

Prepared for:

Carly Barnes

Location:

The Pagham Club
2 West Front Road
Pagham
PO21 4SY

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1. Key Facts

1.1 Flood Risk Posed:

- The site is located within Flood Zones 2 and 3 (Medium and High Probability), which means it is defined as land having between a 1 in 1000 and at least a 1 in 200 annual probability of tidal flooding.
- The risk would appear to be predominantly tidal and originate from the English Channel, which lies approximately 100m to the southeast of the site boundary.
- Modelled flood levels have been provided from the River Arun to East Head (2D) coastal modelling, which was completed by JBA Consulting in 2016.
- Comparison of these modelled flood levels with topographic site levels in the area of the proposed extension, show that the development is located entirely above the modelled 1:200 year flood levels at the present day, the floor level is 0.03m above the defended Higher Central and 0.35m below the Upper End 1:200 year flood level in 2125.
- Risk of pluvial flooding would appear to be "Very Low" to "Low".
- Risk of groundwater and sewer surcharge flooding would appear to be low.

1.2 Flood Risk Mitigation:

- Change of use of part of an existing building, floor levels cannot therefore be raised above existing levels.
- Flood proofing of the development will be incorporated as appropriate.
- Safe escape will be provided by the implementation of a flood warning and evacuation plan, which will be tied in with the existing emergency plans for the area and prepared in liaison with the Council's Emergency Planners.
- The applicant will register with the Environment Agency Floodline Warnings/Alert Direct service.

Assuming accordance with these flood risk management measures, Unda Consulting Limited consider the proposed application to be suitable in flood risk terms.

2. Introduction

Unda Consulting Limited have been appointed by Carly Barnes (hereinafter referred to as “the applicant”) to undertake a Flood Risk Assessment for the proposed development at The Pagham Club, 2 West Front Road, Pagham PO21 4SY (hereinafter referred to as “the site”). The purpose of the study is to support a planning application for the proposed development.

This report presents our findings based on the readily available information and data relating to the site and surrounding drainage area.

The site appears to be located within Flood Zones 2 and 3 as defined by the Environment Agency (EA) on their Flood Map for Planning. Under the National Planning Policy Framework (NPPF), a FRA is required if a proposed development:

- includes building or engineering works in Flood Zone 2 or 3;
- includes building or engineering works on land classified by the Environment Agency as having critical drainage problem;
- changes the use of land or buildings in a location at risk of flooding from rivers or the sea, or with critical drainage problems;
- changes the use of land or buildings in a way that increases the flood vulnerability of the development where it may be subject to other sources of flooding;
- is larger than 1 hectare.

The assessment should demonstrate to the Local Planning Authority (LPA) and EA how flood risk will be managed now and over the development’s lifetime, taking climate change into account, and with regard to the vulnerability of its potential users.

- whether the proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate.

3. Existing Situation

3.1 Site Usage:

The site is an existing Private Club. A map showing the site location is presented below in Figure 1, and the existing frontage shown in Figure 2.

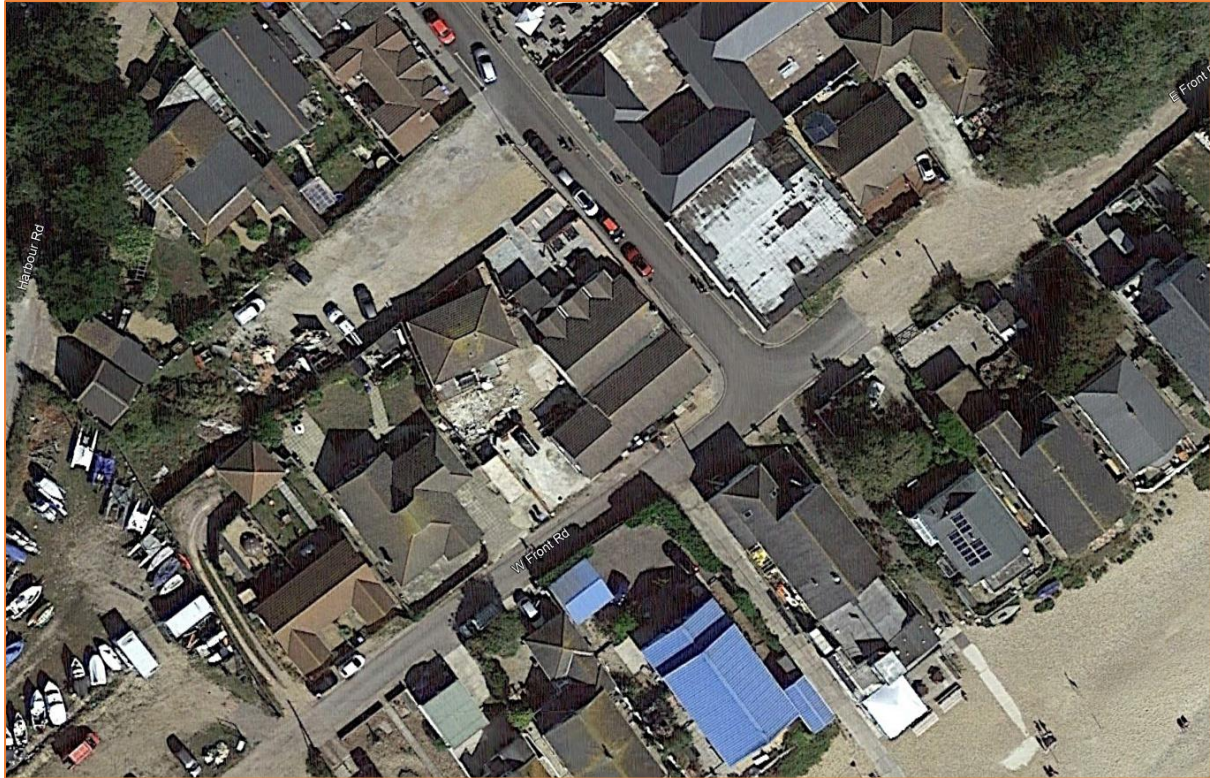


Figure 1: Aerial photograph of site and surrounding area (Source: Google Earth)



