Flood Risk Management Strategy. These are river flooding (fluvial), surface water flooding (pluvial), sewer flooding, groundwater flooding and reservoir flooding [ref.4].

6.1 Main Sources of Flood Risk

6.1.1 River

The proposed site is not located in a flood risk zone 2 or 3 from rivers (see Appendix III).

The primary source of flooding in Knowsley is fluvial flooding [ref.7]. Knowsley Metropolitan Council's area falls within both the River Alt and River Mersey catchments. Figure B1-2 from the SFRA shows the proposed site to not be in a fluvial flooding zone but there is a watercourse which flows north of the site (see Appendices) [ref.7]. This information is mirrored by the EA flood maps (see Appendix III) [ref.8]. Kirkby Brook is a significant tributary of the River Alt and flows in a culvert under Knowsley Industrial Park [ref.9].

6.1.2 Surface Water

Surface water flooding caused because of sewer infrastructure blockage, failure or insufficient capacity, groundwater, pluvial and overland flow all have the potential to contribute to significant flood risk in urban areas. This is due to rapid run-off rates associated with urban land-use and the subsequent volumes of water flowing through infrastructure and overland in relatively short-periods of time [ref.7]. Reported surface water flooding incidents within the Borough are generally associated with highway flooding and are prevalent as with all major conurbations within the Council's boundaries [ref.7]. Pockets of surface water flooding are evident across Knowsley Industrial Estate as can be seen in Figure B5 of the Level 2 SFRA (see Appendix III) [ref.9].

Annual rainfall in 2020 for the North-West was 1,302 mm [ref. 16] which equates to 3.6 mm per day.

The estimated site discharges using UK SuDS surface water storage tool [ref. 17] for a 1 in 100-year rainfall event is 3.9 litres/second (IH124 method, based on 1,302 mm annual rainfall, 100% impermeable site area, and 20% climate change allowance in Table 2). The estimated site discharge is discussed in relation to the site's drainage strategy in Section 10.2.

Surface water from Acornfield Road poses a potential risk to the site. However, any measures to the entrance ways, where the water would enter would be futile as the surface water is able to run under the boundary fencing.

Insynch state that the site has so far not flooded, according to the landowners.

6.1.3 Ground Water

DEFRA has compiled a scoping study report and emergence maps which show areas where groundwater is rising and therefore, where increased flood risk via groundwater is prevalent [ref.7]. The geology of the North-West river basin district means that it has significant aquifers [ref.10]. A decline in industry in the region, leading to reduced water abstraction has also meant that regional groundwater levels are rising [ref.10]. Figure E1 of the SFRA and maps from the British Geological Survey [ref.11] shows that the site is located on bedrock composed of Triassic sandstone (Chester formation), a Principle Aquifer (see Appendix III). Sandstone is relatively porous and so would allow for the percolation of water throughout the bedrock. Superficial deposits on the site comprise of sand (Shirdley Hill) that forms part of a Secondary A Aquifer (see Appendix III) [ref.11].

Despite the information stated above, the level 1 SFRA concludes that based on all the information available, groundwater flooding is not a significant and current risk to the region [ref.7].

6.1.4 Sewers

Private foul and surface water sewers are noted to be located within and adjacent the proposed site. There is, therefore, potential for sewer surcharge flood risk from connections of these private sewers with the relevant public sewer networks on the industrial estate (i.e., United Utilities public foul and surface water sewers).

The sewerage infrastructure of many of the older, urban areas of the Borough is based on Victorian sewers and there is a risk of localised flooding associated with this as the system will be susceptible to blockages [ref.7].

6.1.5 Reservoirs

There are relatively few reservoirs in the Borough, although areas in the south of the Borough are affected by flooding from reservoirs located outside the Borough [ref.9]. As Kirkby is in the north of the Borough it is not at risk from this source of flooding.

6.2 Flood Depth

Due to the site being partially in a flood zone 3 area it is a vulnerable development, and as such the proposed floor levels should be raised by a minimum of 300 mm above the estimated surface water flood level, according to government guidance [ref.13].

The EA estimates showing surface water flood risk water depth, in a low-risk scenario, indicates that the site has potential to have surface water flooding between 300 to 900 mm above ground level (see Figure 4) [ref. 8]. From a 2015 topographic survey of the site, ground level in Flood Zone 3 is approximately 39.3 m AOD [ref. 20].

Final floor levels are worked out as follows:

- $39.6 \text{ m} + 0.9 + 0.3 = 40.8 \text{ m (AOD)}$.

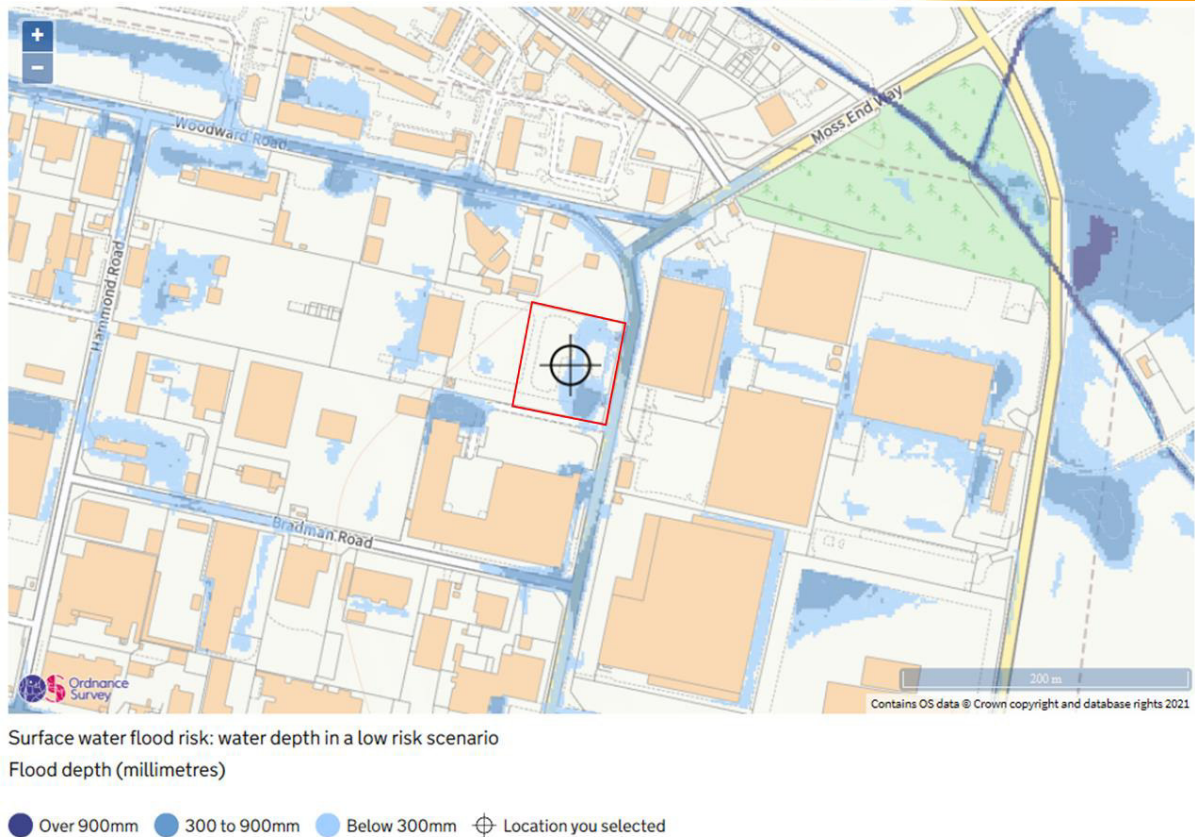


Figure 4: Surface water flood risk: water depth in a low-risk scenario.

