



Flood Risk Assessment

Oldlands Farm, Bognor Regis, PO22 9NN

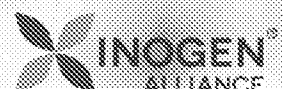
Presented to Lysander Associates

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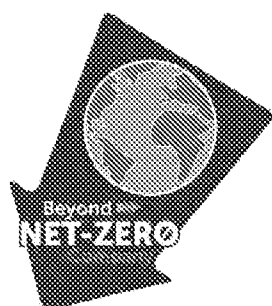
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Specialising in Environment, Health & Safety and Sustainability, Delta-Simons provide support and advice within the property development, asset management, corporate and industrial markets. Operating from across the UK we employ over 120 environmental professionals, bringing experience from across the private consultancy and public sector markets.



Delta-Simons is proud to be a founder member of the Inogen Environmental Alliance, enabling us to efficiently deliver customer projects worldwide by calling upon over 5000 resources in our global network of consultants, each committed to providing superior EH&S and sustainability consulting expertise to our customers. Inogen Environmental Alliance offers its clients more consultants, with more services in more countries than the traditional multinational consultancy.

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Reference of Terms

Canal Failure

Canal failure can include a breach or overtopping of a canal system due to the effects of a high intensity rainfall event or structural failure that is not associated with a rainfall event. Such failure can be very dangerous as it can involve the rapid release of large volumes of water at high velocity, however, it is typically limited to reaches of canal that are raised above the surrounding ground level on one or both side and where watercourses or other structures pass beneath the canal. The size and nature of canals themselves can also have a hydraulic control on the mechanisms of flooding associated with a failure, resulting in a rapid peak in flow followed by a gradual reduction as the flow becomes restricted by the capacity of the canal itself to rapidly pass flow to the breach or failure point.

Fluvial Flooding

Fluvial flooding typically occurs when a river's capacity is exceeded, and the excess water overtops the river banks. It can also occur when the watercourse has a high level downstream, perhaps due to structures or blockage, thus limiting conveyance. This creates a back-up of water which can overtop the banks. Typical flooding issues occur when the natural floodplain has been urbanised and the river has been confined.

Groundwater Flooding

Groundwater flooding is caused by the emergence of water from beneath the ground at either point or diffuse locations when the natural level of the water table rises above ground level. This can result in deep and long-lasting flooding of low-lying or below-ground infrastructure such as underpasses and basements. Groundwater flooding can cause significant damage to property, especially in urban areas, and can pose further risks to the environment and ground stability.

Reservoirs Failure

Reservoir failure can be a particularly dangerous form of flooding as it results in the sudden release of large volumes of water that can travel at high velocity. This can result in deep and widespread flooding, potentially resulting in significant damage. The likelihood of reservoir flooding occurring is generally extremely low given that all large reservoirs are managed in accordance with the Reservoirs Act 1975. Under the Reservoirs Act 1975, a large raised reservoir is defined as one that holds over 25,000 cubic metres of water above the level of the surrounding land. The EA's online reservoir inundation map illustrates the maximum flood extents that could potentially occur in the event of a reservoir failure.

Sewer Flooding

Flooding from sewers primarily occurs when flow entering a system exceeds available capacity or if the network capacity has been reduced through blockage or collapse. In the case of surface water sewers that discharge to watercourses, the same effect can be caused as a result of high water levels in the receiving watercourse. As a result, water can begin to surcharge the sewer network, emerging at ground level through gullies and manholes and potentially causing flooding to highways and properties. If this occurs flooding can represent a significant hazard to human health due to the potential for contaminants in flood water.

Surface Water Runoff

Surface water runoff is defined as water flowing over the ground that has not yet entered a drainage channel or similar. It usually occurs as a result of an intense period of rainfall which exceeds the infiltration capacity of the ground. Typically, runoff occurs on sloping land or where the ground surface is relatively impermeable. The ground can be impermeable either naturally due to the soil type or geology, or due to development which places impervious material over the ground surface (e.g. paving and roads).

Tidal Flooding

Tidal flooding is caused by high tides coinciding with a low-pressure storm system which raises sea and tidal water levels, overwhelming coastal and river defences. This may be made worse by gale force winds blowing the raised body of water up tidal river basins some distance from the coast, due to floodwater being forced up the tidal reaches of rivers and estuaries. Such flooding may become more frequent in future years due to rising sea levels.

Executive Summary

Project Understanding	Delta-Simons has been requested by Lysander Associates (the “Client”) to undertake a Flood Risk Assessment (FRA) for a parcel of land at Oldlands Farm, Bognor Regis. The FRA has been produced to support a planning application for the erection of a warehouse (Use Class B8) with ancillary office, associated vehicle parking, van storage, plant, ancillary structures, lighting, landscaping and infrastructure works including earthworks to facilitate flood compensation area.
Flood Risk Assessment Summary	The existing Site comprises low lying, undeveloped agricultural land and is located within an area allocated for employment use within ADC’s Local Plan. The main potential source of flooding to the Site is fluvial and combined fluvial and tidal flooding, the baseline flood risk from all other sources of flooding are considered Low. EA Modelled flood data indicates that the Site is within the extents of the 5% AEP flood event for both the fluvial and combined fluvial and tidal scenarios. Fluvial risk at the Site is attributed to Oldlands Farm Ditch in the south west and combined flood risk is derived from tidal and fluvial interactions between the on-site land drains and Lidsey Rife to the east of the Site. The baseline fluvial / tidal flood risk at the Site is assessed to be Moderate to High. The identified flood risk will be mitigated by raising ground levels to between 2.5 m to 4.0 m AOD. Finished Floor Level of the proposed unit is to be set at 3.65 m AOD approximately 2.05 m above the maximum flood level expected during the + 35% CC event and 1.94 above the +45% CC event. To ensure land raising does not increase flood risk elsewhere, it is proposed to provide level-for-level floodplain compensation within a parcel of land to the north west of the Site for the 1% AEP + 35% CC event. A high-level assessment of the proposed FCS area indicates that this is feasible for this scheme, the design of the FCS area should be considered further during the detailed design stage. A culvert assessment indicates that there is sufficient capacity within Oldland Farm Ditch box culvert to pass flows during the 1% AEP event. Overall, the proposed mitigation measures will reduce the fluvial / tidal risk at the Site and the impact of the development elsewhere to Low. The impact of the development on surface water risk will be managed with a surface water management scheme, which is designed to restrict flows to the greenfield rate and attenuate storms up to the 1 in 100 year + 40% CC event. Overall, the impact of the development on surface eater risk and all other sources of risk is considered Low.
Recommendations	⚡ Ensure Site levels are raised above the maximum flood level during the 1% AEP + 35% CC event (1.60 m AOD); ⚡ Determine FCS design when undertaking detailed drainage design and on development of a final masterplan; ⚡ Undertake excavation works in drier summer months where possible and employ dewatering activities where groundwater is encountered; ⚡ Obtain ‘Land Drain Ordinary Watercourse’ consent from WSCC LLFA prior to undertaking any infilling / removal works; ⚡ Maintenance access to Oldlands Farm Ditch should be retained. Maintenance access can be ensured by providing a 3.5 m buffer either side of the ditch; ⚡ A 2.0 m easement should be provided from the railway lines along the eastern boundary in accordance with National Rail requirements and as outlined in the 2015 outline application. To ensure the proposed FCS area to the north of the Site does not impact railway infrastructure, it is proposed to provide a 20.0 m easement from the railway lines to the east of the proposed FCS area; and ⚡ A 10 m easement from any gas mains should be retained.

This is intended as a summary only. Further detail and limitations of the assessment is provided within the main body of the Report.

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1.0 Introduction

1.1 Appointment

- 1.1.1 Delta-Simons Environmental Consultants Limited ("Delta-Simons") was instructed by Lysander Associates (the "Client") to carry out a Flood Risk Assessment (FRA) for land at Oldlands Farm, Bognor Regis, PO22 9NN (the "Site").

1.2 Project Understanding

- 1.2.1 The proposed development will comprises erection of a warehouse (Use Class B8) with ancillary office, associated vehicle parking, van storage, plant, ancillary structures, lighting, landscaping and infrastructure works including earthworks to facilitate flood compensation area.
- 1.2.2 On the Environment Agency (EA) Flood Map for Planning, the Site is shown to be within Flood Zone 2 (Medium Probability) and Flood Zone 3 (High Probability).
- 1.2.3 Flood Zone 2 is defined as land assessed as having between a 1% and 0.1% (1 in 1000) annual probability of flooding from rivers, and between a 0.5% and 0.1% annual probability of tidal flooding. Flood Zone 3 is defined as land assessed as having a 1% (1 in 100) or greater annual probability of river flooding and a 0.5% (1 in 200) or greater annual probability of tidal flooding.
- 1.2.4 The aim of this report is to assess the potential flood risk to the Site, the impact of the proposed development on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified risk. This report has been prepared in accordance with the guidance contained in the National Planning Policy Framework (NPPF) revised in 2019, and the National Planning Practice Guidance (NPPG) Flood Risk and Coastal Change.
- 1.2.5 This FRA should be read in conjunction with the separate Drainage Strategy for the Site.

1.3 Scope of Works

- 1.3.1 The scope of works has been as follows for this FRA:
- ▲ Assess flood risk from all sources using best available information including review of EA data and mapping, topography and historical records;
 - ▲ Assess previous relevant studies, local authority plans or strategies;
 - ▲ Assess evacuation routes;
 - ▲ Advise on availability of flood warnings;
 - ▲ Conduct Floodplain Compensatory Storage (FCS) requirements;
 - ▲ Undertake a culvert assessment;
 - ▲ Identify the requirement for a Sequential Test;
 - ▲ Advise on flood mitigation measures and residual risks; and
 - ▲ Prepare FRA report.
- 1.3.2 This report takes into account the following national and local policies:
- ▲ National Planning Policy Framework (NPPF) (2019)¹;
 - ▲ National Planning Practice Guidance (NPPG) (2014)²;
 - ▲ CIRIA Guidance: The SuDS Manual (C753) (2017)³; and

1 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/779764/NPPF_Feb_2019_web.pdf

2 <http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/>

3 https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

- ▲ West Sussex County Council (WSCC) and Arun District Council (ADC) Local Development and Planning Policies.

1.4 Sources of Information

1.4.1 The following sources of information have been reviewed and assessed for the purpose of this FRA:

- ▲ EA online Flood Maps⁴;
- ▲ British Geological Society (BGS) Interactive Map⁵;
- ▲ MAGIC Interactive Map⁶;
- ▲ Beachy Head to Selsey Bill Shoreline Management Plan (2006 SMP);
- ▲ WSCC Preliminary Flood Risk Assessment (2011 PFRA);
- ▲ Lidsey Surface Water Management Plan (2014 SWMP);
- ▲ Hydrock Consulting Flood Risk Assessment and Drainage Strategy (2014 FRA and DS);
- ▲ MJA Consulting Flood Risk and Drainage Assessment (2015 FRA and DA);
- ▲ Arun Strategic Surface Water Management Study (2016 SSWMS);
- ▲ ADC Level 1 and Level 2 Strategic Flood Risk Assessment (2016 SFRA);
- ▲ Hydrock Consulting Desk Study and Ground Investigation, (2017 GI);
- ▲ West Sussex LLFA Policy for the Management of Surface Water (2018 PMSW); and
- ▲ Arun District Council Interactive Map⁷.

1.5 Project Limitations

- 1.5.1 The EA Climate Change Guidance was updated in 2016, therefore it is possible that the data shown on the EA Flood Map for Planning and the EA Long-Term Map does not take into account the implications of climate change. For Sites on the periphery of defended areas and or in close proximity to Flood Zone 3, further work may be required to more accurately determine the flood risk.
- 1.5.2 The wider Delta-Simons limitations are contained within Appendix A.