Figure 2: Existing property frontage from West Front Road (Source: Google Streetview)

3.2 Topography:

Environment Agency LiDAR has been used to assess the topography across the site and wider area. Light Detection and Ranging (LIDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground surface. Up to 100,000 measurements per second are made of the ground, allowing highly detailed terrain models to be generated at high spatial resolutions. The EA's LIDAR data archive contains digital elevation data derived from surveys carried out by the EA's specialist remote sensing team. Accurate elevation data is available for over 70% of England. The LiDAR technique records an elevation accurate to $\pm 0.3\text{m}$ every 2m. This dataset is derived from a combination of the full dataset which has been merged and re-sampled to give the best possible coverage. The dataset can be supplied as a Digital Surface Model (DSM) produced from the signal returned to the LIDAR (which includes heights of objects, such as vehicles, buildings and vegetation, as well as the terrain surface) or as a Digital Terrain Model (DTM) produced by removing objects from the Digital Surface Model.

1m horizontal resolution LiDAR remotely sensed digital elevation data suggests that the ground topography in the area of the proposed extension ranges from approximately 3.60mAOD to 4.30mAOD.

The finished floor level of the existing building is 4.30mAOD (Source: Peter Shaw, Bryceson Shaw Associates).

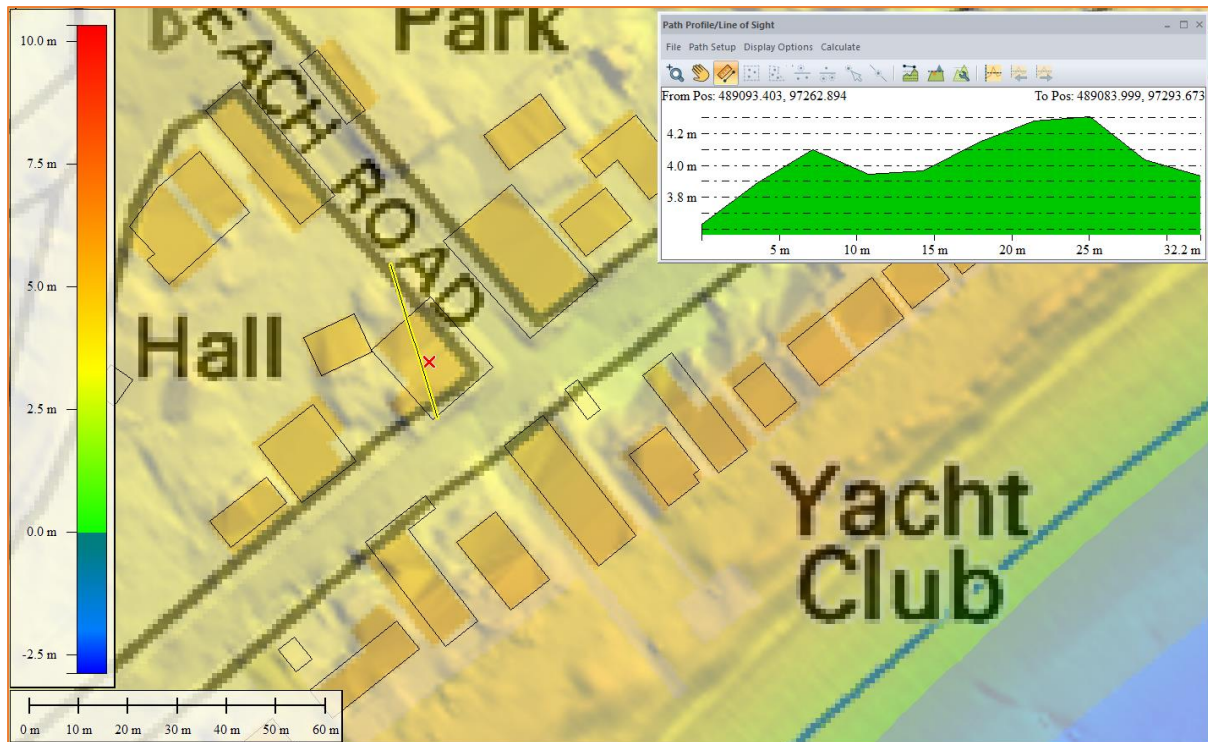


Figure 3: 1m resolution LiDAR DTM showing topographic levels across the site. Transect runs from south to north (Source: EA)

3.3 Geography and Soil:

The British Geological Survey (BGS) Map indicates that the bedrock underlying the site is London Clay Formation – Clay, Silt and Sand, with superficial deposits of Storm Beach Deposits – Gravel.

The soil type in the area taken from the UKSO Website is relatively deep soils of Quaternary Marine / Estuarine Sand soil parent material, with a sandy loam soil texture.