6.3 Site Topography and Flood Risk

The modelled flood zones provided by the EA [ref.2] show the proposed site to be in a mainly flood zone 1 and flood zone 2 area. However, a small portion of the north-eastern side of the site is in flood zone 3 (Figure 2).

Using LiDAR data from 2019 [ref.15] a digital terrain model at 2m resolution was created, allowing the topography of the proposed site, to be compared to the topography of the surrounding land (see Figure 5) In general, the land to the east of the site is higher, and generally decreasing as you look west. The height of the site can be seen to be between 38.2-42.2 m Above Ordnance Datum (AOD). The flood zone 3 area outlined in Figure 2 to the north-east of the site is approximately at a level 39.4m AOD based on topographic data for the site [20].

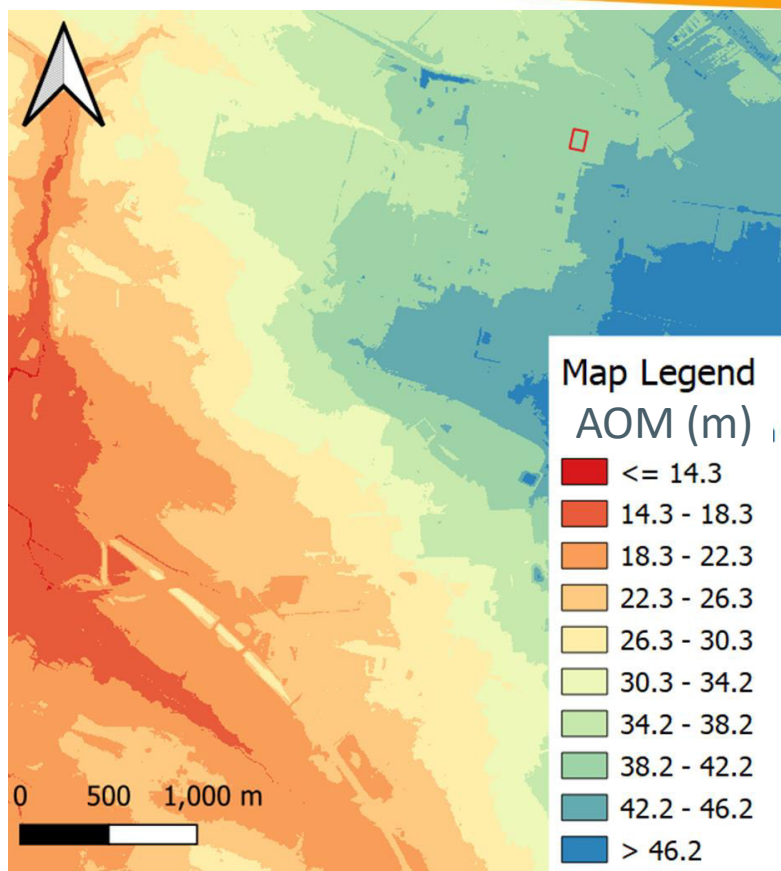


Figure 5: 2019 LiDAR data rendered into a DTM in QGIS [ref.15].

The LiDAR data from 2019 [ref.15] was then used to construct a digital surface model at 2m resolution (see Figure 6). The DSM shows roads and buildings and so gives more detail and point of reference to the site. Here it can be seen that the land immediately east of the site, Acornfield Road is on higher ground (39.6-43m AOD) compared to much of the eastern section of the site, which is between (36.3-39.6m) (although known to be 38.2 to 39.6m due to Figure 5). Therefore, there is a potential surface-water flood-pathway from Acornfield Road to the site as the surface water travels from high to low ground.

The water velocity in a low-risk surface water scenario can also be seen to travel in a northerly direction before entering the south-east area of the site and then travelling through the site in a northerly direction (see Appendix III). It is also likely that flood water from Acornfield Road flowing north may back up as it travels north and as a result cause further flooding.

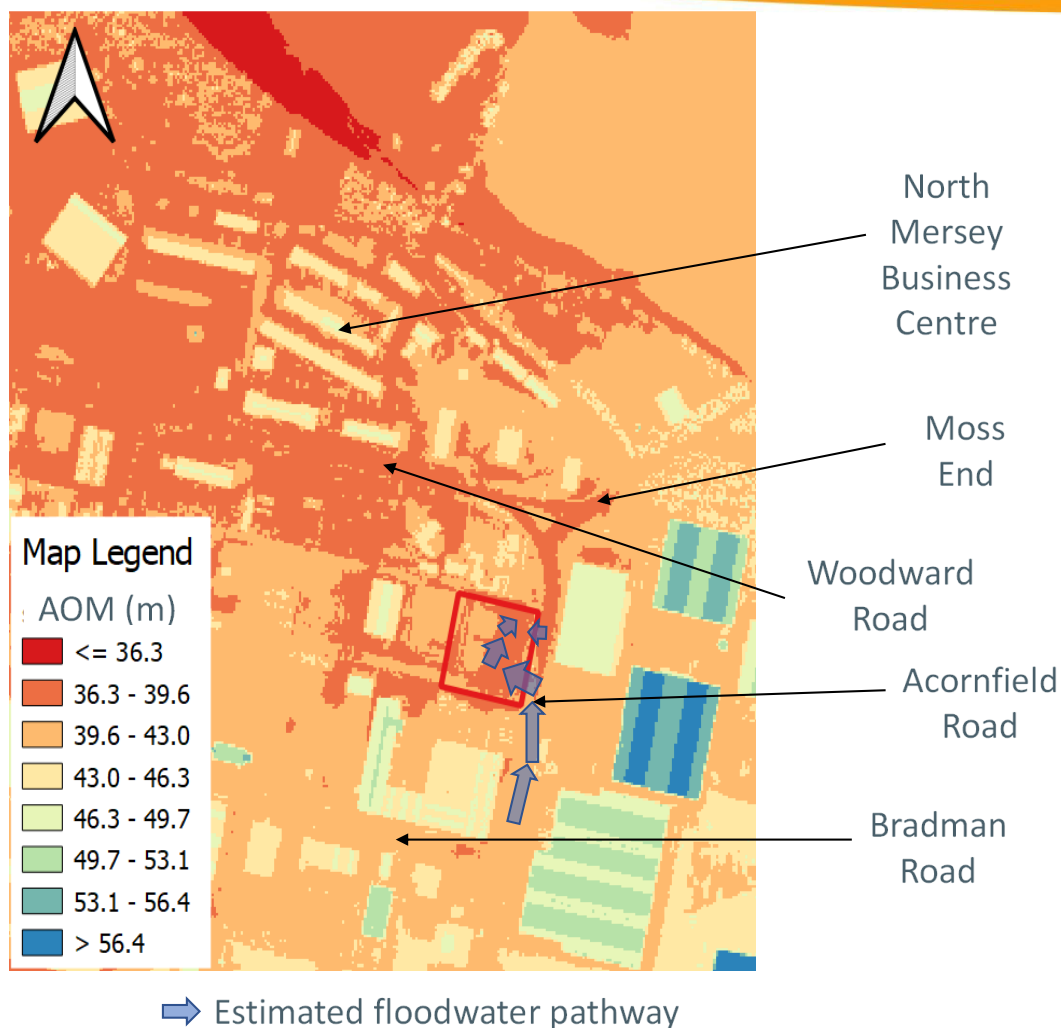


Figure 6: 2019 LiDAR data rendered into a DSM in QGIS.

6.4 Displacement of Flood Water

6.4.1 Local Impacts

The approximate area of the modelled flood zone 3 area within the 0.4882ha proposed site is approximately just 0.002ha (or 20m²), using Magic Map [ref. 1]. With an approximate average depth of 900mm AOD, based on the LiDAR data, this equates to approximately 18m³ of floodwater storage. If the land where the gas peaking plants are located were raised, there is less likelihood that this quantity of water would be stored here and therefore here we consider the local impacts of this.