⁴ <https://flood-map-for-planning.service.gov.uk/>

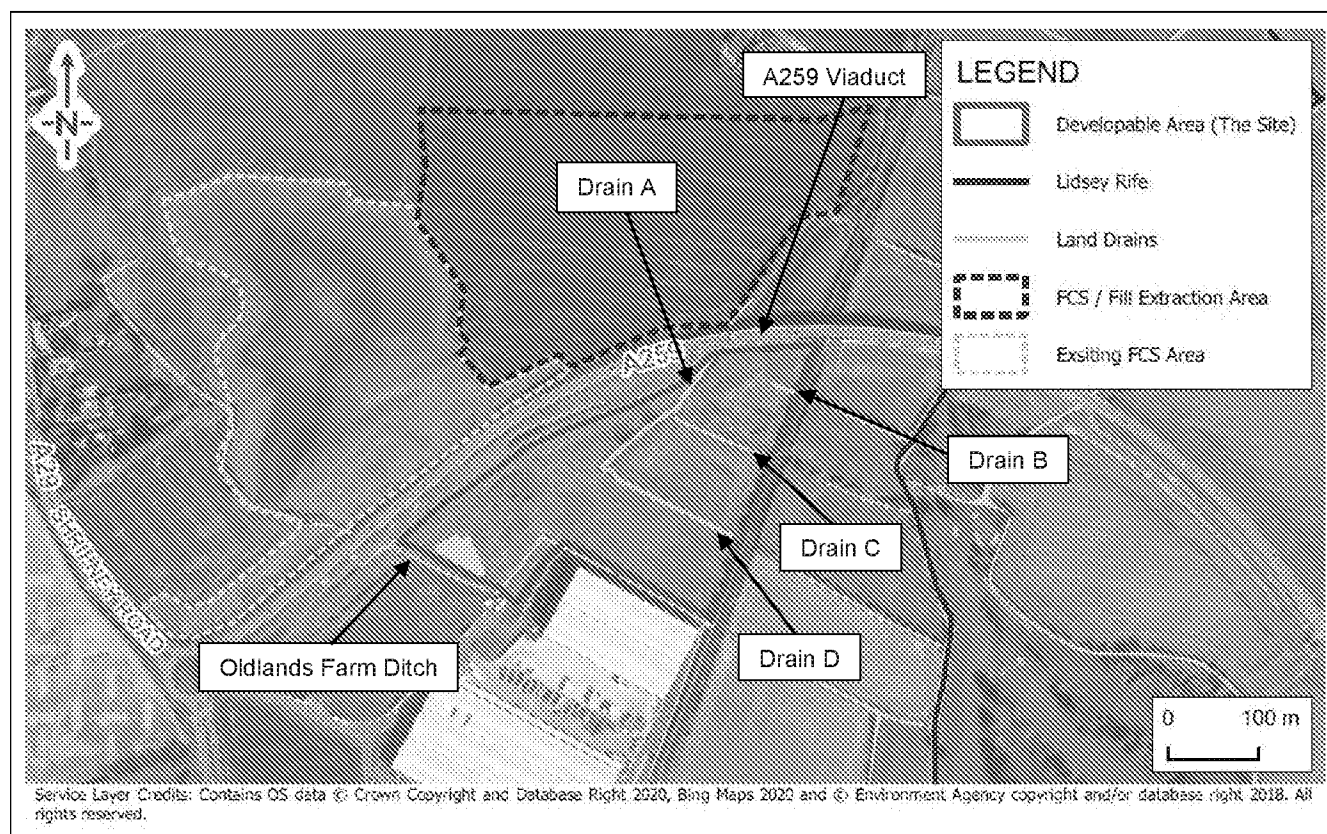
⁵ <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

⁶ <http://www.magic.gov.uk/>

⁷ <https://www1.arun.gov.uk/webapps/wml/Map.aspx?x=492543&y=100908&resolution=1.0&MapName=Helaa>

2.0 Site Description

2.1.1 The aim of this section of the report is to outline key environmental information associated with the baseline environment.



Illustrative Site Layout Plan

Co-ordinates	Centred approximately at National Grid Reference (NGR) 494570, 101850.	Total Area: 18.87 Ha Development Site Area: 7.0 Ha FCS and Fill Extraction Area: 11.87 Ha
Site Location	The Development Site ('The Site') is located approximately 2.6 km north-east of Bognor Regis train station, and approximately 2.3 km north from the English Channel. The Site is bound to the north by the A259, embanked railway lines to the east with the Lidsey Rife beyond, recently developed 'Phase 1' development which comprises the Rolls Royce warehouses to the south and an access road and the A259 to the west. The surrounding land largely comprises undeveloped agricultural land. The proposed development lies within the jurisdiction of Arun District Council (ADC) and West Sussex County Council (WSCC) who are the Lead Local Flood Authority (LLFA) for this region.	
Existing Site Conditions	Online mapping (including Google Maps accessed March 2021) shows that the Site comprises undeveloped agricultural land with field boundaries and agricultural drains. Access to the Site is provided from Felpham Relief Road (A259), turning south-east onto an access road which grants entry to the existing Site. There are no existing buildings or hardstanding on-site, the Site is 100% greenfield. The area to the north of the Site boundary and shown in the Site Layout Plan above is within the Clients ownership and is identified as a potential area to provide Flood	

	Compensatory Storage (FCS) and fill extraction. It should be noted that this area falls within the application boundary, as shown in Appendix B.
Topography	A topographical survey was undertaken at the Site and the parcel of land approximately 85 m north west of the Site boundary in March 2021 by Lane & Frankham Ltd. The surveys are made available in Appendix B. Within the development Site, the survey indicates a topographical high point of 2.65 metres Above Ordnance Datum (m AOD) in the north west and a minimum level of 0.7 m AOD in the north east, adjacent to Drain B. Ground levels slope slightly in a westerly direction; however the majority of the Site is relatively flat with levels ranging between 0.90 m AOD and 1.30 m AOD. Ground levels within the FCS area to the north west are shown to be elevated above Site, rising from a minimum of 2.04 m AOD in the south west to a maximum 5.59 m AOD in the north east, gradually rising in the north eastern direction to the top of a large earth mound. The land is shown to fall away from the mound in all directions with levels generally range between 3.0 m and 4.6 m AOD. Topographic levels to m AOD have also been derived from a 1.0 m resolution Environment Agency (EA) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM), dated 2019. The LiDAR data shows a similar topographical depicted on the topographical survey. Ground levels are generally flat across the Site with a topographical depression in the east and along the land drains. A small earth mound is identified in the south west, this mound is understood to be excavated land from the recent Phase 1 development to the south which comprises the Rolls Royce warehouses and a Lidl Store development. In the wider area, the railway embankment and the Phase 1 development to the south is identified to be raised above the existing Site levels. The railway lines are embanked, elevated at a minimum level of 2.3 m AOD, approximately 1.6 m above the minimum Site level. Ground levels to the south of the Site ranges between 2.1 m and 3.0 m AOD and are understood to have been raised as part of the Phase 1 development to mitigate flood risk. Observations made during the Site walkover noted the A259 rises in a north eastern direction along Site's western and northern boundary, becoming a viaduct to the north of the Site. Land north west of the Site boundary and the A259 is shown be located within a depression at approximately 1.0 m AOD, compared to the adjacent surrounding land. On review of previous planning applications, it is understood that this land was excavated to provide FCS for the A259 and the Phase 1 development. The existing FCS area is shown in the above Site Layout Plan.
Hydrology	There are several land drains and Ordinary Watercourses within and surrounding the Site boundary, these are the responsibility of the LLFA to maintain. A land drain known as Oldlands Farm Ditch runs along the south western boundary, flowing in a west to east direction. The drainage ditch flows through a newly constructed box culvert beneath the A259 and access road, along the Site boundary and beneath the eastern railway lines. Oldlands Farm Ditch eventually drains into Lidsey Rife, which is located approximately 145 m east of the Site boundary, at its closest point. Upstream of the Site, Oldlands Farm Ditch connects to the existing FCS area which is located approximately 70 m west of the Site at its closest point and identified as a large topographical depression on the LiDAR Plan (Appendix B). Balancing ponds are located in the south west and to the west of the Site boundary, the ponds discharge runoff directly to Oldlands Farm Ditch in the south west. A minor land drain is also identified along the eastern boundary of the Phase 1 development, adjacent

	to the railway lines. The land drain is shown to flow northwards and discharges into Oldlands Farm Ditch, south east of the Site. There are several land drains within the Site boundary which are understood to be associated with the Sites former agricultural use. An unnamed land drain is identified to pass beneath the A259 Viaduct, this drain is shown as Drain A in the above figure. A map showing on-site and surrounding watercourses obtained from ADC indicates that the Drain A flows in a north eastern direction, away from the Site (Appendix C). Drains B, C and D convey flows eastwards, beneath the railway lines within 450 mm diameter culverts and eventually drain into Lidsey Rife. The topographical survey (Appendix B) shows there to be no direct connection between Drain A and Drains B, C or D. Lidsey Rife is a designated Main River (responsibility of the EA to maintain), located approximately 145 m east of the Site at its closest point. Lidsey Rife is a tributary of Aldingbourne Rife. The watercourse flows in a north to south direction for approximately 1.5 km until it meets its confluence with Aldingbourne Rife, near Whitfield Close. Aldingbourne Rife continues to flow southwards and eventually discharges into the English Channel via pumped outfalls near Longbrook Park. At its closest point, the English Channel is located approximately 2.3 km south of the Site boundary. Lidsey Rife is a tidally influenced watercourse. There are several culverts associated with the on-site and surrounding drainage channels beneath the railway lines and the A259. A figure showing the location of each culvert and photographs taken during a Site walkover by Delta-Simons in September 2020 is included in Appendix C. The figure also shows the location of 'flood tunnels' which were constructed beneath the A259 during its development. According to the Envirocheck® Report, there are seven licensed abstraction records from surface water located within 1000 m of the Site.
Geology	Reference to the BGS online mapping (1:50,000 scale) indicates that the majority of the Site is underlain by superficial deposits of Raised Marine Deposits consisting of clay, silt, sand and gravel. The western extent of the Site is shown to be underlain with superficial deposits of River Terrace Deposits (undifferentiated) containing sand, silt, and clay. The underlying bedrock comprises undifferentiated chalks of the Lewis Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and the Portsdown Chalk Formation. The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a Site-specific basis. There are no BGS recorded boreholes on the Site or in the immediate vicinity of the Site. However, previous investigation conducted on the Site (Hydrock, October 2017) shows the geology encountered comprised the following generalised sequence: ▲ Topsoil comprising dark brown gravelly slightly clayey sand to depths between 0.2 and 0.80 m below ground level (bgl); ▲ Made Ground comprising variable dark brown to pink brown gravelly sand. Gravel of asphalt, concrete, brick, plastic and rope to depths of 0.30 m bgl – this was present on in one location (TP129) in the north-western edge of the Site; ▲ Raised Marine Deposits comprising very soft light grey mottled orange gravelly sandy or silty clay, locally with plant remains and gravel of flint and chalk to depths between 0.90 and 5.80 m bgl; and ▲ Undifferentiated chalks comprising structureless chalk of sandy gravelly silt and sandy gravel to 15 m bgl (base of the exploratory boreholes).

Hydrogeology	According to the EA's Aquifer Designation data, obtained from MAGIC Map's online mapping (accessed 24/03/2021), the superficial geology of the Raised Marine Deposits and River Terrace Deposits are classified as Secondary A Aquifer. Secondary A Aquifers are 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'. The underlying bedrock geology is described as a Principal Aquifer, these are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. There are no recorded groundwater abstractions within 1 km of the Site. Monitoring data from the Hydrock, October 2017 investigation shows the groundwater table is standing at approximately 0.84 m to 1.2 m bgl beneath the development Site. Groundwater is expected to flow to the east, towards the Lidsey Rife river. Updated groundwater monitoring was undertaken by Hydrock between November 2020 to February 2021. The water table was recorded between 0.07 m and 1.32 m bgl, however the standing groundwater / waterlogged soils were noted in logs BH04 / BH05 and BH06 on 15/12/2021. The water table underlying the FCS area to the north west of the Site was recorded between 1.10 m to 1.20 m bgl. The EA's 'Source Protection Zones' data, obtained from MAGIC Map's online mapping [accessed 24/03/2021], indicates that the Site is not located within a Groundwater Source Protection Zone. Further information is included in the Preliminary Risk Assessment produced by Delta-Simons.
Proposed Site Conditions	The proposed development involves erection of a warehouse (Use Class B8) with ancillary office, associated vehicle parking, van storage, plant, ancillary structures, lighting, landscaping and infrastructure works including earthworks to facilitate flood compensation area. A parcel of land to the north west of the Site boundary has been identified as a potential area to provide FCS, this is detailed further within this report and shown in Appendix D. The proposed development will result in an increase in hardstanding areas in the form of buildings and access. It is proposed to raise Site level to between 2.5 m and 4.0 m AOD. Finished Flood Level (FFL) of the proposed unit will be set at 3.65 m AOD. An indicative development plan and Site levels plan (ref: C002 Rev P4) are included in Appendix E.
Previous Planning	A hybrid planning application for was submitted for the Site in June 2015 (Ref: AL/58/15/OUT) which comprised a full planning application for earth works to facilitate flood compensation area and an outline application (all matters reserved) for up to 20,453 sq m of B2 General Industrial Floorspace together with B8 warehousing & distribution floorspace. The 2015 FRA and DA was produced to support the development in 2015. It is understood that the application was granted planning with the following conditions imposed on the scheme relating to flood risk: ➤ Condition 4 required no development to be carried until details of the proposed compensatory flood storage has been submitted to and approved by the Local Planning Authority (LPA); ➤ Condition 18 required detailed plans submitted to the LPA for approval, including details and plans which show that sufficient space has been allowed for the maintenance of Oldlands Farm Ditch. An easement area was not specified; and ➤ Condition 20 details that the development shall not proceed until formal consent has been approved in writing from the Lead Local Flood Authority (WSCC) or its agent (ADC) for the discharge of any flows to watercourses, or the culverting, diversion,

	infilling or obstruction of any watercourse on the site. It is stated any discharge to a watercourse must be at a rate no greater than the pre-development run off values. Given the similarities between the 2015 application and the proposed development, the above application has been considered as part of this assessment.
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3.0 Relevant Planning Policy and Guidance

3.1 Introduction

- 3.1.1 The aim of this section of the report is to discuss the main aspects of the local and national planning policies that are relevant to any proposed development on the Site and relevant guidance and legislation.