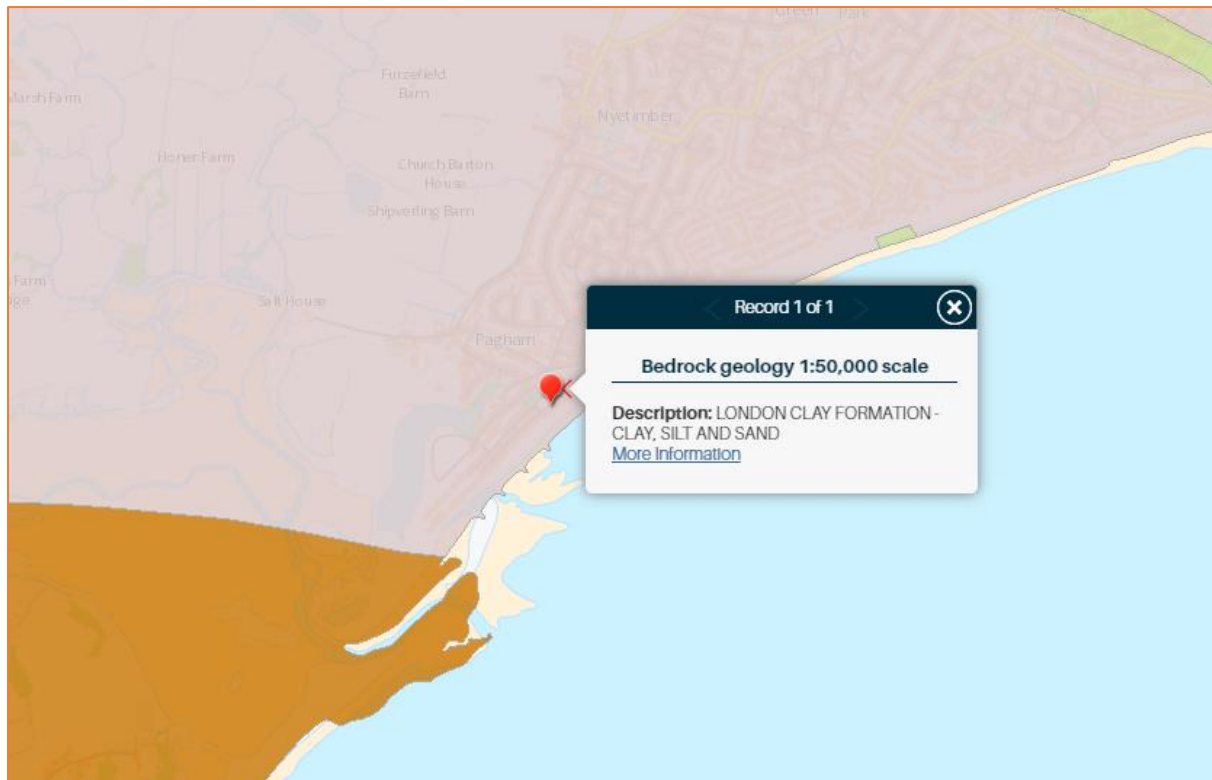


Figure 4: Bedrock Geology (Source: BGS)

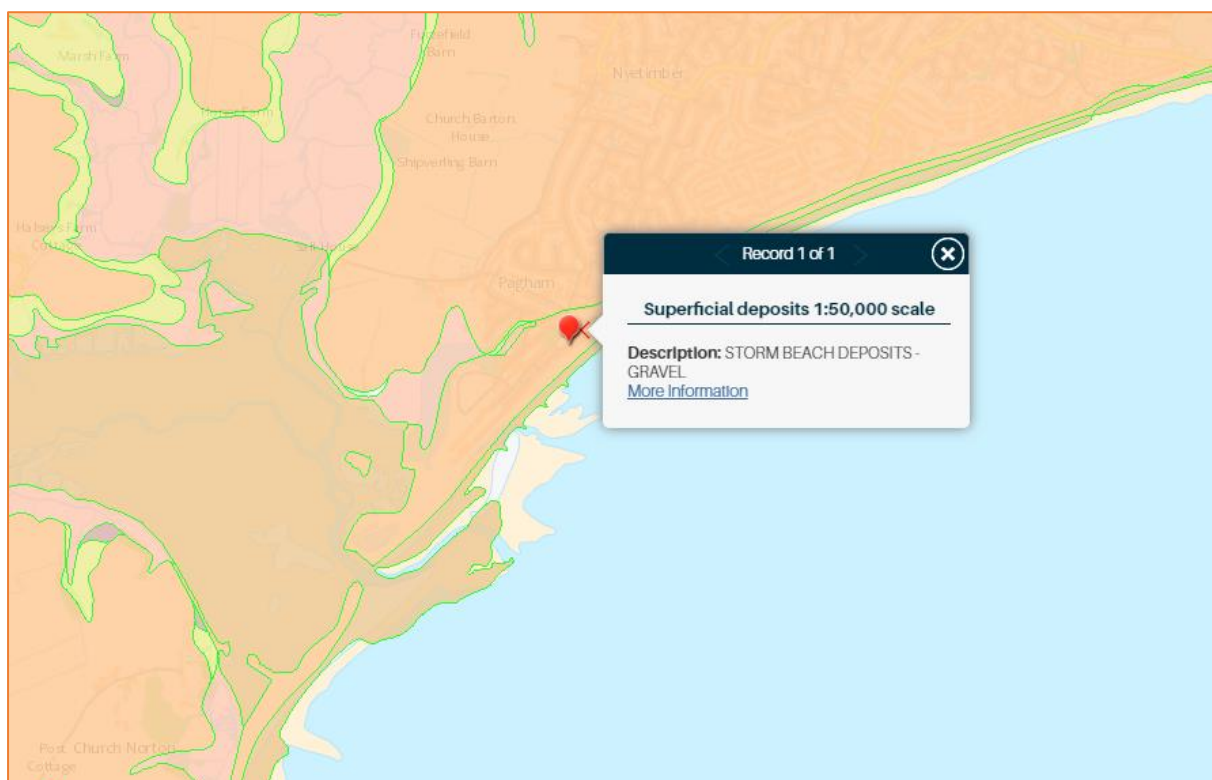


Figure 5: Superficial Deposits (Source: BGS)



Figure 6: Soil type (Source: UK Soils)

4. Development Proposal

The proposed planning application is for the sub division of existing private club to include 1 no. holiday let accommodation.