Figure 6 shows the likely floodwater pathways under the site's current layout. The current main cause of flooding to the site is from the southern access point via Acornfield Road. It is expected that the installation of a raised area will change the direction of this pathway and alter the potential

accumulation of water in the flood zone 3 area in the north-east region of the site. This will potentially have the following knock-on local impacts:

- Floodwater from the south would potentially travel further north and flood to a greater extent in areas to the north. This may include the section of Acornfield Road to the north of the site, and potentially as far as the junction to Moss End Way.
- Floodwater from Acornfield Road may gather in larger quantities in other areas of the site.
- Displacement of floodwater to the land east of Acornfield Road is unlikely due to the higher ground.

6.4.2 Wider Impacts

Figure 2 shows the location of the site in relation to current flood risk for the surrounding area. As the flood zone 3 area in the site is approximately 20 m² the amount of floodwater the site is modelled to store (approx. 18 m³) is considered to be insignificant by this FRA compared to the flooding modelled in the wider area. This includes modelled fluvial flooding to the north and also flooding to fields that are north-east of the industrial estate. It is therefore considered that the proposed site use will have an insignificant impact on flood dynamics of the wider area.

7 Surface Water Management

SUDS measures at the lower end of the SUDS Hierarchy is proposed to be implemented for this site. It is planned that the site will utilise the current drainage system in place with alterations. Gravel areas for around the gensets (see Site Plan in Appendix I) will provide localised rainfall infiltration. These alterations are detailed in the drainage strategy section of this report (see 10.2).

The geology of the catchment has an impact on the potential and function of infiltration SUDS [ref.10]. Sandstone deposits such as those where the proposed site is located have reasonable permeability and as a result may be suitable for an infiltration-based drainage system [ref.9]. The level 2 SFRA identifies Kirkby (in the north of the Borough) to be the area with the highest potential for infiltration-based SUDS due to having sand drift deposits and underlying sandstone geology [ref.9].

8 Occupants and Users of the Development

Flooding of the site off Acornfield Road is predicted but the site would not be routinely staffed and can be operated remotely during a flood event.

9 Exception Test

As the proposed development is within a flood zone 3 area, the exception test must be applied.

The UK power mix moving rapidly away from fossil fuels to include renewables and nuclear presents a continuity and capacity problem for the National Grid at peak consumption and when it is cloudy and still. The solution is the strategic development of local short-term balancing reserves that can smooth the peaks, generating between 10-50 MW. The proposed gas peaking plant will help to provide these reserves through a high-power output and high electrical efficiency with low levels of emissions.

Regarding social impacts, the development will create 4 full-time equivalent jobs in support roles and supplement further work for maintenance of the gas engines.

As discussed earlier in the document the site has been designed to be safe over its lifetime.

10 Flood Risk Mitigation

10.1 Finished Floor Levels

As per Environment Agency guidance, the finished floor levels of the proposed site, where the engines are positioned shall be at least 300 mm above Flood Zone 3 flood depths of 900 mm as worst case [ref.13] with reference to site topography based on 2015 surveys [ref. 20]:

- The approximate level of the current level 3 flood zone = $39.6 + 0.9 = 40.5$ m AOD
- Standing Advice Freeboard = 0.3 m
- **Minimum ground floor levels**
 - $40.5 + 0.3 = 40.8$ m AOD

Equipment should be installed at or above this elevation.

10.2 Drainage Strategy

A section of the local development order for Knowsley Industrial and Business Park [ref.14] states the following:

'SC6: Drainage: No development shall commence until a scheme for the provision and implementation of a surface water regulation system to manage the risk of flooding from both overland flow and from

the sewer network has been submitted to and approved in writing by the Local Planning Authority. The development shall not be brought into use until the approved scheme has been implemented in its entirety'. [ref.14].

It is proposed that the current drainage system in place on the site will be utilised. However, it is important that the status of the drains on the site are checked and verified before work progresses. As mentioned in the local development order, it is necessary that the site has a detailed drainage management system in place where the design flow for floodwater has been put in place. The drains put in place will need to be able to handle the design flow of 3.9 litres/second (Section 5.2) and be accessible for inspection and maintenance.

10.3 Safe Access and Egress

- Flooding of the access and egress route off Acornfield Road is predicted but the site would not be routinely staffed and can be operated remotely during a flood event.
- In the event of flooding the plant will be subject to remote shut down/isolation.
- No significant effects on the existing surface water drainage regime are anticipated as a result of the development proposal. However, the existing regime will likely need to be redeveloped due to damage caused through the remediation works.
- All on-site controls and critical infrastructure will be raised to 40.8 m AOD elevation. This is to reduce residual risks associated with flood defence breach and increase flood warning time in this event.

11 Residual Risk

A review of residual risk was required as part of this FRA process and appropriate mitigation measures considered. The risks that remain after risk management and mitigation as per Environment Agency guidance [ref.13] have also been presented (Appendix II).

In summary, there is a low residual risk of flooding on site.

12 Conclusions

The proposed 0.4882ha development of a gas peaking plant at the Knowsley Industrial Estate site, off Acornfield Road, Kirkby, is a low residual risk from flooding. The proposed site is located within a modelled Flood Zone 3a; however, re-profiling of the site levels will provide final floor levels of 40.8 m AOD elevation which will mitigate against surface water flooding from Acornfield Road.

Flood impact to the surrounding area is considered insignificant.

A drainage management system needs to be installed which will manage surface water flooding from Acornfield Road.

Flooding of the access and egress route off Acornfield Road is predicted but the site would not be routinely staffed and can be operated remotely during a flood event. In the event of flooding the plant will be subject to remote shut down/isolation.

13 Recommendations

- Drainage management that can handle a design flow of 3.9 litres/sec.
- Final floor levels for all site controls and critical infrastructure at 40.8 m AOD elevation to mitigate against potential surface water run off via Acornfield Road.
- Flood Management and Recovery Plan outlining the procedures to be followed in the event of flooding, including site evacuation – the site operator should develop and maintain such plans under their site management plan. This will ensure the business is prepared for flooding and what to do in an emergency. Collaboration with neighbouring businesses and community for flood resilience and recovery should be an aspect of these plans.
- Flood Alerts – the site operator should sign up for alerts from the local flood authority, Met Office, and Environment Agency. This will provide further resilience to the business and further safety benefits in terms of potential evacuation and execution of the Flood Management Plan
- Raised electrical sockets, wires, and other services of the proposed development, making buildings and/or plant more resilient to flooding by reducing the risk of having to replace services following flooding (e.g. security cabin, plant and distribution control panels, lighting, substation etc.).
- Using paints/plasters, floor finishes and insulation in buildings that are resilient to water.
- As best as practicable, the proposed development should be designed for ease of drying and cleaning of building and plant areas following flooding. For example, making sure there's access to all spaces to enable drying and/or cleaning.

14 Flood Risk Assessment Credentials

Dr Peter Shanahan is a member of the Chartered Institution of Water and Environmental Management (CIWEM), with experience of completing industrial flood risk assessments. He has completed flood risk training with CIWEM and Symmons Madge.