3.2 Assessment of Flood Risk

- 3.2.1 The flood risk from fluvial (Main Rivers) and coastal flooding is assessed through the use of the EA Flood Maps (flood risk from rivers or the sea). This map defines three zones of different flood risk, the third of which is subdivided into two categories:

- ▲ Zone 1 “Low probability of flooding” – This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%);
- ▲ Zone 2 “Medium probability of flooding” – This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year;
- ▲ Zone 3a “High probability of flooding” – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year; and
- ▲ Zone 3b “Functional floodplain” – A sub-part of Zone 3, this zone comprises land where water has to flow or be stored in times of flood. This zone is not normally included within the national Flood Map for Planning and is calculated where necessary using detailed hydraulic modelling.

3.3 National Planning Policy Framework

- 3.3.1 Flood risk in England is normally considered through the planning process in the NPPF (2019), produced by Ministry of Housing, Communities and Local Government.

- 3.3.2 The principle aim of the NPPF assessment of flood risk is that:

“Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere”.

- 3.3.3 The NPPF requires a FRA to be produced where development Sites are:

- ▲ Greater than one hectare in size;
- ▲ All proposals for new development (including minor development and change of use) in Flood Zones 2 and 3;
- ▲ Or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the EA); and
- ▲ Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

- 3.3.4 The NPPF requires that developers consider not just the flood risk to the development but also the impact that the development might have on flood risk elsewhere. As well as Main Rivers and the sea, it is also necessary to consider flood risk from other sources, including surface water, groundwater, Ordinary Watercourses, artificial drainage systems, canals and reservoirs.

Sequential Test

- 3.3.5 A key part of the NPPF is that a proposed development must first pass a “Sequential Test” to demonstrate that the overall development proposal is appropriate in terms of flood risk. It ensures that a sequential approach is followed to guide new development to areas with the lowest probability of flooding.

Vulnerability Classification

- 3.3.6 In accordance with Table 2 of the NPPG: Flood Risk and Coastal Change, commercial / industrial developments are considered to be 'less vulnerable'. Table 3 of the NPPG (reproduced below as Table 1), states that 'less vulnerable' development is considered appropriate within Flood Zones 2 and 3. Given that development is deemed acceptable in this location, the Exception Test does not need to be applied in this instance.

Table 1: Flood Risk Vulnerability Classification (from Table 3 of online Planning Practice Guidance)

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water-Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	✗	Exception Test required	✓	✓
Zone 3b	Exception Test required	✗	✗	✗	✓

✓ development is permitted

✗ development is not permitted

3.4 Local Policy

- 3.4.1 The ADC's Housing & Economic Land Availability Assessment (HELAA) is a technical and theoretical assessment of sites that could potentially contribute towards the future supply of housing and employment land within the Local Planning Authority (LPA) areas. The ADC Interactive Map shows that the Site is located within an area designated as a potential 'Employment Site (Business/Industrial)'.
- 3.4.2 The ADC Local Plan was adopted on 18th July 2018 and sets out the spatial vision, objectives and a sustainable strategy for delivering the needed growth of the District over the period 2011- 2031. The plan contains the following policies and requirements for FRA and surface water management:

Policy W SP1: Water

...Development will be encouraged to make active use of surface water as a design feature and permitted where it identified measures to improve and enhance waterbodies, coastal habitats or provides additional flood relief.

The council will also support development that:

- Is appropriately located, taking account of flood risk and promotes the incorporation of appropriate mitigation measures into new development, particularly Sustainable Drainage Systems that reduce the creation and flow of surface water and improves water quantity;*
- Reduces the risk to home and places of work from flooding whilst increasing biodiversity;*
- Delivers a range of community benefits including enhancing the quality of life and providing greater resistance to the impact of climate change.*

Policy W DM2: Flood Risk

...Development in areas at risk from flooding, identified on the latest Environment Agency flood risk maps and the Council's Strategic Flood Risk Assessment (SFRA__, will only be permitted where all the following criteria have been satisfied:

- a. The sequential test in accordance with the National Planning Policy Guidance has been met.*
- b. The site specific Flood Risk Assessment demonstrates that the development will be safe, including access and egress, without increasing flood risk elsewhere and reduce flood risk overall.*
- c. The sustainability benefits to the wider community are clearly identified.*
- d. The scheme identifies adaption and mitigation measures.*
- e. Appropriate flood warning and evacuation plans are in place; and*
- f. New site drainage systems are designed to take account the events which exceed the normal design standard i.e. consideration of flood flow routing and utilising temporary storage areas.*

The reports prepared as part of the criteria above must take into account contingency allowances, taking climate change into account as set out in the Flood Risk Assessments: climate change allowances section of the NPPG.

In location where strategic flood defence or resilient and resistant construction measures are necessary within the site itself, proposals will be required to demonstrate how measures have been incorporated as intrinsic part of the scheme in manner which is compatible with the latest Strategic Flood Risk Assessment.

All developments proposals must take account of relevant Surface Water Management Plans, Catchment Flood Management Plans and related Flood Defence Plans and strategies such as the lower Tidal River Arun Strategy. The council may require financial contributions from development on sites where measures to address flood risk or to improve the environmental quality of watercourses have been identified by these Plans and Strategies.

Policy W DM3: Sustainable Urban Drainage Systems

...To increase the levels of water capture and storage and improve water quality all development must identify opportunities to incorporate a range of Sustainable Urban Drainage Systems (SUDS), appropriate to the size of development, at an early stage of the design process.

Proposals for both major and minor developments proposals must incorporate SUDS within the private areas of the development in order to provide source control features to the overall SUDS design. These features include:

- Green roofs*
- Permeable driveways and parking*
- Soakaways*
- Water harvesting and storage features including water butts.*

Proposals for major development must also integrate SUDS within public open spaces and roads, reflecting discussion with the appropriate bodies. SUDS must therefore be integrated into the overall design of the development and must:

- a. Contribute positively to the appearance of the area, integrating access to allow maintenance of existing watercourses and the system.*
- b. Effectively manage water (including its quality)*

- c. Accommodate and enhance biodiversity by making connections to existing Green Infrastructure assets and*
- d. Provide amenity for local residents (ensuring a safe environment)*
- e. Retain the existing drainage network of the site and the wider area,*
- f. Be maintained in perpetuity, supported through a Maintenance and Management Plan/Regime, including its financing, agreed with the Local Planning Authority.*

In order to ensure that SUDS discharge water from the development at the same or lesser rate, as prior to construction, developers must:

- f. Follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in the Approved Document H of the Building Regulations and the SUDS manual produced by the CIRIA.*
- g. Undertake up to six months groundwater monitoring within the winter period.*
- h. Undertake winter percolation testing in accordance with BRE365.*
- i. The proposed drainage system must be designed to ensure that there is no flooding in a 1 in 30 year storm event.*
- j. The design must also take account of the 1 in 100 year storm events plus 30% allowance for climate change, on storage volumes, to ensure that there is no flooding of properties or the public highway or inundation of the foul sewerage systems. Any excess flows must be contained within the site boundary, and within designated storage areas.*

3.4.3 The Aldingbourne Neighbourhood Plan 2014-2034 was adopted in October 2016 and forms part of the Development Plan. The following policies within the plan relate to flood risk and sustainable drainage:

Neighbourhood Plan Policy EH4 (Protection of Watercourse)

Proposals that support and promote river catchment management, wildlife conservation and reduce flood risk will be supported.

Neighbourhood Plan Policy EH5 (Surface Water Management)

New development, within areas at risk from flooding, will not be permitted unless it is supported by a site-specific Flood Risk Assessment which provides clear evidence to demonstrate that the proposal:

- a. Would not give rise to additional risk of flooding, either to the development site or to other land, arising from the carrying out or use of the development;*
- b. Would make appropriate provision for accommodating the surface water and foul water arising from the development*

3.5 Consultation

3.5.1 A pre-planning opinion request was submitted to the EA and LLFA in March 2021, a response was not provided at the time of writing. The LLFA were also consulted in October 2020 for site specific flood risk information, this is included in Appendix F and discussed further in Section 4.1.14.

3.5.2 An 'Ordinary Watercourse Land Drainage' consent form has been submitted to the council in March 2021, a response is awaited.

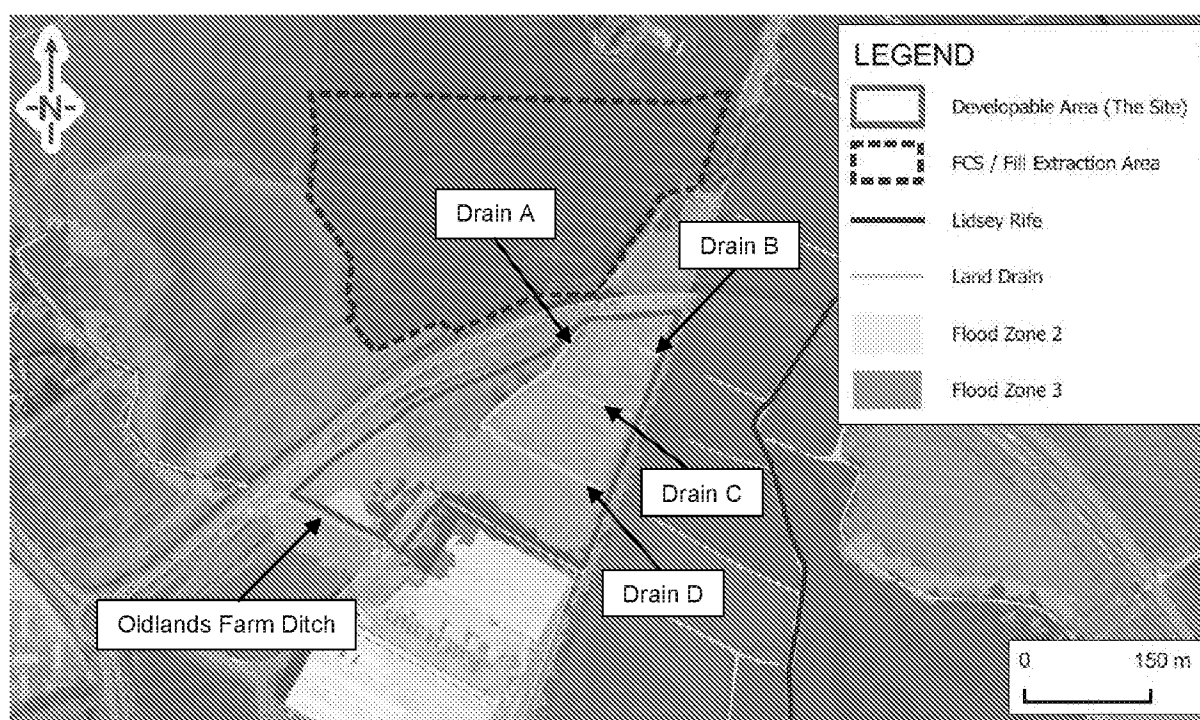
3.5.3 The Site is not located within an Internal Drainage Board (IDB) District.

4.0 Assessment of Flood Risk

4.1 Fluvial / Tidal Flood Risk

- 4.1.1 The EA Flood Map for Planning shows that the development Site is largely located within Flood Zone 2 (Medium Probability). A portion of the south western periphery and land to the east of the railway lines is shown to lie within Flood Zone 3 (High Probability), as shown in Figure 1 below.
- 4.1.2 Land to the north west of the Site which is to be utilised for FCS / fill extraction is within Flood Zone 1 (Low Probability) and outside the extreme 0.1% AEP flood extent. The location of the FCS area is shown in Appendix D.
- 4.1.3 The Site is located approximately 2.3 km north of the English Channel and 145 m west of Lidsey Rife, which is tidally influenced in this location. There are several land drains on-site and in the surrounding areas. Fluvial flows within Oldlands Farm Ditch and Drains B, C and D are conveyed eastwards, beneath the railway line and discharge into Lidsey Rife. Drain A is shown to issue on-site and flow in a north eastern direction, connecting to the wider drainage system to the north and eventually discharging flows into Lidsey Rife.
- 4.1.4 Tidal / fluvial flooding derived from the on-site drainage ditches and Lidsey Rife is a potential source of flood risk at the development Site. Two potential flood mechanisms have been identified. Fluvial flooding could occur if Lidsey Rife or the on-site land drains overtop their banks during or following an extreme rainfall event. There is also a potential risk of flooding due to tidal locking, where high water levels in Lidsey Rife restrict fluvial flows at the outfall of the land drains, causing flows to back up and overtop the drainage ditches further upstream and potentially impact the Site.