It is understood that the proposal is to convert part of the premises to a residential holiday let by internal alterations, the remainder will be retained as a smaller club.

The proposal is for a 139m² apartment with 3 bedrooms.

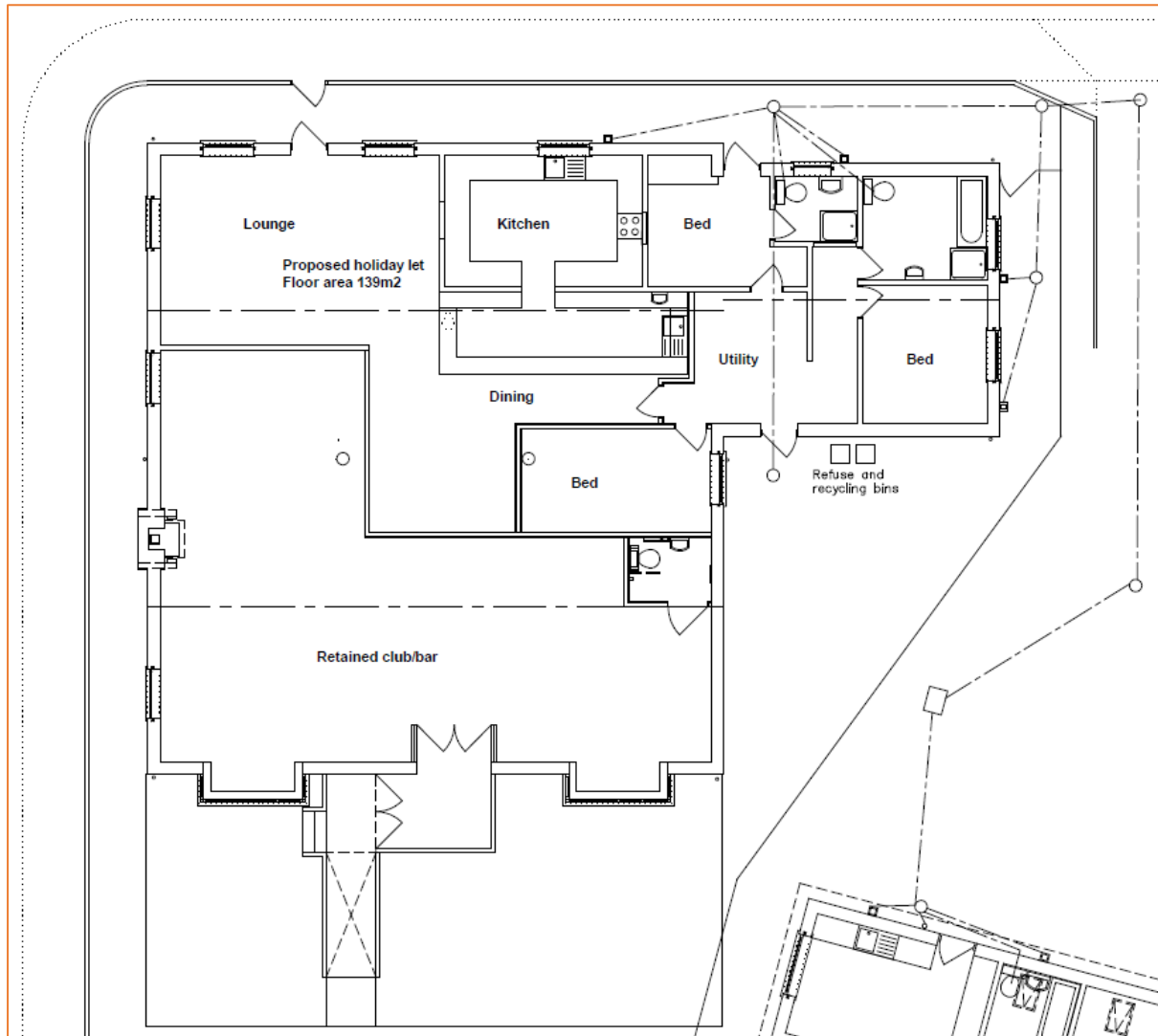


Figure 7: Proposed Ground Floor Plan (Source: Bryceson Shaw Associates)

5. Assessment of Flood Risk

5.1 Flood Zones:

Within planning, Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. They are shown on the Environment Agency's Flood Map for Planning (Rivers and Sea), available on the Environment Agency's website.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Table 1: Flood Zones

The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding.