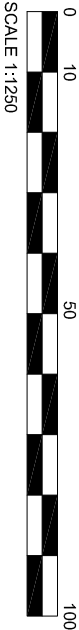
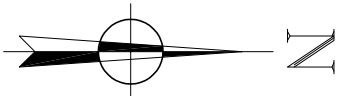
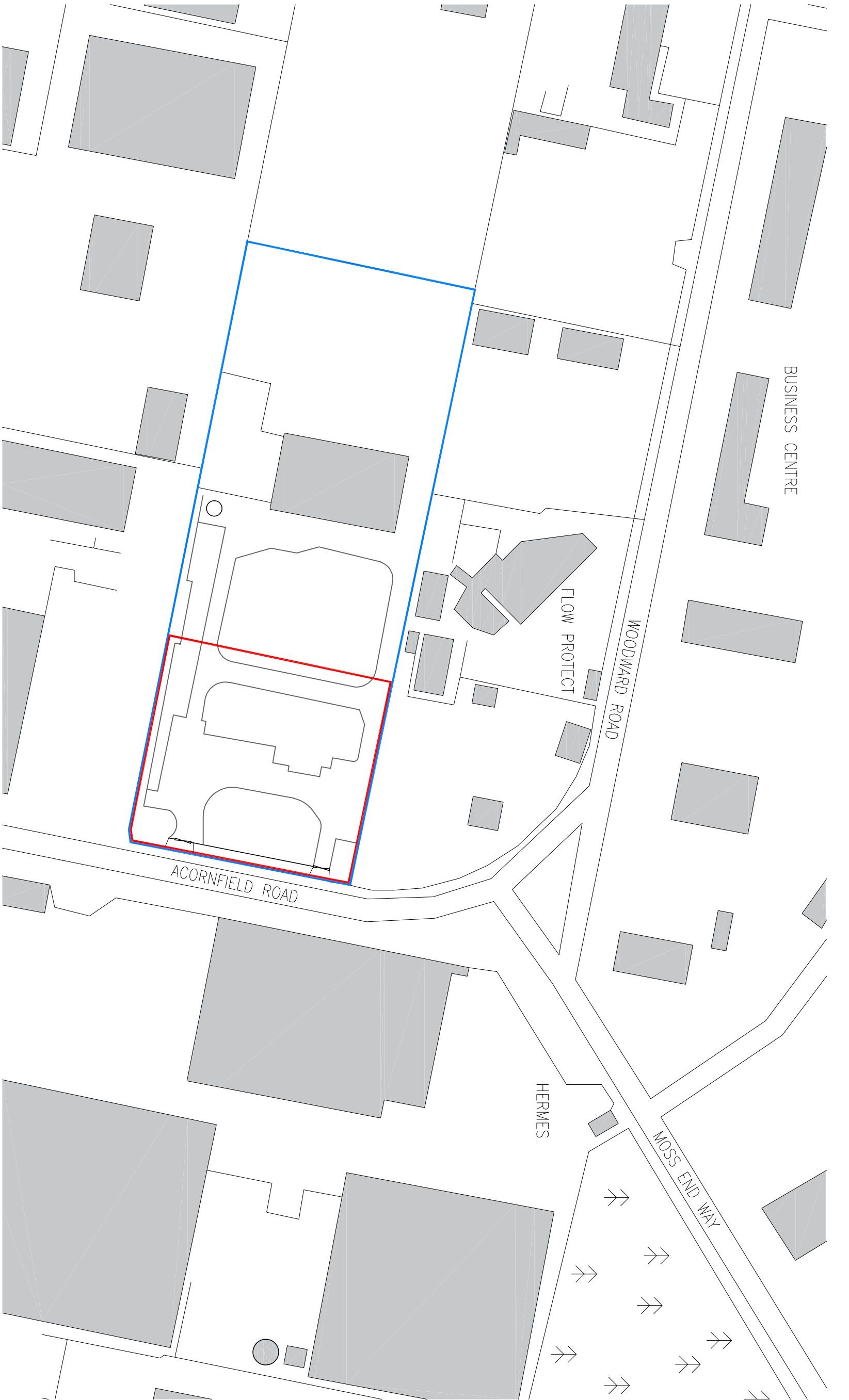
References

- 1 Department for Environment, Food and Rural Affairs (DEFRA) (2021), (<https://magic.defra.gov.uk/magicmap.aspx>).
- 2 Environment Agency (EA) (2021), Flood map for planning.
- 3 Ministry of Housing, Communities & Local Governance (2014), Flood risk and coastal change (<https://www.gov.uk/guidance/flood-risk-and-coastal-change>).
- 4 Knowsley Metropolitan Borough Council (MBC) (2017), Local Flood Risk Management Strategy (<https://www.knowsley.gov.uk/knowsleycouncil/media/Documents/kmbc-local-flood-risk-managemend-strategy-october-2017.pdf>).
- 5 Environment Agency (EA) (2015), River basin district map (<https://www.gov.uk/government/publications/river-basin-district-map>).
- 6 Environment Agency (EA) (2020), Flood risk assessments: climate change allowances (<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>).
- 7 Knowsley Council and Sefton Council (2009), Strategic Flood Risk Assessment (http://www.knowsley.gov.uk/pdf/eb14_strategicfloodriskassessment.pdf).
- 8 Environment Agency (EA) (2021), Check the long-term flood risk for an area in England (<https://flood-warning-information.service.gov.uk/long-term-flood-risk/risk>).
- 9 Knowsley Metropolitan Borough Council (2012), Level 2 Strategic Flood Risk Assessment (http://www.knowsley.gov.uk/pdf/eb15_strategicfloodriskassessment-level2.pdf).
- 10 Environment Agency (EA) (2016), North West river basin district, Flood Risk Management Plan 2015 to 2021 (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/507122/LIT_10210_NORTH_WEST_FRMP_PART_B.pdf).
- 11 British Geological Survey (BGS) (2021), Geology of Britain viewer. (<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>).
- 12 Insynch Energy Services (2019), Gas Peaking Plant Feasibility Study, Kirkby, Acornfield Industrial Estate.
- 13 Environment Agency (2019), Preparing a flood risk assessment: standing advice (<https://www.gov.uk/guidance/flood-risk-assessment-standing-advice#extra-flood-resistance-and-resilience-measures>).
- 14 Knowsley Council (2021), Knowsley Industrial and Business Park Local Development Order (www.knowsley.gov.uk/pdf/Adopted%20Knowsley%20Industrial%20Park%20LDO.pdf#:~:text=1.1).
- 15 Department for Environment, Food & Rural Affairs (DEFRA) (2021), Defra Survey Data Download (<https://environment.data.gov.uk/DefraDataDownload/?Mode=survey>).

- 16 Met Office (2021), Monthly Northwest England & Wales precipitation. Hadley Centre observations datasets. (<https://www.metoffice.gov.uk/hadobs/hadukp/>)
- 17 UK SUDS (2021), Surface water storage volume estimation tool (<https://www.uksuds.com/drainage-tools-members/surface-water-storage-tool.html>)
- 18 DAY Architectural (2021), Location Plan, Gas Peaking Plant Acornfield Road, Kirkby, 1:2500, 1185-21-XX-00-DR-A-0001 Rev A.
- 19 DAY Architectural (2021), Gas Engine Container Plans and Elevations, Gas Peaking Plant Acornfield Road, Kirkby, 1185-21-XX-00-DR-A-0005 Rev A.
- 20 AMEC (2016), Syntor Acornfield Road Remediation Verification Final Report 17223i2.
- 21 DAY Architectural (2021), Gas Engine Container Plans and Elevations, Gas Peaking Plant Acornfield Road, Kirkby, 1185-21-XX-00-DR-A-0004 Rev A.