Figure 1: EA's Flood Map for Planning



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Flood Defences

- 4.1.5 The EA's online Flood Map shows the worst-case, undefended scenario and therefore is potentially overexaggerating fluvial / tidal risk at the Site and in the wider area.

- 4.1.6 The EA Spatial Flood Defence database indicates that there is 'high ground' on either side of Lidsey Rife which is assumed to be in the form of a natural earth embankments. The left embankment is shown to provide a Standard of Protection (SoP) up to the 20% (1 in 5 year) event. Crest levels of the embankment are not made available, and the cited Condition Grade is 3 (*Fair - defects that could reduce performance of asset*).
- 4.1.7 No crest level or defence information is available for Oldlands Farm Ditch or the on-site land drains. The topographical survey shows the banks of Drains B, C and D are situated at between 1.0 m and 1.4 m AOD. Oldlands Farm Ditch has a crest levels of between 1.0 m and 1.5 m AOD along the left bank and Drain A has a minimum crest levels of 1.35 m AOD.
- 4.1.8 The 2016 SFRA and the EA defence dataset indicates a range of tidal defences are present along the Bognor Regis coastline and the Aldingbourne Rife outfall.
- 4.1.9 A raised embankment providing a 1 in 200 year SoP is present along the coastline. The Bognor Regis Promenade (road) is situated on top of the embankment with a further tidal flood wall providing a 1 in 10 year SoP located to the rear of the Promenade road. The embankment and tidal flood wall are noted to have a Condition Grade of 3 and an effective crest level of 5.64 m AOD. However, the actual crest level of the tidal flood wall is likely to be higher than 5.64 m AOD as it is situated on top of the embankment.
- 4.1.10 The EA Asset Information Management System (AIMS) shows Aldingbourne Rife drains into the English Channel via flapped outfalls and a 'Pumping Station Compound'. During high tide levels, the pressure from the sea causes the flap valves to close shut, preventing tidal flows from entering the watercourse and travelling upstream. The pumping station pumps flows from Aldingbourne Rife out to sea when the flap valve has been closed shut via separate discharge pipes which are situated above the tide level. The pumping station ensures fluvial waters do not build behind the outfall at times when there are tidal restrictions at the outfall. The pumping station comprises three pumps and four spare pumps are available if needed. The station operated approximately 4 to 6 hours at a time and is monitored 24 hours a day via telemetry. The EA also has secondary valves upstream of Felpham Bridge to serve as a backup flood defence if the flap valves at the pumping station were to fail.
- 4.1.11 The 2006 SMP is to adopt a '*Hold The Line*' policy across this stretch of the estuary. This means that the long-term plans in this location are to maintain or improve the existing SoP whilst maintaining the existing alignment.
- 4.1.12 The Site is bound to the east by railway lines a top of an embankment which is raised approximately 2.0 m above Site levels on assessment of topographical information (Appendix B). The railway embankment acts as an informal defence. However, it should be noted that there are four culverts beneath the railway lines and adjacent to the eastern Site boundary, meaning potential flow paths exist through these culverts.
- 4.1.13 A Site walkover undertaken by Delta-Simons in March 2021. The eastern culverts associated with Drains B, C and D (shown in Appendix C) are noted to be approximately 450 mm in diameter and the Oldlands Farm Culvert is approximately 1200 mm. In the unlikely event, tidal locking at the Lidsey Rife outfall causes fluvial flows to back up along the land drains, flows entering the Site in the east will be limited to size of the pipes which convey the water underneath the railway lines. As such, tidal flood waters are largely expected to impact land to the east of the Site boundary and railway lines, as indicated on the EA Flood Maps.

Historic Flooding

- 4.1.14 The EA and 2014 SWMP historic flood maps, made available in Appendix G, the mapping indicates that the Site is not located within the extents of historic fluvial / tidal flood event. There are also no records of historic flooding incident impacting the Site within the 2011 PFRA. In contrast, the 2015 FRA indicates that the Site is known to flood adjacent to the on-site watercourses and the 2016 SFRA shows the Site to lie within a historic flood outline, an extract of the 2016 SFRA map is included in Appendix G. The assessments do not provide further information on the source or date of the historic flooding.

- 4.1.15 Delta-Simons consulted the LLFA in October 2020, the Site was confirmed to have been flooded in 2019/2020 following heavy rainfall throughout the winter. The source of the flooding was indicated to be tidal locking associated with Lidsey Rife, the LLFA stated *'The area in question is linked to the Lidsey Rife (see attached plan) which outfalls into the sea at Felpham. This outfall, twice a day, becomes tide locked resulting in the local rife network backing up and flooding the flood plain during very wet periods'*.
- 4.1.16 The LLFA have provided images of the flooding on-site, these are made available in Appendix F along with the consultation response. The images show the eastern extent of the Site and areas adjacent to the on-site land drains was impacted during this event. In the wider area, the land to the east of the railway lines is also shown to be impacted.

EA Estimated Flood Levels

- 4.1.17 Modelled flood information for Lidsey Rife and associated drainage channels has been obtained from the EA in October 2020. This data is taken from the EA Aldingbourne 2015 model, which was updated in 2017 to include the latest Climate Change (CC) guidance. Flood extent and depth outputs from this dataset are provided in Appendix H, I and J.
- 4.1.18 Estimated flood levels for the fluvial event (defended) and combined fluvial and tidal event (defended and undefended) are summarised in Table 2 below.

Table 2: EA Estimated Maximum Flood Levels (m AOD)

Return Period	Fluvial (Defended)	Combined (Defended)	Combined (Undefended)
5% AEP*	1.18	0.61	-
1% AEP	1.30	1.32	1.24
0.1% AEP	1.39	1.95	1.99

*Annual Exceedance Probability

** Climate Change

Fluvial Flooding

- 4.1.19 As shown in Table 2, the maximum water level during the 5% AEP event (defended) is 1.18 m AOD. However, the majority of the Site is located outside the flood outline, as shown in Appendix H1. During this event, shallow flooding (largely between 0.1 m and 0.2 m) is expected along the south western boundary associated with Oldlands Farm Ditch. Areas within the 5% AEP event constitute functional floodplain, however given the coarse resolution of the data the flows are considered to be constrained to the channel.
- 4.1.20 The maximum water level during the 1% AEP is 1.30 m AOD. Fluvial extents (Appendix H2) are shown to overtop Lidsey Rife and inundate land to the east of the railway lines. The Site however is shown to largely remain flood free during this event with some potential flood risk shown along the south western boundary associated with Oldlands Farm Ditch. Given the coarseness of the data, the majority of flows are shown to be largely constrained to the ditch or within the southern extremities of the Site. Where flood depths exceed 0.3 m (considered impassable by people and vehicles) this is largely contained within Oldlands Farm ditch.
- 4.1.21 The maximum water level during the 0.1% AEP event is 1.39 m AOD. Fluvial extents extend across majority of the development Site with depths generally ranging between 0.8 m and 1.3 m above existing ground levels (Appendix H3). However, given that this is an extreme event with a 0.1% probability of occurrence in any given year, fluvial risk is considered Low and a residual risk.

Combined (Fluvial and Tidal Flooding)

- 4.1.22 A maximum flood level of 0.6 m AOD is anticipated during the 5% AEP flood event (defended), resulting in shallow flooding (between 0.1 m and 0.2 m) in the south western and eastern portions of the Site (Appendix I1). As such, the Site is shown to be situated within functional floodplain during a combined fluvial and tidal flood event.

- 4.1.23 The EA have provided flood data for the defended and undefended scenario for the 1% AEP and 0.1% AEP combined flood events. During both scenarios, land adjacent to the on-site drainage channels is within the 1% AEP and the extreme 0.1% AEP flood outlines. Appendix I2 and I3 show fluvial extents during the 1% AEP flood event, a maximum flood depth of 0.7 m is expected on-site during the undefended scenario with majority of the Site within the flood outlines. This risk is shown to be exacerbated during the 0.1% AEP extreme event (Appendix I3 and I4).

Climate Change

- 4.1.24 The EA 'Flood Risk Assessments: Climate Change Allowances' guidance states that less vulnerable development within Flood Zone 2 and 3 should utilise the 'Central' and 'Higher Central' Categories to assess a range of allowances. The Arun District is within the South East River Basin District (RBD), the central and higher central allowances within this location equate to 20% and 30% up to the year 2050 and 35% and 45% up to the year 2080.
- 4.1.25 Given the recent flood event and the complex interactions between the tidal Lidsey Rife and associated land drains, the 2080 design level has been used to assess the impact of the CC at the Site. The 2080 design level will ensure the development will remain flood resistance up to the year 2080. A summary of the maximum flood levels expected during the 1% AEP + CC event is provided in the below table.

Table 3: EA Estimated Flood Levels

	1% AEP + 35% CC*	1% AEP + 45% CC*
Defended	1.31	1.40
Undefended	1.60	1.71

* Climate Change

- 4.1.26 The Site is situated at a minimum level of 0.7 m AOD in the eastern boundary, with ground levels generally ranging between 0.7 m and 1.30 m AOD. Therefore, a large portion of the Site lies within the 1% AEP + CC flood outlines during the existing scenario. Flood outlines for the + 35% CC defended and undefended event are provided as Appendix J1 and J2 and as J3 and J4 for the +45% CC event.
- 4.1.27 A comparison of the minimum Site level and the above flood levels shows that the Site is expected to flood to a maximum depth of approximately 0.9 m during the 1% AEP plus 35% CC event and 1.01 m during the 1% AEP plus 45% CC event. As mentioned above, flood depths in excess of 0.3 m are not considered to be passable by pedestrians and vehicles. As such, safe access and egress is not considered feasible during the existing scenario.
- 4.1.28 On assessment of the modelled flood extent data, the land to the north of the Site which is set aside to provide FCS is shown to remain flood free during all scenarios, including the extreme 0.1% AEP fluvial and combined fluvial/tidal flood extent.

Summary

- 4.1.29 The above assessment of modelled flood data indicates that the development Site is at risk from both fluvial and combined fluvial and tidal flooding during the both the existing and future CC scenarios. Based on the above evidence, the baseline fluvial and tidal risk is assessed as **Moderate to High**.
- 4.1.30 The land to the north west of the Site is located within Flood Zone 1 (Low Probability) and therefore at **Low** risk from fluvial / tidal flood flooding.
- 4.1.31 To facilitate development, it is the developer's intention to infill / remove Drains A, B, C and D and to raise ground levels to 2.5 m to 4.0 m AOD. FFL of the proposed unit is to be set at 3.65 m AOD, approximately 1.94 m above the maximum flood level during the 1% AEP + 45% CC undefended level. Ground works will essentially lift the Site out of the floodplain, removing the existing fluvial / tidal risk. To do this, it is proposed to provide floodplain compensation within a parcel of agricultural land to the north east of the Site boundary. A similar approach has been adopted as the approved commercial developments (Phase 1) to the south of the Site boundary.

4.1.32 Mitigation measures, access and egress and the impact of the development of flood risk is assessed further in Sections 4.6 and 4.8.