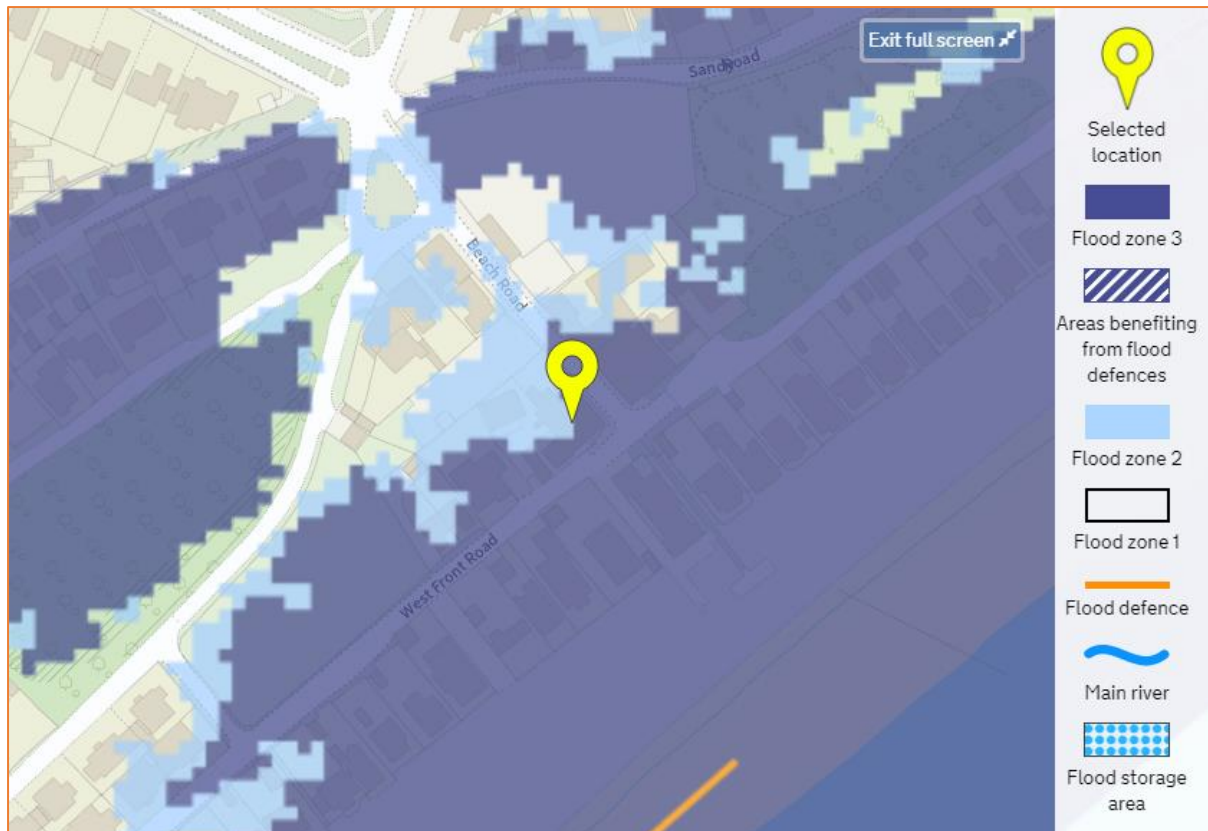


Figure 8: Environment Agency Flood Map for Planning (Rivers and Sea) (Source: EA)

The site is located within Flood Zones 2 and 3 (Medium and High Probability), which means it is defined as land having between a 1 in 1000 and at least a 1 in 200 annual probability of tidal flooding.

The risk would appear to be predominantly tidal and originate from the English Channel, which lies approximately 100m to the southeast of the site boundary.

5.2 Tidal

5.2.1 English Channel

The English Channel, also called simply the Channel, is the body of water that separates Southern England from northern France and links the southern part of the North Sea to the Atlantic Ocean.

It is about 560 km long and varies in width from 240 km at its widest to 33.3 km in the Strait of Dover. It is the smallest of the shallow seas around the continental shelf of Europe, covering an area of some 75,000 km².

Uniquely, The English Channel acts as a funnel that amplifies the tidal range from less than a metre as observed at sea to more than 6m as observed in the Channel Islands, the west coast of the Cotentin Peninsula and the north coast of Brittany. The time difference of about 6 hours between high water at the eastern and western limits of the Channel are indicative of the tidal range being amplified further by resonance. Some areas along the south coast are particularly vulnerable to severe storms moving from the Atlantic eastwards along the English Channel.

5.2.2 Detailed flood modelling:

Modelled flood levels and flood extents have been requested from the EA as part of the Product 4 data request (see Appendix).

Modelled flood levels have been provided from the River Arun to East Head (2D) coastal modelling, which was completed by JBA Consulting in 2016.

	1:200 year	1:200 year in 2115	1:1000 year
Undefended	3.75mAOD	4.84mAOD	3.94mAOD
Defended	N/A	4.24mAOD	N/A

Table 2: Modelled flood levels (Source: EA)

The site is shown to be entirely outside of the defended 1:200 year flood extent. For the undefended 1:200 year flood event, comparison of the modelled undefended on-site flood level (3.75mAOD) with topographic site levels (3.60mAOD to 4.30mAOD) shows that the site is between 0.15m below and 0.55m above the undefended flood level. The existing finished floor level is 4.30mAOD – which is 0.55m above the 1:200 year flood level. The site is however defended, with an effective crest level of 5.72mAOD (Source: EA).

Modelled flood levels have been provided for 2115, however the EA has stated that the flood risk data provided is based on existing EA hydraulic models for existing 0.5% annual probability events with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 17 December 2019. Developers should refer to 'Flood risk assessments: climate change allowances' for the most up to date allowances. Developers will need to undertake further assessment of future flood risk using different allowances to ensure the assessment of future flood risk is based on best available evidence.