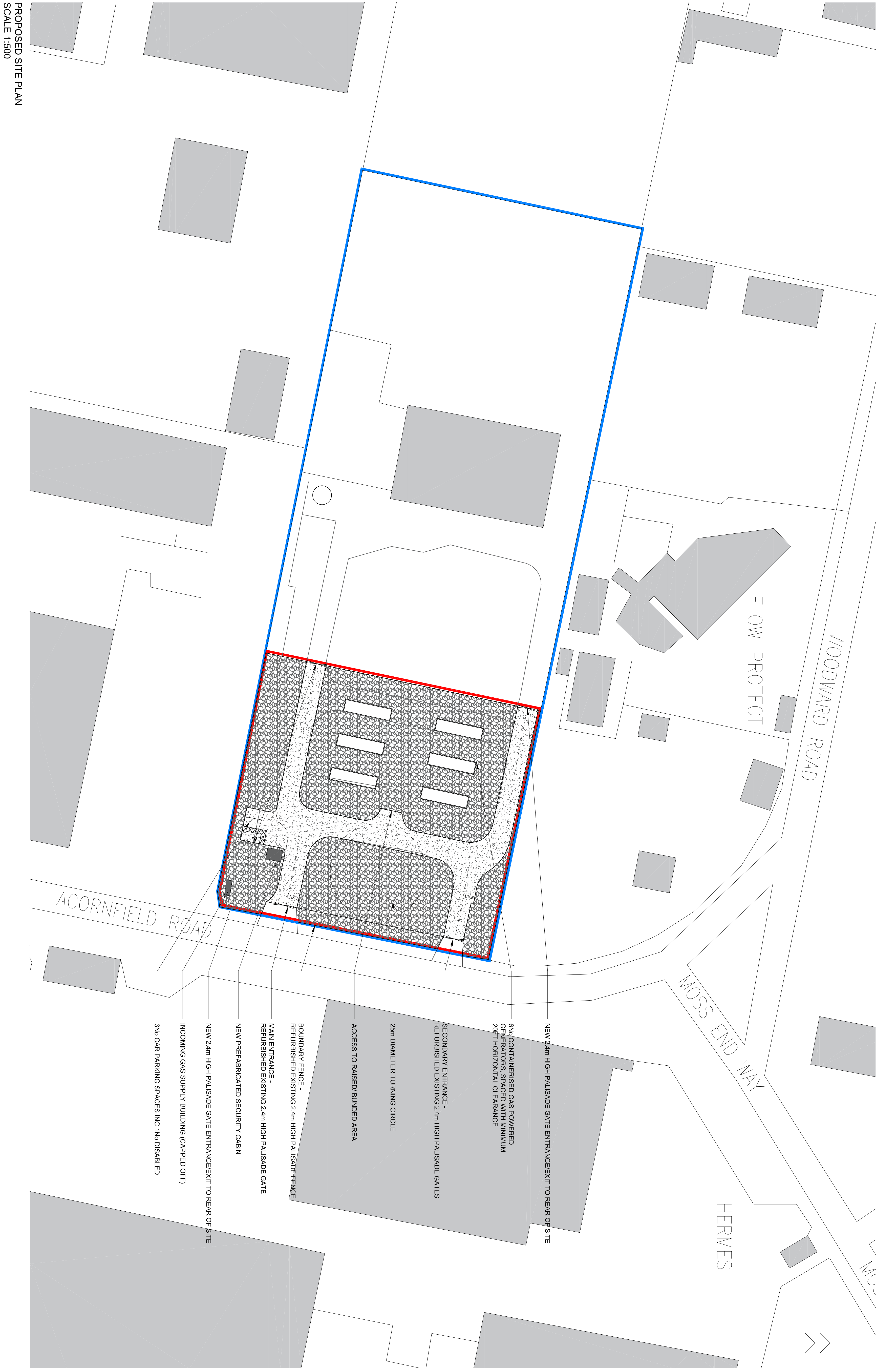
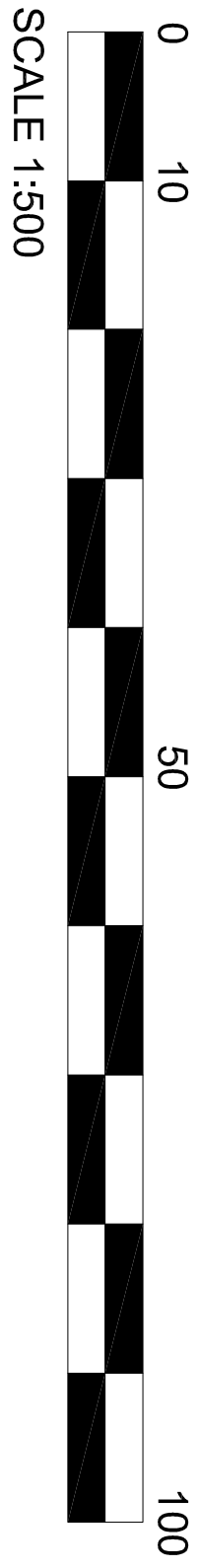
Appendices

Appendix I. Plans



GENERAL NOTES: DAY Architectural Ltd accepts no responsibility for any costs, losses or claims whatsoever arising from these drawings, specifications and related documents unless there is full compliance with the Client or any unauthorised user of the following: - All boundaries, dimensions and levels are to be checked on site before construction and any discrepancies reported to the Architect / Designer. - Partial Service Any discrepancies with site or other information is to be submitted to the Architect / Designer and checked and / or approved to be as shown before the implementation of the design. - Block and site plans are reproduced under license from the Ordnance Survey. - Do not scale the drawings. - For the purpose of construction, all relevant parties must check the information prior to implementation and report any discrepancies to the Architect / Designer.		LINE TYPE KEY SITE BOUNDARY 14,493sqm / 3.6 Acres APPLICATION BOUNDARY 4,882 sqm / 1.2 Acres			
CLIENT Insynch Energy Services LTD		DRAWING Location Plan			
PROJECT Gas Peaking Plant, Acornfield Road, Kirby		SCALE 1:1250	PAPER SIZE A3		
		DATE 15/04/2021	DRAWN BY MDB		
		DAY DRAWING NO. 1185-21-XX-00-DR-A-0001	REVISION A	PROJECT NO. 1185-21	
		DRAWING STATUS PLANNING			
REV A	DESCRIPTION Initial issue	DATE 15.04.21	Information contained on this drawing is the sole copyright of DAY Architectural Ltd and is not to be reproduced without their permission.		
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REV	DESCRIPTION	DATE	REV BY	CHKD BY	PROJECT Acornfield Road, Kirkby	SCALE 1:300	PAPER SIZE A1	DRAWN BY MDB	PROJECT No. 1185-21
A	Initial Issue	15/04/21	MDB		DAY DRAWING No. 1185-21-XX-00-DR-A-0004	DATE 15/04/2021	REVISION A		
					DRAWING STATUS PLANNING				



PROPOSED SITE PLAN
SCALE 1:500

Appendix II. Residual Flood Risk

No.	Hazard	Cause	Before controls			Consequence	Response	After controls		
			P	I	Risk =PxI			P	I	Risk=PxI
1	Flooding of property.	Surface water runoff from extreme rainfall above design standards.	4	2	8	Damage to gas engines. Cleaning of installation and subsequent building work for repairs.	Developer: suitably maintained drains, grids, and guttering. Final floor level 40.8 m AOD (300 mm above FZ3 flood depth 900mm)	4	1	4
2	Flooding of property.	Failure of site drains.	4	2	8	Damage to gas engines. Cleaning of installation and subsequent building work for repairs.	Developer: suitably maintained drains, grids, and guttering. Final floor level 40.8 m AOD (300 mm above FZ3 flood depth 900mm) Site drainage management plan incorporated into Environmental Management System.	4	1	4
3	Road flooding.	Extreme rainfall.	2	5	10	Impeded access/egress to the site. Delayed emergency response.	Final floor level 40.8 m AOD (300 mm above FZ3 flood depth 900mm) Assumed management of highways drainage by local authority. Proposed flood management and recovery plans of site operator.	2	2	4