4.2 Surface Water Flood Risk

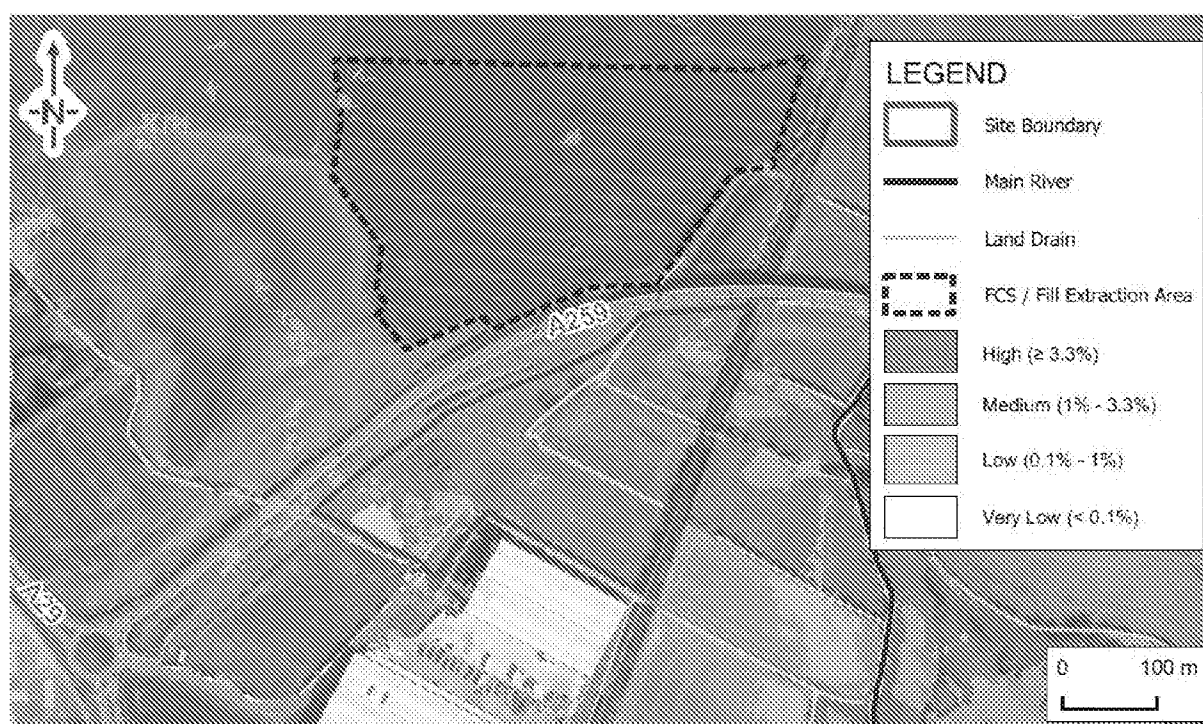
4.2.1 The EA's Long-Term Flood Risk Map (Surface Water) indicates that the Site is largely at 'Very Low' risk from surface water flooding (<0.1% annual probability). The land to the north west of the Site which is to be utilised for FCS is shown to be entirely at Very Low risk.

4.2.2 Isolated pockets of 'Low' risk (between a 1% and 0.1% annual probability) are identified across the Site associated with on-site land drains and/or topographical depressions within the existing land, which allow surface water to pond. An area of 'High' surface water risk (> 3.3% annual probability) is identified associated within the drainage ditches in the northern periphery.

4.2.3 Any surface water ponding is shown to remain below 0.3 m during the 1% and 0.1% annual probability rainfall events, both on-site and along the A259. Flood depths are noted to exceed 0.3 m in the north east and southern boundary, which is considered impassable by pedestrians and vehicles. However, these flood depths are confined to the land drains and do not impact the wider Site area.

4.2.4 There are no distinct flow routes in the area which would direct any potential surface water flooding in the surrounding area towards the Site.

Figure 2: EA's Long-Term Flood Risk Map (Flood Risk from Surface Water)



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4.2.5 The pockets of surface water risk associated with the existing drainage channels and topographical depressions will be removed during land raising and levelling activities during the Site construction. Surface water within the Site is proposed to be managed with a sustainable surface water drainage scheme, discussed further below. Ground levels surrounding the proposed buildings will be profiled to encourage surface water runoff and any overland flows away from the built development and towards the nearest drainage point or proposed landscaped / impermeable areas.

4.2.6 The existing surface water risk does not appear to impede potential access and egress routes from the development Site.

- 4.2.7 A historic flood map is provided as Appendix A (Plan 3 South) within the 2014 SWMP for the Lidsey Catchment and made available as Appendix G. Two recorded incidents are noted within Shripney Village, approximately 575 m and 960 west of the Site boundary and along the A29, approximately 1.55 km north west of the Site. The map shows that the Site itself is not located in an area that has historic been impacted by historic surface water flooding.
- 4.2.8 The 2016 SFRA reports that surface water flooding incidents are typically linked to drainage blockages within the Lidsey Catchment. This may result from a combination of heavy rainfall, high tide, and river levels blocking surface water outfalls, resulting in a potential surcharge of the surface water drainage systems. Post development, it is recommended the on-site drainage is well maintained through a maintenance regime involving a regular monitoring and clearing of the drainage system.
- 4.2.9 A separate outline Drainage Strategy (DS) has been produced by EirEng Consulting Engineers which details the proposed surface water management scheme for the development. In accordance with local and national policy, surface water runoff rates and volumes will be controlled, and storage will be provided on-site for the 1 in 100 year + 40% CC event. The proposed surface water management scheme is discussed further in Section 4.8.
- 4.2.10 It can therefore be concluded that the baseline surface water risk at the Site and the proposed FCS area to the north west is **Low**.

4.3 Groundwater Flood Risk

- 4.3.1 A description of geology underlying the Site has been provided in Section 2.0.
- 4.3.2 Ground investigations undertaken at the Site indicate that the Site is underlain with topsoil at the surface which overlies relatively impermeable Raised Marine Deposits comprising sandy / silty clay. The Raised Marine Deposits are underlain with permeable deposits of undifferentiated chalks (chalk of sandy gravelly silt and sandy gravel).
- 4.3.3 The 2016 SFRA has made available an Areas Susceptible to Groundwater Flooding map, the map suggests that within the 1 km² area that the Site is located within, there is between a 25% to <50% susceptibility of groundwater flooding. Third party reports (2011 PFRA, 2014 SWMP and the 2016 SFRA) suggest that there are no recorded incidents of groundwater flooding impacting the Site.
- 4.3.4 The underlying water table was noted to stand at approximately 0.07 m to 1.32 m bgl during the most recent groundwater monitoring works. Standing water at the surface was recorded within BH04 / BH05 and BH06 on 15/12/2021 and waterlogged soils were noted across the Site during the investigations between November 2020 and February 2021. It must be note that these investigations were undertaken during wetter winter months. The underlying aquifer is expected to be in hydraulic connectivity with Lidsey Rife, groundwater is largely expected flow east towards the watercourse than emerge at the surface during normal conditions.
- 4.3.5 Ground investigations indicate that the water table beneath the proposed FCS area is between 1.10 m to 1.20 m bgl (2.15 m and 2.05 m AOD). Groundwater could potentially be encountered during excavation works which require excavation to a maximum 0.7 m AOD to construct the proposed fcs area. Where groundwater is encountered during excavation, temporary dewatering activities can be undertaken to remove the groundwater. Works should be carried in accordance with appropriate health and safety procedures and in drier summer months to reduce the change of encountering groundwater. Consideration to the underlying water table will be needed when designing the FCS area during the detailed design stage, this is discussed further in Section 4.8.9.
- 4.3.6 Where clay deposits predominantly overly groundwater, the impermeable nature of the clay deposits is expected to inhibit the upward migration of groundwater. Furthermore, significant hardstanding is proposed across the Site, this permanent impermeable surface will limit the vertical migration of groundwater to the surface.
- 4.3.7 According to BGS mapping, as provided within an Envirocheck® Report, the Site is illustrated to have the *'potential for groundwater flooding of property situated below ground level'*.

- 4.3.8 As detailed in Section 4.8 below, it is proposed to raise the existing ground levels across the Site to 2.5 m to 4.0 m AOD, FFLS are to be set at 3.65 m AOD, approximately 2.95 m above the minimum site level (0.7 m AOD). Raised Site levels will further limit groundwater emergence / seepage at the surface. Furthermore, no basement levels are identified on plans.
- 4.3.9 It can therefore be concluded that the baseline risk of groundwater flooding is **Low to Moderate** at the Site and at the proposed FCS area land to the north west. It is recommended to consider the mitigation measures detailed above and in Section 4.6 to limit groundwater risk during the constructional phase.

4.4 Artificial Sources Flood Risk

Sewer Flooding

- 4.4.1 Sewer records were not available at the time of the writing. A utilities survey shows a foul water rising main to the south of the A259. It is also likely that there are separate public / private surface and foul water sewers to the south of the Site associated with the Rolls Royce / Lidl development and within the A259 to the west. There are no distinct flow routes in the area which would direct any potential flooding arising from any public / private sewers in the A259 road or the southern developments towards the Site or the proposed FCS area.
- 4.4.2 Southern Water are responsible for all public sewers within this location. Sewer flooding is largely associated with surface water sewers, as there are no surface water sewers within the immediate vicinity of the Site the risk is deemed low. In addition, the public sewer network is generally designed to accommodate the 1 in 30 year (3.3% AEP) frequent rainfall event, ensuring no flooding occurs above ground level for this return period. The 2016 SSWMS indicates that the surface water drainage system serving the development to the south of the Site is design to attenuated surface water within a balancing pond up to the 1 in 100 year + 30% CC event. Ensuring the southern developments do not increase surface water risk at the Site.
- 4.4.3 There is no evidence of historic sewer flooding impact the Site or the immediate surrounding land within the 2011 PFRA, 2014 SWMP or the 2016 SSWMS.
- 4.4.4 The 2016 SFRA states that there have been incidents of historic sewer flooding in the Lidsey catchment, including 28 incidents within the 'PO22 9' postcode group. There is no site-specific information regarding these incidents. Given that the development nature of the existing Site and the recent development of the A259 and industrial properties to the south, it is unlikely that the Site has been impacted by historic sewer flooding.
- 4.4.5 It can therefore be concluded that the baseline risk of sewer flooding at the Site and the proposed FCS area is **Low**.

Reservoir and Canal Flooding

- 4.4.6 The EA Long-Term Flood Risk Map (Reservoirs) indicates that the Site is not within the flood extents of a reservoir overtopping or breach event and there are no canals within the vicinity of the Site.
- 4.4.7 The EA state that reservoir flooding is extremely unlikely to happen. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the EA ensure that reservoirs are inspected regularly, and essential safety work is carried out.
- 4.4.8 It can therefore be concluded that the baseline flood risk associated with sources is **Negligible**.

4.5 Summary of Flood Risk

- 4.5.1 The main potential source of flood risk at the Site is fluvial and combined (fluvial and tidal) flooding and groundwater flooding during the excavation. All other sources of flood risk are assessed as either **Low or Negligible**.

- 4.5.2 As discussed in Section 4.1 above, the EA modelled data shows the Site to lie within the extents of the 5% AEP fluvial and the 5% combined fluvial and tidal flood event and greater. The existing baseline fluvial / tidal risk at the Site is considered **Moderate to High**. The associated risk has been used to inform mitigation design, which will reduce the existing risk down to **Low**. This is discussed further below.

4.6 Mitigation

Fluvial / Tidal Flood Risk

- 4.6.1 Development must remain flood free during the 1% AEP +35% CC event and flood resilient up to the 1% AEP +45% CC event. The existing Site is identified to be at risk of fluvial / tidal flooding with a maximum flood level of 1.60 m AOD expected during the 1% AEP plus 35% CC event and 1.71 m AOD during the 1% AEP plus 45% CC event.
- 4.6.2 It is proposed to set FFL's of the proposed unit at 3.65 m AOD, approximately 2.05 m above the maximum flood level expected during the + 35% CC event and 1.94 m above the +45% CC event. This will ensure that the Site will remain flood free during the 1% AEP plus CC scenario. The development is also expected to remain flood free during the extreme 0.1% AEP event which has a maximum level of 1.99 m AOD during a combined event and 1.39 m AOD during a fluvial dominated event. The development Site will essentially be lifted outside the floodplain, reducing fluvial / tidal risk to **Low**.
- 4.6.3 As the proposed unit will be situated 1.94 m above the maximum 1% AEP + 45% CC level, incorporating additional flood resistance or resilience measures into the development design is not deemed necessary in this instance.
- 4.6.4 A similar mitigation approach has been adopted for the approved Phase 1 development to the south of the Site as indicates within the 2014 FRA. Ground levels are understood to be raised approximately >2.0 m above predevelopment levels. To do this FCS was provided, ensuring the scheme did not remove flood storage space from the floodplain. Raising ground levels within the 1% AEP +35% CC extent will result in a loss of flood storage, therefore it is also proposed to provide FCS as part of this development, this is discussed further in Section 4.8 below.

Land Drain Infill / Removal

- 4.6.5 The ADC's watercourse map (Appendix C) shows Drain A to issue on-site and flows in a north eastern direction, away from the Site boundary. The topographical survey shows no connection between Drain A and Drains B, C and D. On-site land drains are understood to serve agricultural land within the Site boundary, there is no upstream connectivity to the wider catchment.
- 4.6.6 In order to facilitate development, it is proposed to remove / infill Drains A, B, C and D during development. As there is no upstream connectivity, the proposed removal of these drains are not expected to alter or have an adverse impact on flow characteristics.
- 4.6.7 The proposed works will require formal consent from the LLFA, who have been consulted as part of this assessment on 25/03/2021 to confirm feasibility and any specific requirements for undertaking such works. A formal 'Ordinary Watercourse Land Drainage' consent has also been submitted to ADC, a response is currently awaited.

Groundwater Flood Risk

- 4.6.8 There is a potential risk of encountering groundwater during the excavation / constructional stage. Where groundwater is encountered during excavation, temporary dewatering activities can be undertaken to remove the groundwater. It is advised to undertake works during drier summer months to reduce the chance encountering groundwater and all works should be carried in accordance with appropriate health and safety procedures.