The 'Flood risk assessments: climate change allowances' guidance for the South East area of England provides the following sea level allowances:

Area of England		2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 / metres (m)
South East	Higher Central	5.7	8.7	11.6	13.1	1.2
South East	Upper End	6.9	11.3	15.8	18.2	1.6

Table 3: Sea Level Allowances for the South East River Basin District for each epoch in mm per year (Source: 'Flood risk assessments: climate change allowances')

The River Arun to East Head (2D) coastal modelling report (Emsworth to Littlehampton West Bank Coastal Modelling, April 2016), states that water level rise for the modelling study uses sea-level rise estimates from the NPPF – which was a 1.13m rise from 2016 to 2115.

Based on the current climate change allowance guidance, the cumulative rise for the Higher Central and Upper End allowances (from 2016 which is the model base year) is 1.12m and 1.50m respectively.

Area of England		2016 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2010 to 2125 / metres (m)
Site	Higher Central	114	261	348	393	1.12
Site	Upper End	138	339	474	546	1.50

Table 4: Sea Level Allowances for the site for each epoch in mm per year (Source: 'Flood risk assessments: climate change allowances')

The undefended 1:200 year flood level for the present day (2016) is 3.75mAOD. For the Higher Central and Upper End climate change allowances in 2125 the 1:200 year flood level is therefore 4.87mAOD and 5.25mAOD.

Comparison of these modelled flood levels with the topographic finished floor level of 4.30mAOD, shows that the floor level is 0.57m below the undefended Higher Central and 0.95m below the Upper End 1:200 year flood level in 2125.

The site is entirely outside of the modelled defended 1:200 year flood extent at the present day. In order to estimate the Higher Central and Upper End climate change allowances in 2125, the same approach is applied as for the undefended scenarios. The undefended 1:200 year Higher Central flood level in 2125 is 0.03m higher than the undefended 2115 flood level provided, and the Upper End 2125 flood level is 0.41m higher than the undefended 2115 flood level provided. As such, applying the same principle to the defended flood level, a defended 2115 flood level of 4.24mAOD has been provided. The defended Higher Central and Upper End flood levels in 2125 are therefore 4.27mAOD and 4.65mAOD respectively.

Comparison of the defended Higher Central and Upper End flood levels in 2125 with the topographic finished floor level of 4.30mAOD, shows that the floor level is 0.03m above the defended Higher Central and 0.35m below the Upper End 1:200 year flood level in 2125.

It should be noted however that the site is defended with the primary defence running the length of Pagham being shingle beach defences – both natural and manmade, with an effective crest level of 5.72mAOD. The beach is maintained by Arun District Council and the Shoreline Management Plan Policy for this area of Pagham (unit 4d24) is to Hold the Line.

5.2.3 Flood defences:

The primary defence running the length of Pagham is shingle beach defences – both natural and manmade, with an effective crest level of 5.72mAOD. The beach is maintained by Arun District Council and the Shoreline Management Plan Policy for this area of Pagham (unit 4d24) is to Hold the Line.

5.2.4 Residual risk (breach or overtopping of flood defences):

Breaching of flood defences can cause rapid inundation of areas behind flood defences as flow in the river channel discharges through the breach. A breach can occur with little or no warning, although they are much more likely to concur with extreme river levels or tides when the stresses on flood defences are highest. Flood water flowing through a breach will normally discharge at a high velocity, rapidly filling up the areas behind the defences, resulting in significant damage to buildings and a high risk of loss of life. Breaches are most likely to occur in soft defences such as earth embankments although poorly maintained hard defences can also be a potential source of breach.

Overtopping of flood defences occurs when water levels exceed the protection level of raised flood defences. The worst case occurs when the fluvial or tidal levels exceed the defence level as this can lead to prolonged flooding. Less severe overtopping can occur when flood levels are below defence levels, but wave action causes cyclic overtopping, with intermittent discharge over the crest level of the defence. Flood defences are commonly designed with a freeboard to provide protection against overtopping from waves. The risk from overtopping due to exceedance of the flood defence level is much more significant than the risk posed by wave overtopping. Exceedance of the flood defence level can lead to prolonged and rapid flooding with properties immediately behind the defences at highest risk.

The site is shown to be outside of the modelled 1:200 year defended tidal flood extent. The EA has confirmed that there are flood defences in the form of a shingle beach.

The site is defended from tidal flooding to the 1:200 year standard, however in the event of failure (breach) or exceedance (overtopping) of the flood defences the site would be at risk of inundation.

The Arun to East Head model includes a number of breach model simulations, including a 40m breach through the spit located directly in front of the harbour mouth at Pagham. For the present day 1:200 year and 1:1000 year events the site is entirely outside of the maximum modelled breach extent.

5.2.5 Historical flood events:

The EA has no record of flooding affecting the site previously.

5.3 Pluvial (Surface Water):

Pluvial (surface water) flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

In 2013 the EA, working with Lead Local Flood Authorities (LLFAs), produced an updated Flood Map for Surface Water. It is considered to represent a significant improvement on the previous surface water flood maps available, both in terms of method and representation of the risk of flooding. The modelling techniques and data used are considerably improved, and also incorporated locally produced mapping where this is available to represent features best modelled at a local scale.

The Flood Map for Surface Water assesses flooding scenarios as a result of rainfall with the following chance of occurring in any given year (annual probability of flooding is shown in brackets):

- 1:30 (3.3%)
- 1:100 (1%)
- 1:1000 (0.1%)

The mapping below shows the Risk of Flooding from Surface Water centred on the site. Please note that the EA do not consider this information suitable to be used to identify the risk to individual properties or sites. It is useful to raise awareness in areas which may be at risk and may require additional investigation.