Appendix III. Maps

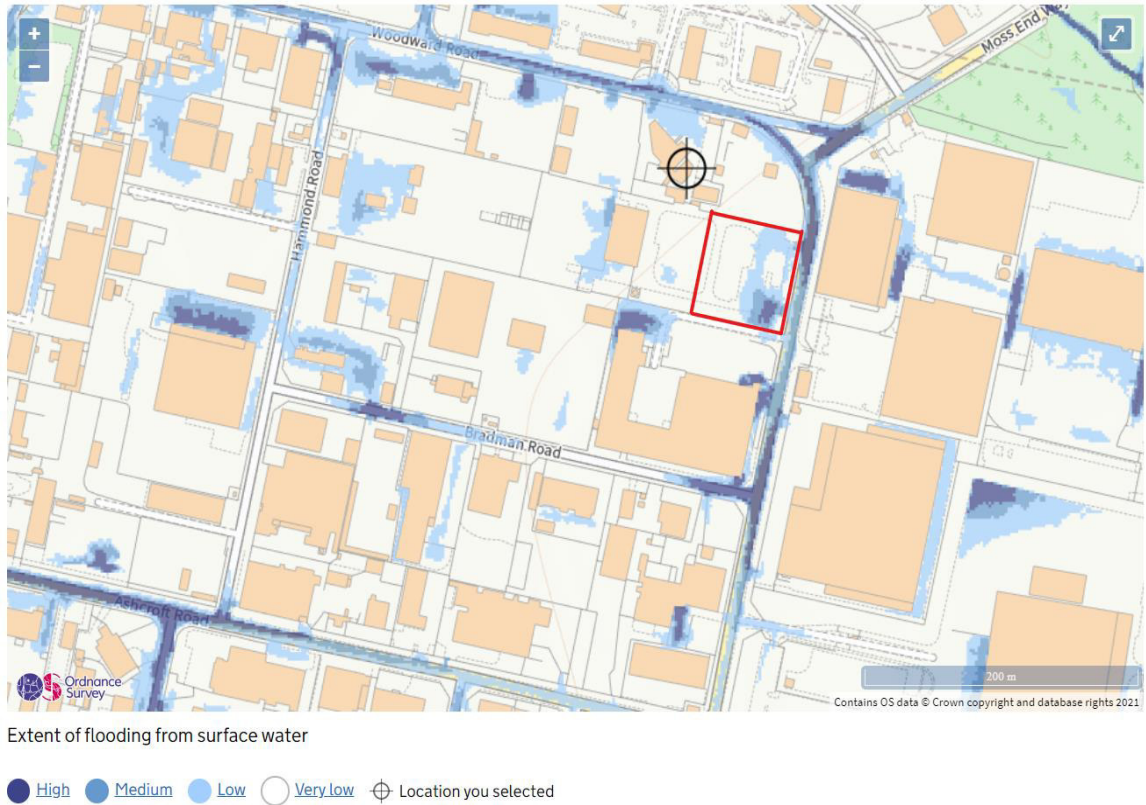
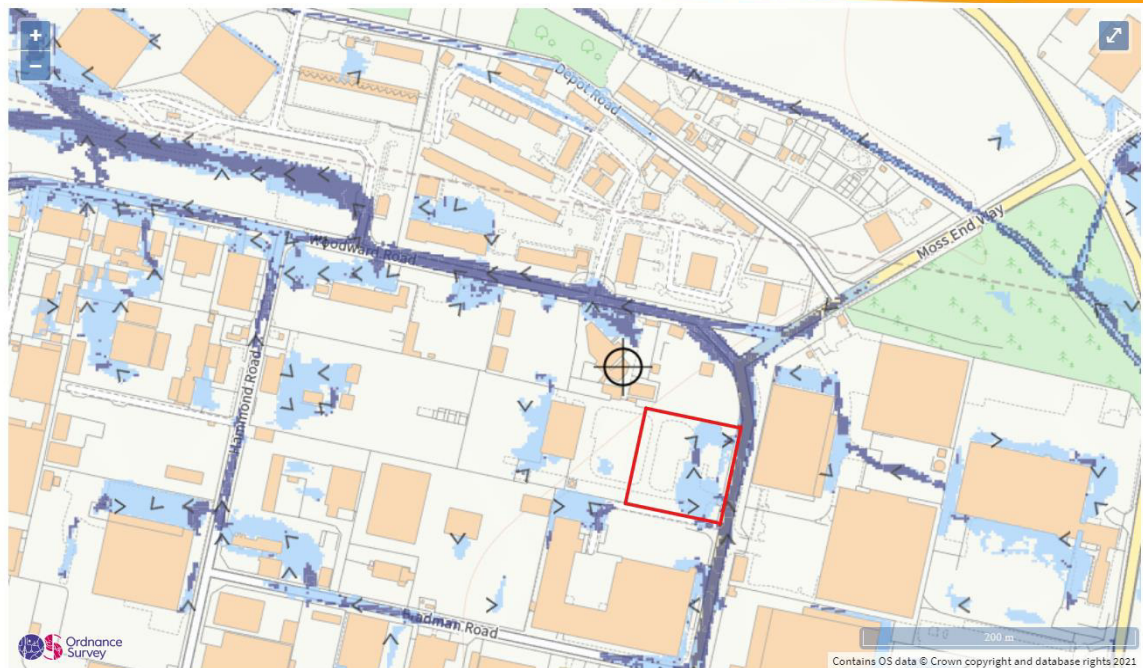


Figure 7: Risk of flooding from surface water [ref.8].

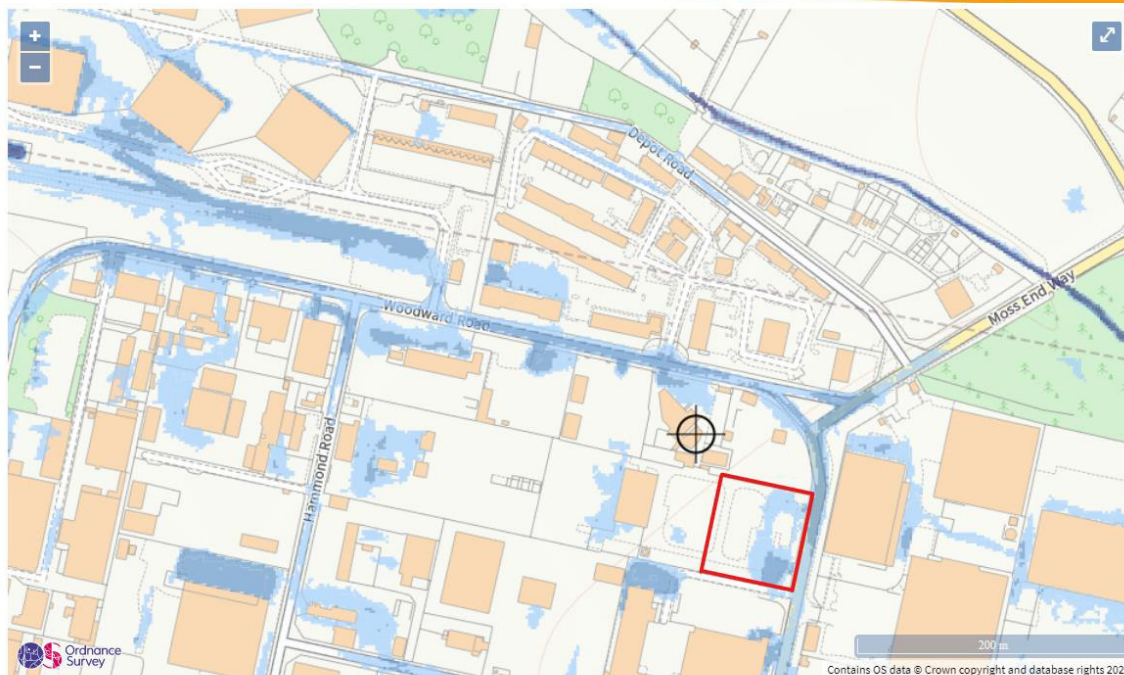


Surface water flood risk: water velocity in a low risk scenario

Flood velocity (metres/second)