Flood Warnings and Evacuation

- 4.6.9 Flood Warnings / Flood Alerts cover this area. Site users should register to receive flood warnings / alerts. Flood Warnings Alerts is a free service that provides prior warning of a fluvial / tidal flood event.

- 4.6.10 Access and egress should ideally involve a route which does not exceed 0.3 m. EA's modelled flood depths indicate safe access and egress is not feasible from the existing Site during the 1% AEP event or greater. However, ground level will be raised above the maximum flood level expected during the 1% AEP + 45% CC event and the extreme 0.1% AEP event. Post development, access and egress is considered achievable via the access roads and heading onto the A259, which remains flood free during all scenarios.

4.7 Residual Risks

- 4.7.1 A residual risk is an exceedance event, such as the 1 in 1000 year (0.1% AEP) flood event that would overtop Lidsey Rife and associated drains, potentially impacting the Site. As the proposed development is to be located more than 2.16 m above the maximum flood level expected during the extreme 0.1% AEP flood event, the probability is low and, therefore, no further mitigation beyond what is proposed is required.
- 4.7.2 In the event of the defences failing or an exceedance event occurring, the residual risk to people working within the Site can be managed through the implementation of an appropriate Site management plan, which recognises the residual risks and details what action is to be taken by staff in the event of a flood to put occupants in a place of safety.

4.8 Impact on Flood Risk Elsewhere

Fluvial / Tidal Flood Risk

Floodplain Compensation

- 4.8.1 As detailed above, the existing Site lies in Flood Zone 2 and 3 with ground levels currently ranging between 0.7 m and 2.2 m AOD. It is proposed to raise ground level across the Site to between 2.5 m and 4.0 m AOD, FFL of the proposed unit is to be set 2.05 m above the maximum flood level expected during the 1% AEP + 35% CC event. Proposed ground and FFL are made available on the Site levels plan (ref: C002 Rev P4) in Appendix E.
- 4.8.2 The EA requires floodplain compensation for any land raising with the 1% AEP + 35% CC outline to ensure flood risk is not exacerbated elsewhere and adversely impacts downstream receptors. To ensure the development will not result in a loss in flood storage space from the floodplain, floodplain compensation on a level-for-level and volume-for-volume basis will be provided within a parcel of undeveloped agricultural land to the north west of the Site boundary, which is within the Clients ownership.
- 4.8.3 An existing FCS area lies on either side of Oldlands Farm Ditch and was designed to attenuate displaced flood water from the A259 and Phase 1 development to the south of the Site. A new box culvert for the Oldlands Farm Ditch and corrugated arch culverts were constructed beneath the A259 during its development. Flood water from the existing flood compensation area is transported eastwards, under the A259 box and arched culverts and then within Oldlands Farm Ditch along the south western Site boundary, beneath the railway lines and eventually discharges to Lidsey Rife to the east.
- 4.8.4 The proposed FCS area for the development Site is to be located adjacent to an existing FCS area, ensuring hydraulic connectivity between the two areas.
- 4.8.5 Volumetric analysis was undertaken in GIS to determine the volume of floodplain displacement that requires compensating for on a level for level basis. The proposed development will displace approximately 18,224.3 m³ of flood water during the 1% AEP + 35% CC undefended flood event within the Site boundary. This is an indicative volume which should be reconsidered on completion of a final masterplan during the detailed design stage. Table 4 below provides the flood displacement calculations.

Table 4: Flood Displacement Area and Volume

Ground Level (m AOD)	Surface Area (m ²)	Volume (m ³)
0.7 (Base Level)	0	0
0.7 – 0.8	1,369	103.4
0.8 – 0.9	700	168.3
0.9 – 1.0	3,638	371.5
1.0 – 1.1	5,178	829.2
1.1 – 1.2	9,646	1,501
1.2 – 1.3	13,779	2,817.4
1.3 – 1.4	5,874	3,771.3
1.4 – 1.5	3,122	4,187
1.5 – 1.6	2,300	4,448.2
Total	45,606	18,224.3

- 4.8.6 The topographical survey indicates that the land identified as a potential FCS area is elevated above Site levels, as shown in Appendix B and detailed in Section 2.0. This land will initially need to be excavated to the design water level for the 1% AEP + 35% CC event (1.60 m AOD), resulting in a removal of approximately 94,093 m³ of spoil. Once the spoil has been removed, the remaining land can be excavated to develop the FCS. The reuse of any excavated material and engineering design of the FCS area is considered outside of this FRA.
- 4.8.7 Floodplain compensation should be designed in accordance with EA's guidance for FCS which requires any loss of flood storage must be compensated for by the reduction in level of nearby ground, such that the same volume is available at every flood level before and after the works and it can freely fill and drain. In other words, in order to mirror the existing situation for a particular flood, each stage (or level) is provided with the same storage volume, cut and fill must equate on a level for level basis, i.e. at each level (say at 0.1 metre vertical intervals for example) the excavated and filled volumes are equal.
- 4.8.8 Following this methodology, 0.1 m 'slices' were taken through the 1% AEP + 35% CC flood extents on Site to calculate the volume of floodplain displacement which totalled 18,224.3 m³ as shown in Table 4 above. The surface area was also calculated for each slice (Table 4) for which the maximum surface area of the flood extent was recorded at 45,606 m² and used to delineate the FCS to the north which has a marginally larger surface area of 45,706 m². A cross sectional drawing is included in Appendix K which illustrates the volume of floodwater displacement for each 0.1 m interval and to show that the FCS area is feasible and able to store the floodplain displacement volume on a like-for-like and level-for-level basis.
- 4.8.9 Calculations suggest a total volume of 41,135.4 m³ is available within the proposed FCS area, sufficient to compensate 18,224.3 m³ of flood water displaced by the proposed development. By adopting this methodology, it further demonstrates there is sufficient space and volume, adjacent to the existing FCS area, to provide floodplain compensation on a like-for-like and level-for-level basis. Please see Appendix D which contains the flood displacement calculations and denotes the proposed FCS area.
- 4.8.10 The water table underlying the land to the north of the Site where the FCS area is proposed was recorded between 2.15 m and 2.05 m AOD during winter groundwater monitoring where groundwaters tend to be naturally higher. A base level of 0.7 m AOD is required to provide compensation on a level for level basis for the FCS area and therefore FCS area could potentially expose the underlying water table. Further consideration should be given during the detailed design stage to ensure the water table does not impact the proposed FCS area. Appropriate measures such as an impermeable lined membrane could be incorporated into the design to limit groundwater seepage into the proposed storage basin.
- 4.8.11 The design of the FCS area will need to be considered further during the detailed design stage and on completion of a final masterplan. The above calculations indicates that there is sufficient storage to contain the displaced floodwater within the land to the north of the proposed development.

- 4.8.12 The development Site is shown to be located within the 'Enterprise Bognor Regis Strategic Development Site (SDS)' in the 2016 SSWMS. The 2016 SSWMS includes an assessment of the existing Flood Management scheme for the Enterprise Bognor Regis area, which reviews the existing FCS area. The 2016 SSWMS has identified issues with the existing FCS area and the Oldlands Farm Ditch box culvert beneath the A259 and stated the following:

'...The flood compensation area used for BNRR [A259] is believed to operate effectively, however the adjoining Oldlands Farm development [Phase 1] flood compensation area is currently not operating effectively as it is unable to drain. ADC are currently raising issues with the developer regarding its current operational performance; whereby it is full of water with no means for it to self-empty/fill via the Oldlands Farm ditch and thereby unable to provide storage during flood events. Currently it resembles a standalone pond. The developer is currently investigating this issue.

...The BNRR flood relief tunnels are located underneath the BNRR. ADC has raised possible issues with the tunnels and their relative levels to the service road finished surface levels that run parallel to the relief road. The new Oldlands Farm Ditch culvert under the service road also appears too low and is submerged a majority of the time. This is currently being investigated by WSCC/ADC with the developer who constructed the road'.

- 4.8.13 The LLFA were consulted to confirm if further investigations and works have been undertaken to resolve the standing water issues associated the existing FCS area and if any improvements have been made to the box culvert. A response was not provided at the time of writing. These identified issues should be considered further through consultation with the LLFA and Local Planning Authority (LPA) to ensure the proposed FCS area is able to freely fill and drain.

Culvert Assessment

- 4.8.14 As mentioned above, the 2016 SSWMS highlights potential issues with the culverts beneath the A259. A culvert assessment has been undertaken to determine if flows from the development Site will pass through the existing box / arched flood tunnels beneath the A259, allowing the existing and proposed FCS area to drain freely.
- 4.8.15 During the Site walkover, eight, 1.5 m to 2.0 m diameter wide, corrugated steel flood tunnels were observed which are composed of two half round segments situated adjacent to each other as semi-circle arches. The corrugated tunnels were noted to be encased in thick concrete coating, approximately 150 mm thick. The Oldlands Farm Ditch box culvert was noted to be approximately 4.0 m (W) X 2.0 m (H) in diameter.

Inputs

- ⌘ Catchment Area: 81.28 Ha – This represents the total Site Area (6.28 Ha)) + the upstream catchment area drainage into the land drainage ditch (75 Ha)
- ⌘ Standard Average Annual Runoff (SAAR): 720 mm
- ⌘ Standard Percentage Runoff (SPR): 0.37
- ⌘ Hydrological Region (HR): 7

Methodology

- 4.8.16 The assessment has estimated the mean annual flow (Qbar) at the inlets using the IH124 method, and this has been scaled up using growth curves presented in the SuDS Manual for Hydrometric Region 7 to produce an estimated 1 % AEP flow rate. Based on guidance from the Design Manual for Roads and Bridges (DMRB) HA106/04, the Manning's equation has been used in conjunction with these flow estimates to estimate the necessary size of the road bridge to effectively convey flows from the upstream catchment.

Results

- 4.8.17 The IH124 method estimates that the maximum 1% AEP flow rate from the upstream catchment is 0.81 m³/s (805 l/s). The minimum box culvert diameter required to convey 100 % of these flows is approximately 1.0 m (H) x 1.4 m (W) and the minimum pipe culvert diameter required to convey these flows is approximately 1.2 m. As such, there is **sufficient capacity** within the Oldlands Farm Ditch box culvert to convey flows during the 1% AEP rainfall event. In addition to the box culvert, the arched flood tunnel also has sufficient capacity to pass flows in the event flows through the main box culvert is restricted. The IH124 catchment data and tabular outputs from the culvert assessment are included in Appendix L.
- 4.8.18 Based on the above, the impact of the proposed development on fluvial and combined fluvial / tidal risk elsewhere is considered **Low**.

Surface Water Flood Risk

- 4.8.19 The proposed development will increase the impermeable hardstanding area of the Site, consequently increasing surface water runoff rates and volumes. To ensure surface water risk is not exacerbated off-site, runoff rates and volumes will be controlled to the QBAR greenfield rate and attenuated up to the 1 in 100 year + 40% storm event. Attenuation is to be provided using a combination of attenuation tanks and a detention basin which will eventually discharge flows to existing and new ditches. The proposed surfaces water and foul drainage scheme is detailed further within a separate report prepared by EirEng Consulting Engineers.
- 4.8.20 The impact of the development on surface water risk is therefore considered **Low**.

4.9 Other Considerations

- 4.9.1 Prior to undertaking any removal / infilling works, 'Land Drain Ordinary Watercourse' consent from ADC should be obtained. A request has been submitted to ADC in March 2020, a response is currently awaited;
- 4.9.2 Maintenance access to Oldlands Farm Ditch should be retained. Maintenance access can be ensured by providing a 3.5 m buffer either side of Oldlands Farm Ditch in line with local policy; and
- 4.9.3 A 2.0 m easement should be provided from the railway lines along the eastern Site boundary in accordance with National Rail requirements and as outlined in the 2015 outline application. To ensure the proposed FCS area to the north of the Site does not impact railway infrastructure, it is proposed to provide a 20.0 m easement from the railway lines to the east of the proposed FCS area, as shown in Appendix D.
- 4.9.4 A 10 m easement from the gas main to the north of the proposed FCS area should be retained.