The EA Risk of Flooding from Surface Water Map suggests that the site lies within an area of “Very Low” risk of flooding from surface water. Beach Road and West Front Road adjacent to the site are shown to be at “Low” risk of flooding from surface water.

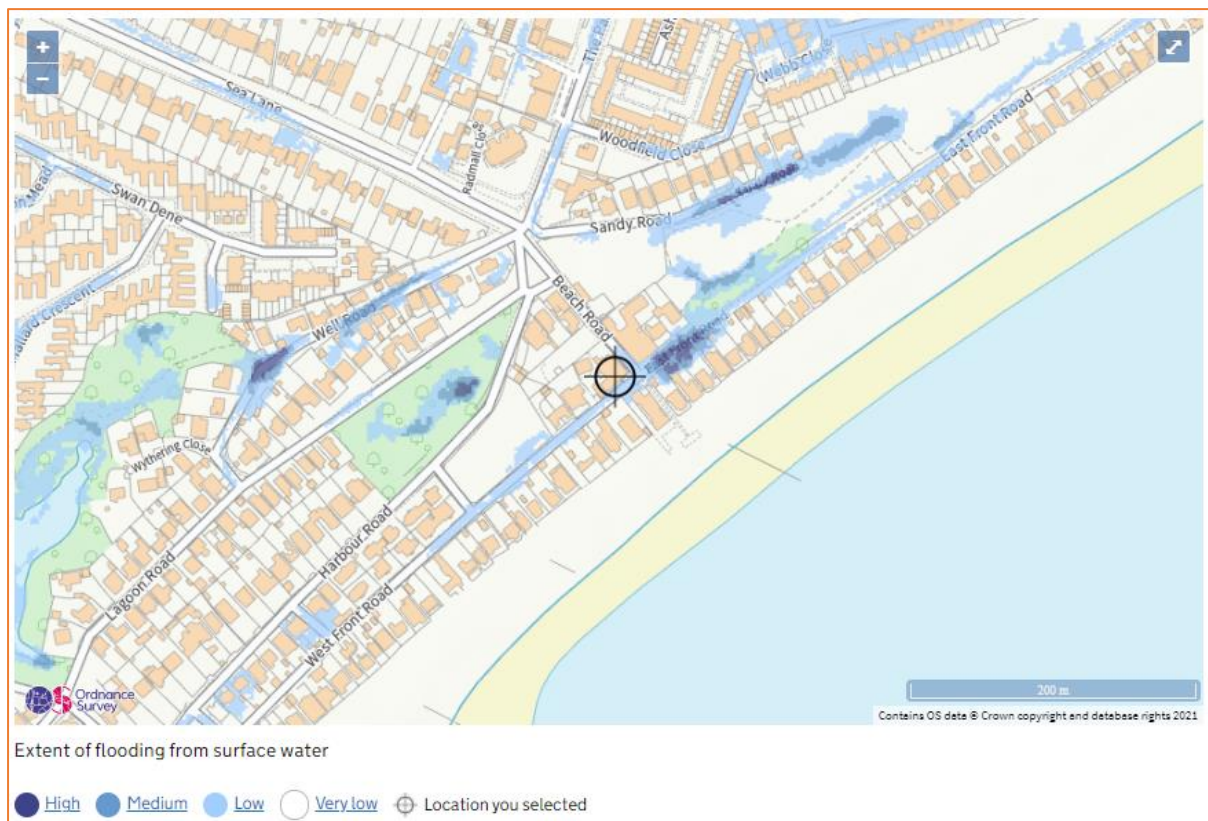


Figure 9: Extract from Environment Agency RoFSW map (Source: EA)

5.4 Groundwater:

Groundwater flooding occurs as a result of water rising up from the underlying rocks or from water flowing from abnormal springs. This tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas the water table is usually at shallower

depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as chalk or sandstone, or may be localised sands or river gravels in valley bottoms underlain by less permeable rocks. Groundwater flooding takes longer to dissipate because groundwater moves much more slowly than surface water and will take time to flow away underground.

No records of groundwater flooding in the vicinity of the site have been provided however, and no basements are proposed as part of the development.

5.5 Sewer Surcharge:

Sewer flooding occurs when the sewer network cannot cope with the volume of water that is entering it. It is often experienced during times of heavy rainfall when large amounts of surface water overwhelm the sewer network causing flooding. Temporary problems such as blockages, siltation, collapses and equipment or operational failures can also result in sewer flooding.

All Water Companies have a statutory obligation to maintain a register of properties/areas which have reported records of flooding from the public sewerage system, and this is shown on the DG5 Flood Register. This includes records of flooding from foul sewers, combined sewers and surface water sewers which are deemed to be public and therefore maintained by the Water Company. The DG5 register records of flood incidents resulting in both internal property flooding and external flooding incidents. Once a property is identified on the DG5 register, water companies can typically put funding in place to address the issues and hence enable the property to be removed from the register. It should be noted that flooding from land drainage, highway drainage, rivers/watercourses and private sewers is not recorded within the register.

No records of sewer flooding at the site have been provided.

5.6 Other Sources:

The EA Risk of Flooding from Reservoirs Map suggests that the site lies outside of the “Maximum extent of flooding” from reservoir failure. The EA also advise on their website that reservoir flooding is extremely unlikely. All major reservoirs have to be inspected by specialist dam and reservoir Engineers. These inspections are monitored and enforced by the EA themselves. The risk to the site from reservoir flooding is therefore minimal and is far lower than that relating to the potential for fluvial flooding to occur.