● Over 0.25 m/s ● Less than 0.25 m/s ▼ Direction of water flow ⊕ Location you selected

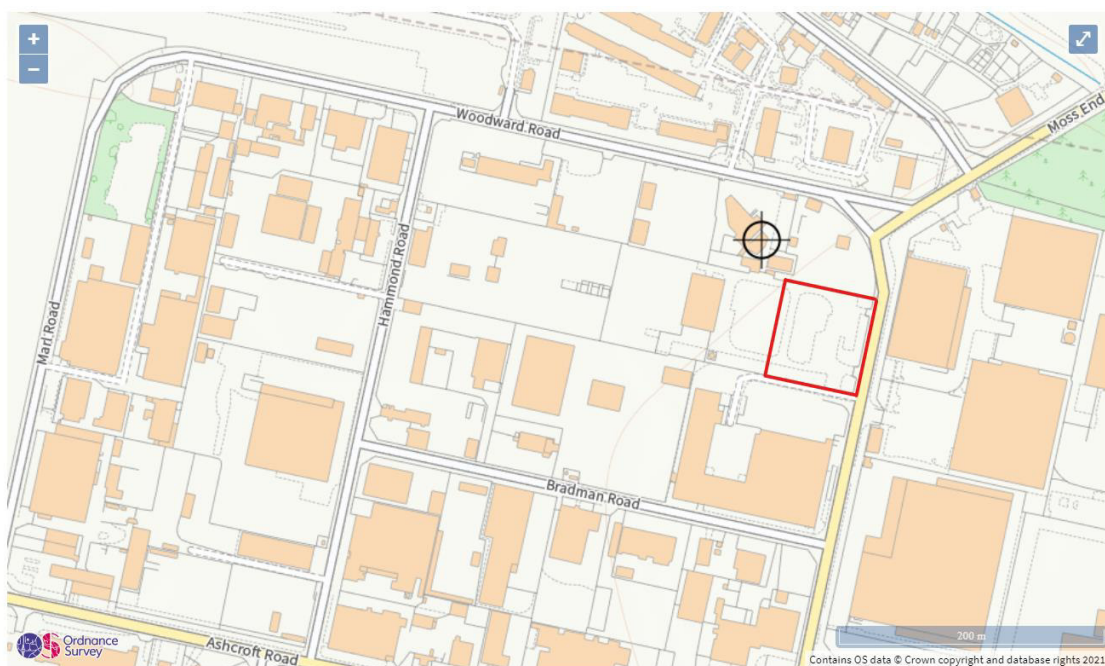
Figure 8: Surface water flood risk: water velocity in a low-risk scenario [ref.8].



Surface water flood risk: water depth in a low risk scenario
Flood depth (millimetres)

Over 900mm 300 to 900mm Below 300mm Location you selected

Figure 9: Surface water flood risk: water depth in a low-risk scenario [ref.8].



Extent of flooding from rivers or the sea

High Medium Low Very low Location you selected

Figure 10: Extent of flooding from rivers or the sea [ref.8].

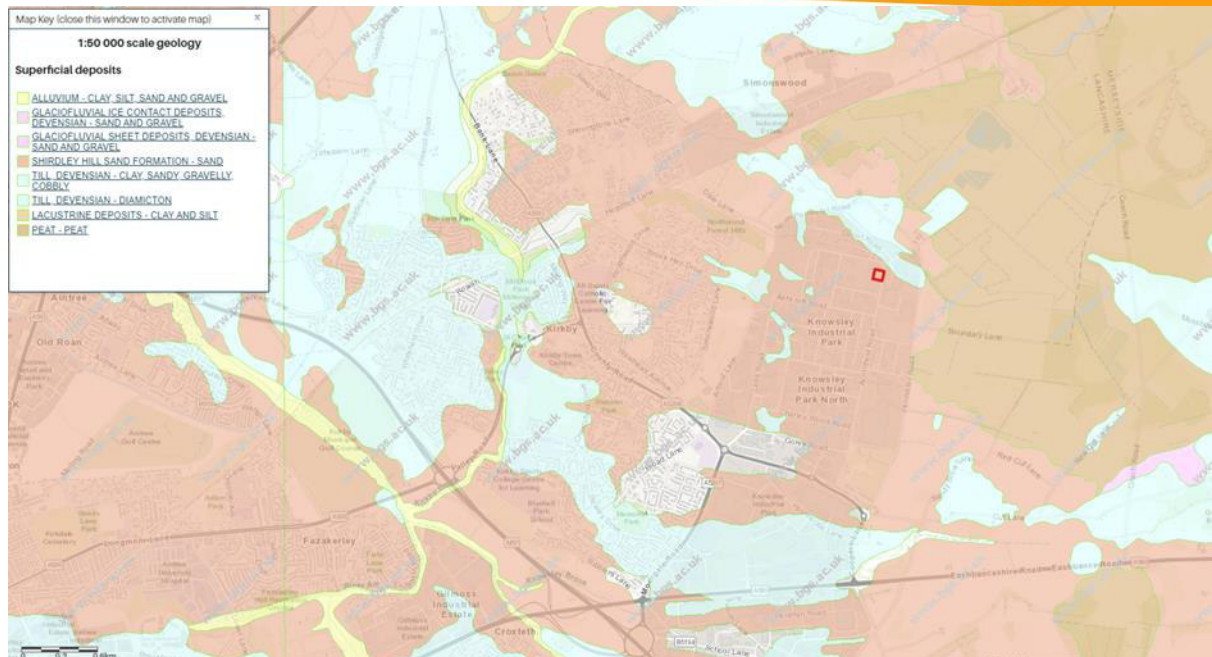


Figure 11: Superficial deposits at the site and the surrounding area [ref.11].

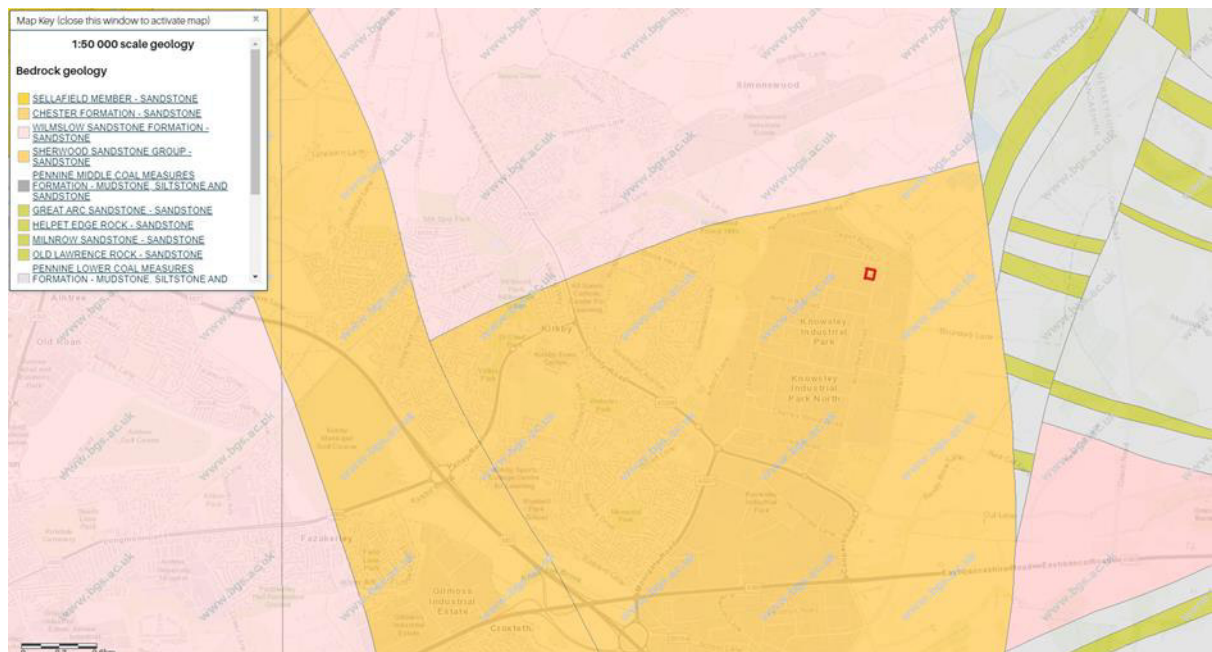


Figure 12: Bedrock geology at the site and surrounding area [ref.11].