5.0 Conclusions and Recommendations

5.1 Conclusions

- 5.1.1 The existing Site comprises low lying, undeveloped agricultural land and is located within an area allocated for employment use within ADC's Local Plan. The proposed development is for an industrial development comprising warehousing with associated access, car parking, van storage, service yard areas and landscaping.
- 5.1.2 The main potential source of flooding to the Site is fluvial and combined fluvial and tidal flooding, the baseline flood risk from all other sources of flooding are considered **Low**.
- 5.1.3 EA modelled flood data indicates that the Site is within the extents of the 5% AEP flood event for both the fluvial and combined fluvial and tidal scenarios. Fluvial risk at the Site is attributed to Oldlands Farm Ditch in the south west and combined flood risk is derived from tidal and fluvial interactions between the on-site land drains and Lidsey Rife to the east of the Site. The baseline fluvial / tidal flood risk at the Site is assessed to be **Moderate to High**.
- 5.1.4 The identified flood risk will be mitigated by raising Site levels to 2.5 to 4.0 m AOD. Finished Floor Level of the proposed unit is to be set at 3.65 m AOD approximately 2.05 m above the maximum flood level expected during the + 35% CC event and 1.94 above the +45% CC event. To ensure land raising does not increase flood risk elsewhere, it is proposed to provide like-for-like and level-for-level floodplain compensation within a parcel of land to the north west of the Site for the 1% AEP + 35% CC event. A high-level assessment of the proposed FCS area indicates that this is feasible for this scheme, the design of the FCS area should be considered further during the detailed design stage.
- 5.1.5 Overall, the proposed mitigation measures will reduce the fluvial / tidal risk at the Site and the impact of the development elsewhere to **Low**.
- 5.1.6 The impact of the development on surface water risk will be managed with a surface water management scheme, which is designed to restrict flows to the greenfield rate and attenuate storms up to the 1 in 100 year + 40% CC event. Overall, the impact of the development on surface water risk and all other sources of risk is considered **Low**.

5.2 Recommendations

Flood Risk

- ▲ Ensure Site levels are raised above the maximum flood level during the 1% AEP + 35% CC event (1.60 m AOD);
- ▲ Determine FCS design when undertaking detailed drainage design and on development of a final masterplan; and
- ▲ Undertake excavation works in drier summer months where possible and employ dewatering activities where groundwater is encountered.

Other Considerations

- ▲ Prior to undertaking any removal / infilling works, 'Land Drain Ordinary Watercourse' consent from ADC should be obtained. A request has been submitted to ADC in March 2020, a response is currently awaited;
- ▲ Maintenance access to Oldlands Farm Ditch should be retained. Maintenance access can be ensured by providing a 3.5 m buffer either side of Oldlands Farm Ditch;
- ▲ A 2.0 m easement should be provided from the railway lines along the eastern Site boundary in accordance with National Rail requirements and as outlined in the 2015 outline application;
- ▲ To ensure the proposed FCS area to the north of the Site does not impact railway infrastructure, it is proposed to provide a 20.0 m easement from the railway lines to the east of the proposed FCS area; and

- ▴ A 10 m easement from the gas main to the north of the proposed FCS area should be retained.

Appendix A – Limitations

Limitations

The recommendations contained in this Report represent Delta-Simons professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Delta-Simons conclusions, opinions and recommendations has been determined using this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

Appendix B – Site Location Plan and Topographical Information



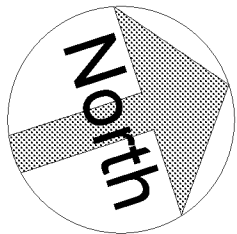
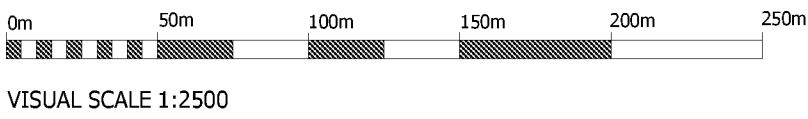
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Scale for planning purposes only
ashton smith to be notified of discrepancies in figured dimensions
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LOCATION PLAN:

NOTES:



P1	13/05/2021	Red Line Boundary Updated
P2	14/05/2021	Red Line Boundary Updated to match Eirring drawing C005 (P6)
P3	18/05/2021	Red Line Boundary updated following receipt of DWG from Eirring

REV	DATE	DESCRIPTION

DE	GC
DE	GC
DE	GC

DRAWN BY	CHECK BY

PROJECT TITLE Bognor Regis					
DRAWING TITLE Site Location Plan					
RIBA STAGE	STATUS			DRAWN BY DE	CHECKED BY GC
SHEET A1	SCALE 1 : 2500	DATE 30/04/2021	SUITABILITY S2	REVISION P3	
DRAWING NO. 21023 - ASA - V0 - XX - DR - A - PL01 - (S2 - P3)					

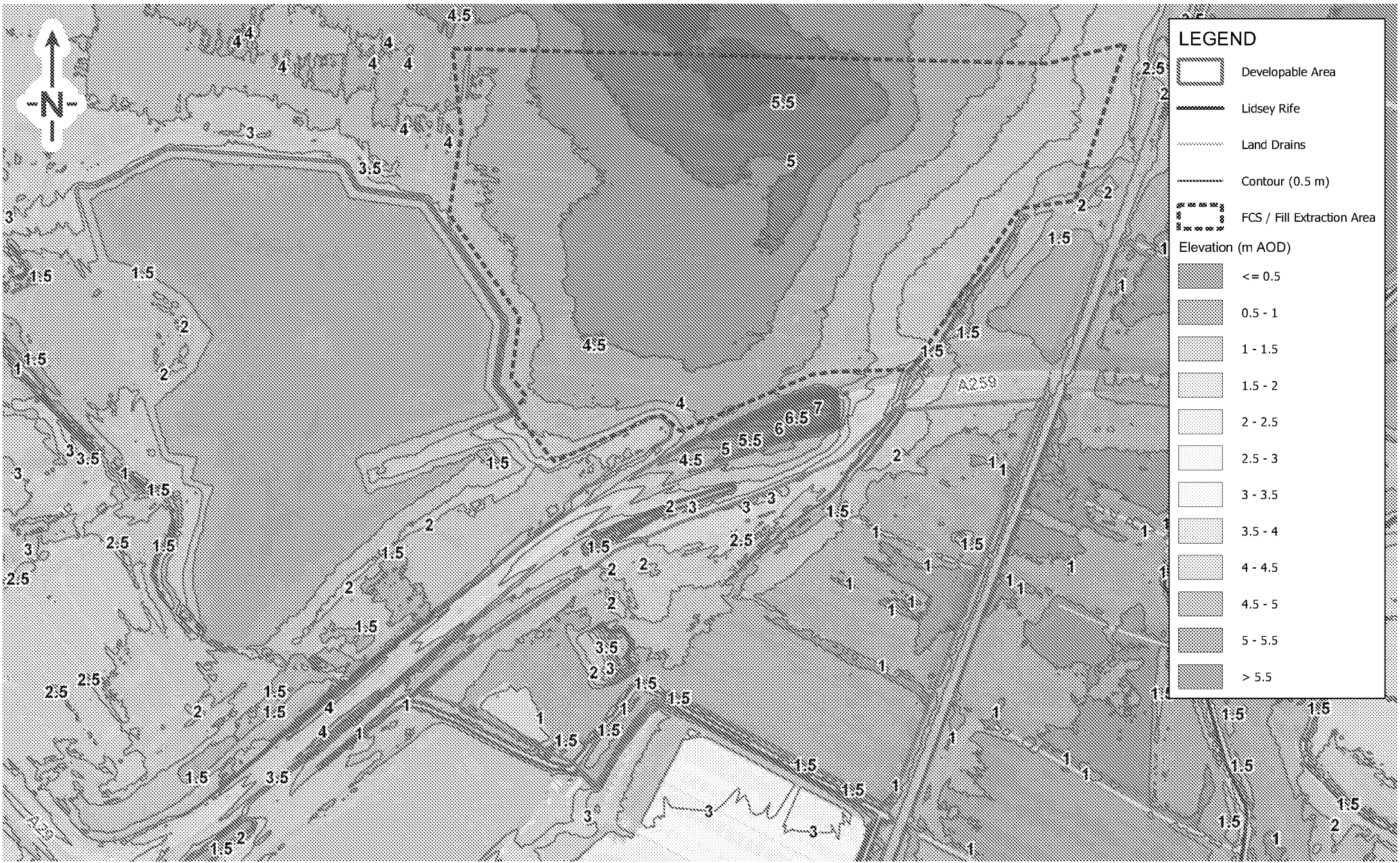
CLIENT

LYSANDER

ashtonsmith
beyond design

Ashton Smith, Belvedere House, 2 Victoria Avenue, Harrogate, North Yorkshire, HG1 1EL
Tel: 01423 522882 Fax: 01423 565104
www.ashtonsmith.co.uk

JOB NO.



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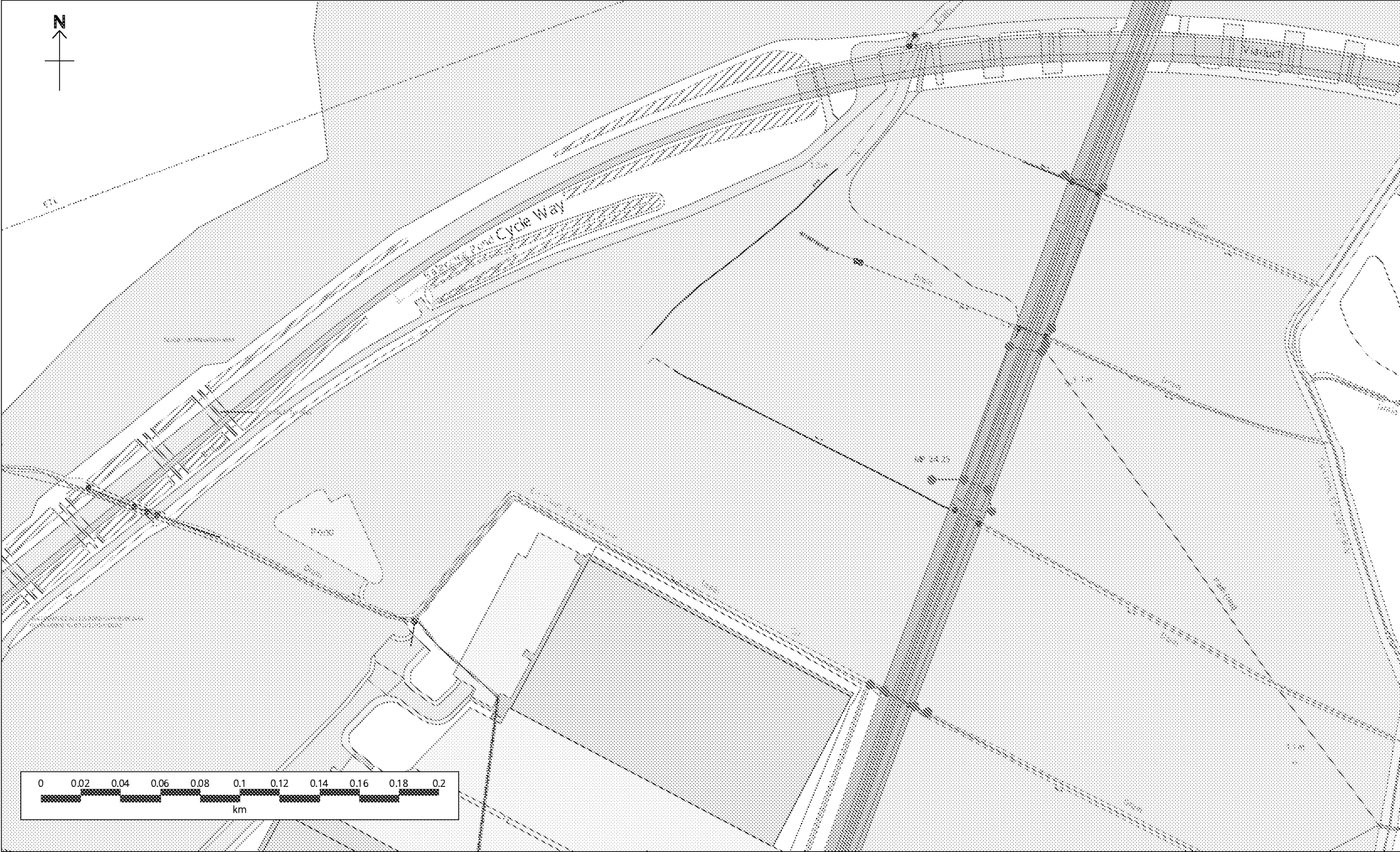


TITLE:
LiDAR Plan
Oldlands Farm, Bognor Regis, PO22 9NN

DRAWN BY: AB	SCALE (@A4): 1:3600	PROJECT NO: 20-1543.06
CHECKED BY: AP	REVISION: -	FIGURE NO: B4
DATE: 20 May 2021		

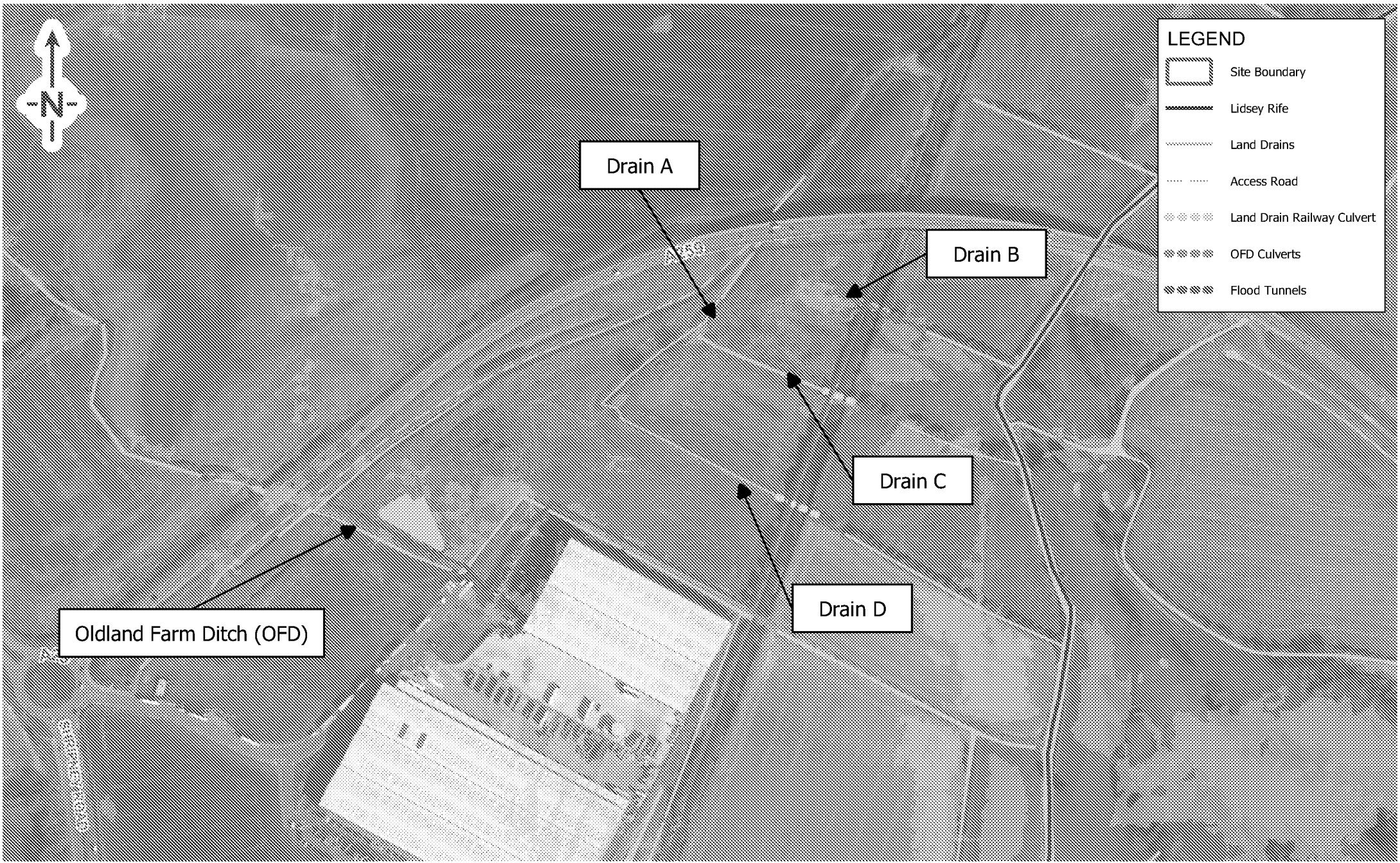
Appendix C – Arun District Councils Watercourse Map and Culvert Locations

Arun District Council Maps



Mapping produced by Arun District Council

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Production Date: 12 March 2021



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Land Drain Railway Culverts (approx. 450 mm to 600 mm Ø)





Oldland Farm Ditch Railway Culvert (approx. 800 mm to 1200 Ø)





Oldland Farm Ditch A259 Culvert (approx. 4.0 m x 2.5 m)



Oldland Farm Ditch Access Road Culvert (approx. 4.0 m x 2.0 m)



Flood Tunnels (approx. 1.2 m to 1.5 m Ø)

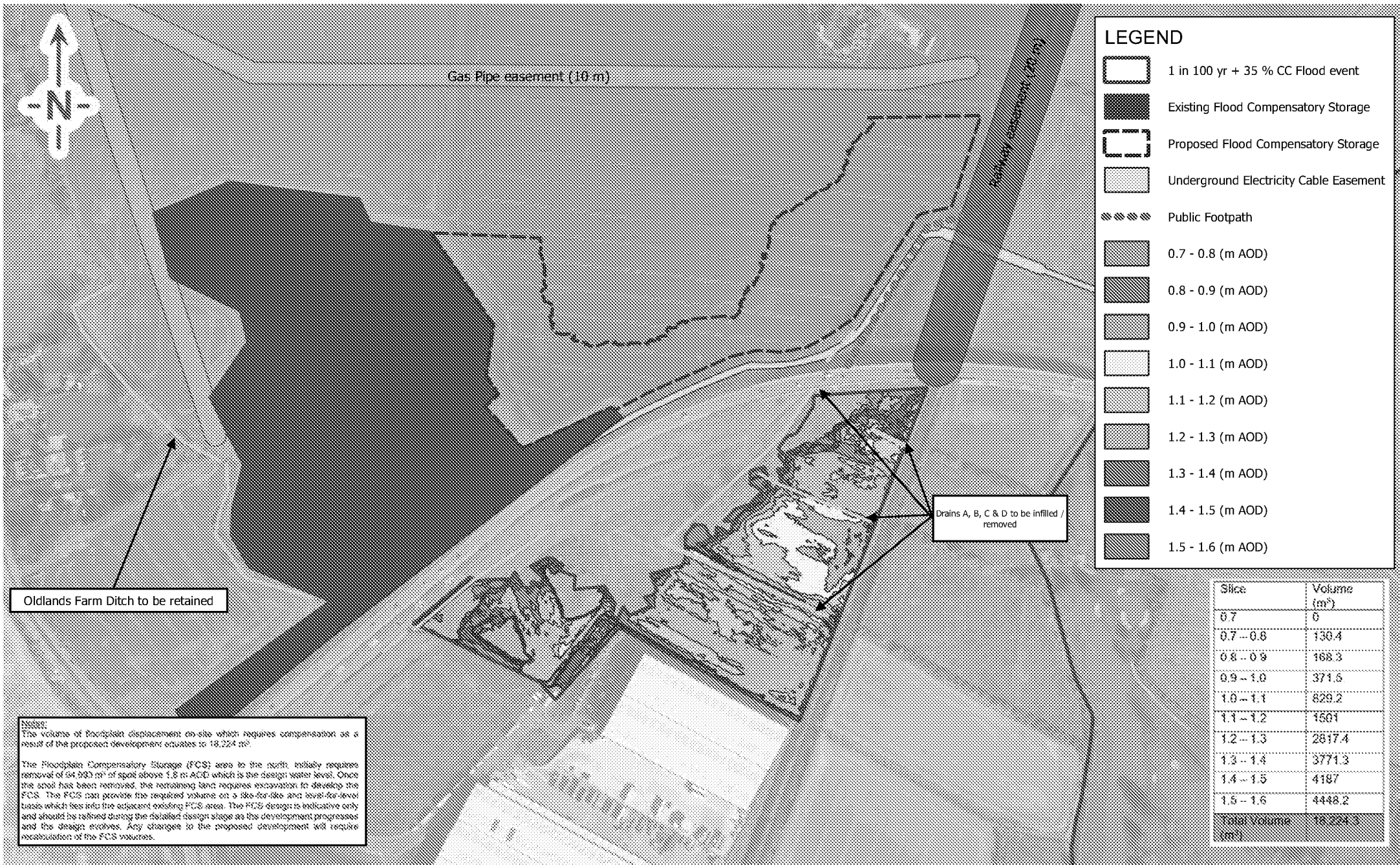




A259 Viaduct

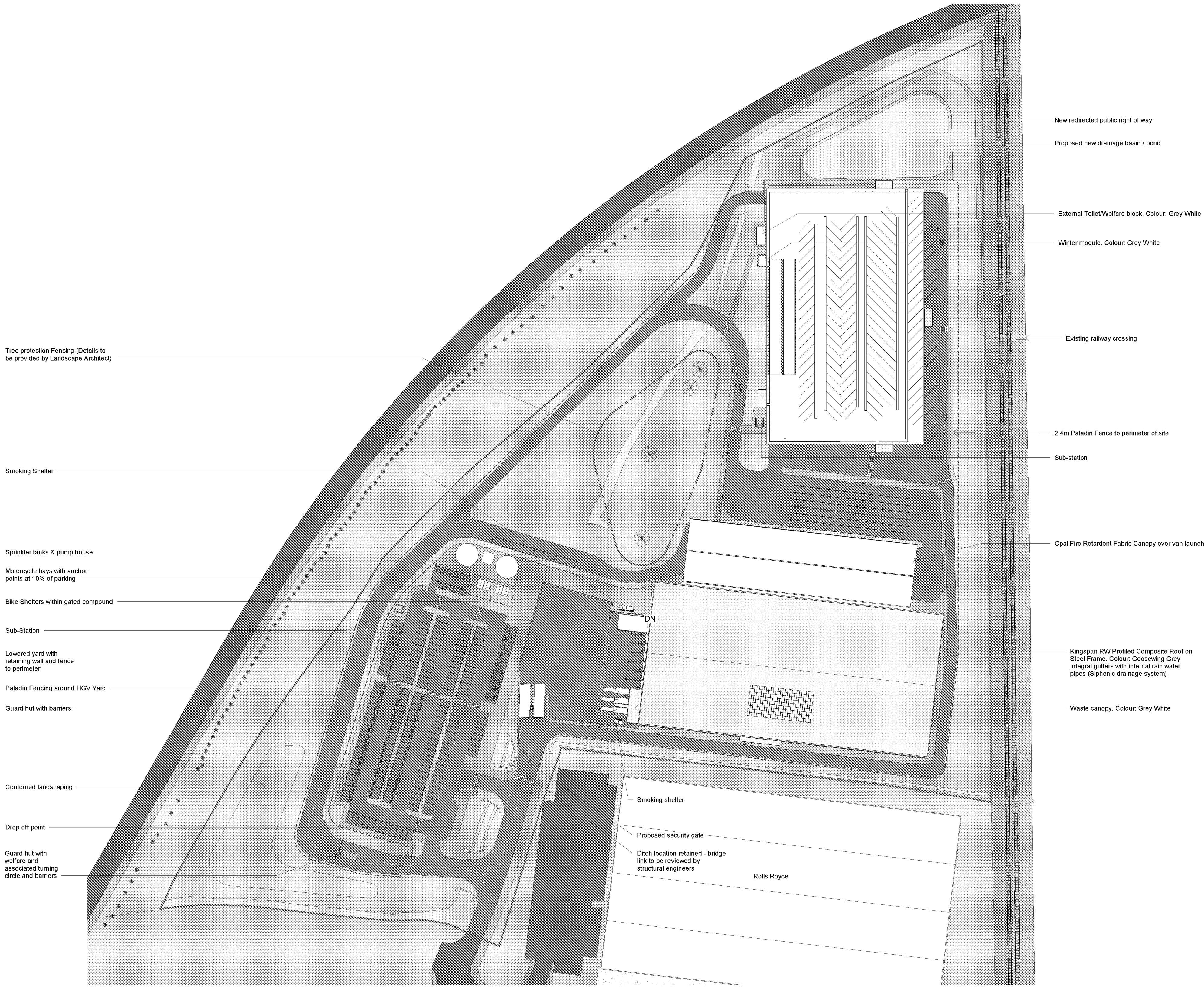


Appendix D – Proposed Flood Compensatory Storage



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Appendix E – Indicative Development Plan



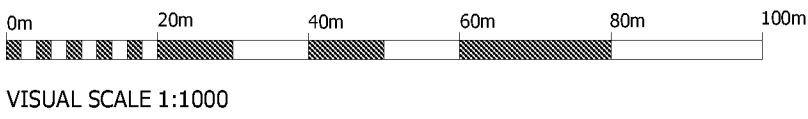
Proposed Site Plan
1 : 1000

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LOCATION PLAN:

NOTES:



P1	17/05/2021	Updated following Planning Consultants comments
P2	21/05/2021	Pond relocated to North of site
P3	27/05/2021	Updated to DWG comments

REV	DATE	DESCRIPTION
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REVISIONS

DRAWN BY

CHECK BY

PROJECT TITLE
Bognor Regis

DRAWING TITLE
Proposed Site Plan

RIBA STAGE	STATUS	PLANNING	DRAWN BY	CHECKED BY
			DE	GC
SHEET	SCALE	DATE	SUITABILITY	REVISION
A1	1 : 1000	30/04/2021	S2	P3

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