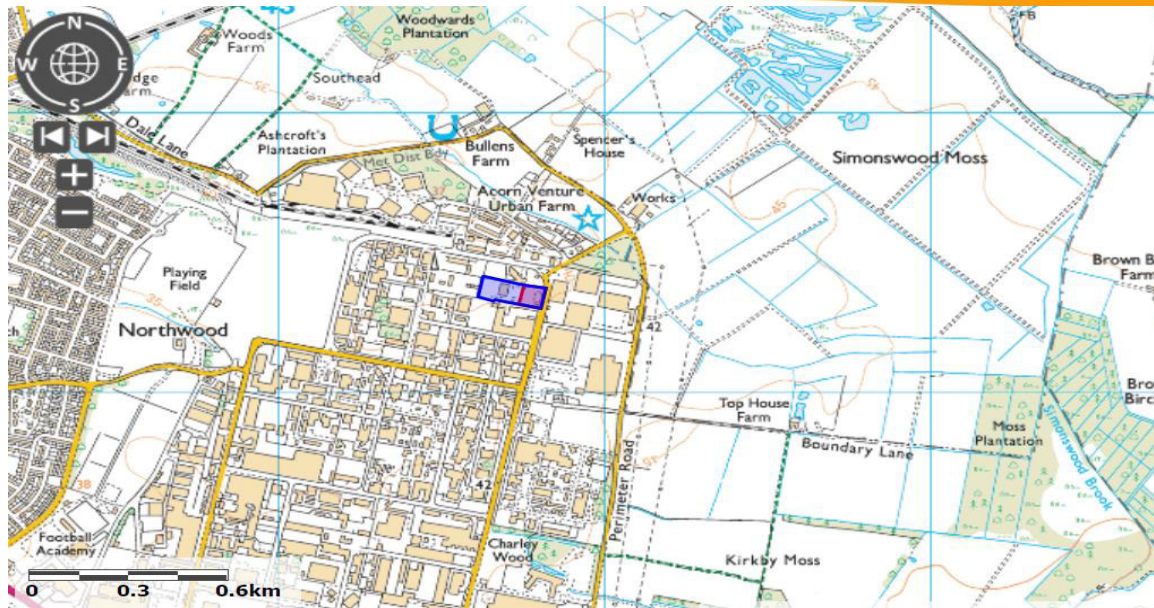


Figure 13: Map of the site and surroundings [ref.1].

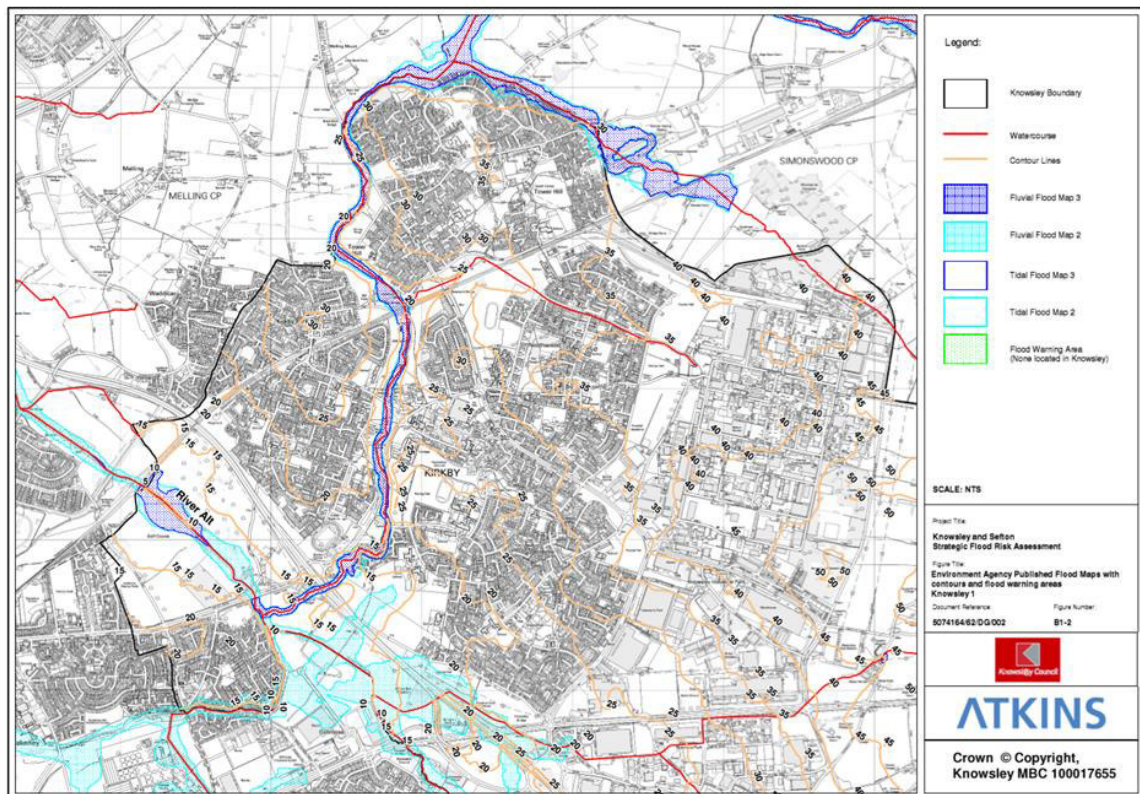
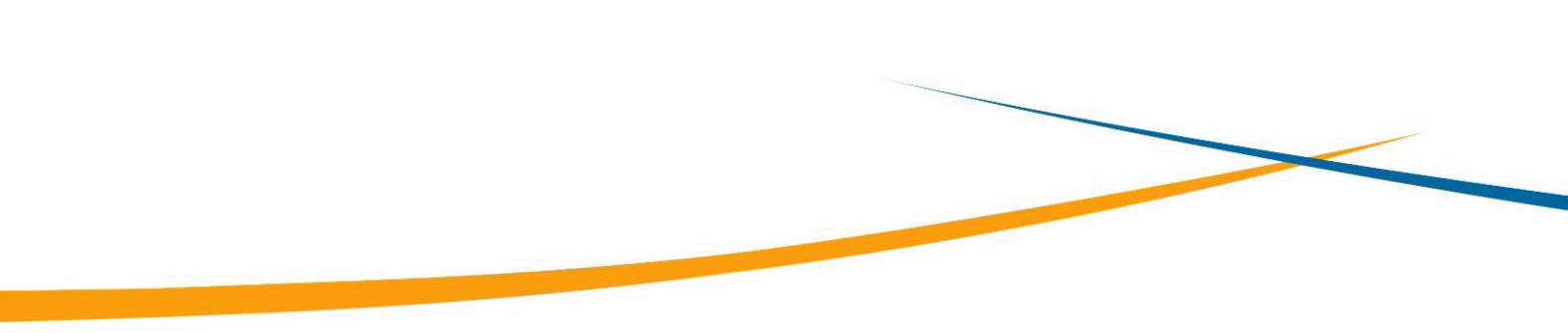


Figure 14: Fluvial flood map of Knowsley with contours [ref.7].



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