No further information has been provided to suggest the site is susceptible to from the failure of reservoirs, canals or other artificial infrastructure from the risk of flooding.

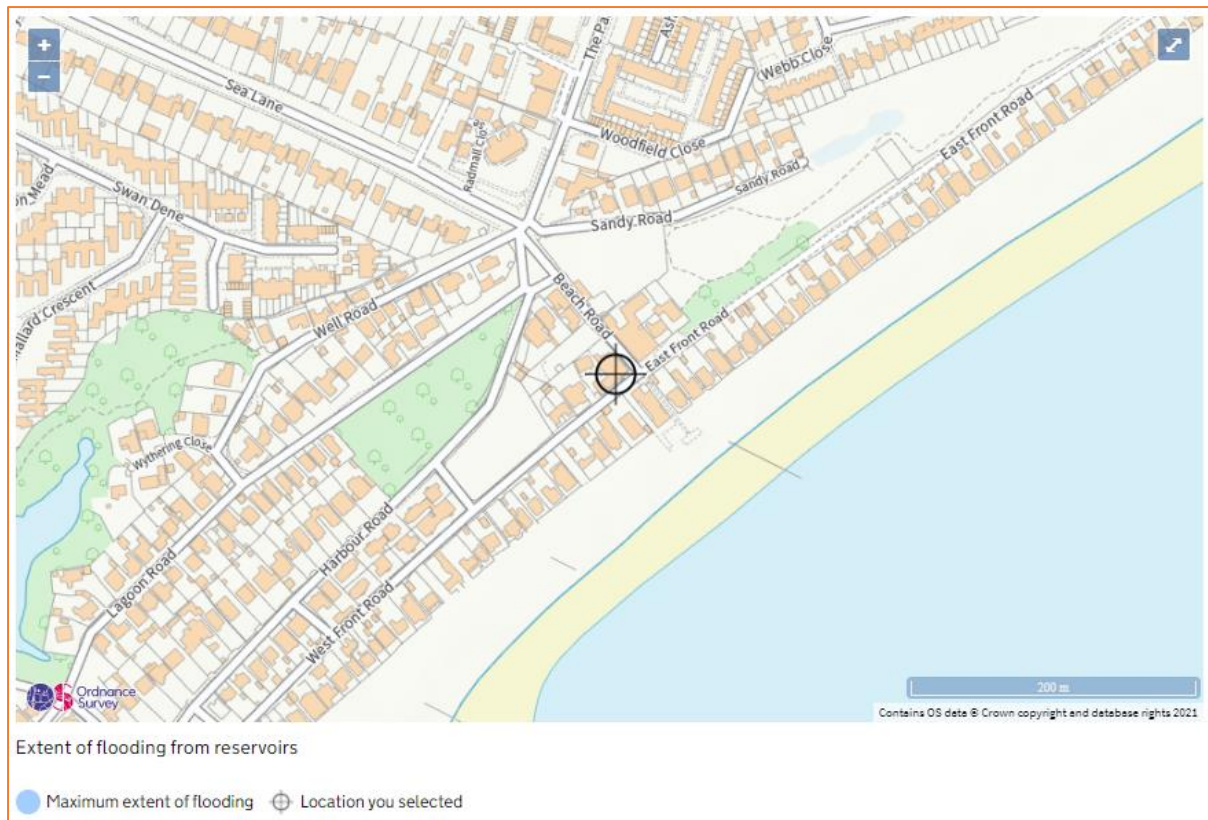


Figure 10: Extract from Environment Agency Risk of Flooding from Reservoirs Map (Source: EA)

6. Flood Risk Management

6.1 Vulnerability to flooding:

The NPPF classifies property usage by vulnerability to flooding.

The existing site usage is classified as "more vulnerable" throughout, as it is Private Club (drinking establishment). Post development, the site will remain "more vulnerable", as the application is for the sub division of existing private club to include 1 no. holiday let accommodation.

Accordingly, it is considered that the vulnerability of the site as a whole will not increase post development, however there will be the introduction of a new residential unit.

6.2 EA Standing Advice:

The EA Standing Advice guidance is for domestic extensions and non-domestic extensions where the additional footprint created by the development does not exceed 250m². It should not be applied if an additional dwelling is being created, e.g. a self-contained annexe or additional commercial unit.

The proposal introduces a new residential unit.

6.3 Physical Design Measures:

The proposal is for the change of use of part of the existing building. As such, it is understood that it is not feasible to raise the existing floor levels – given the constraints of the existing structure.

The existing finished floor level is 4.30mAOD – which is above the modelled defended 1:200 year Higher Central flood level in 2125, but 0.35m below the defended Upper End 1:200 year flood level in 2125.

To help protect against flooding during extreme events, the applicant has agreed to implement flood resistant design measures into the proposed change of use, in consultation with the Local Authority building control department. These measures could include the following where possible:

- Closed-cell foam used in wall cavities;
- External walls rendered resistant to flooding to first floor level;
- Exterior ventilation outlets, utility points and air bricks fitted with removable waterproof covers;
- Electrical incomer and meter situated at least 300mm above defended 1:200yr Upper End climate change flood level (0.65m) above finished ground floor level;
- Boilers, control and water storage / immersion installed at least 300mm above defended 1:200yr Upper End climate change flood level (0.65m) above finished ground floor level;
- Gas meter installed at least 0.65m above finished ground floor level;
- Plumbing insulation of closed-cell design;

- Non-return valves fitted to all drain and sewer outlets;
- Manhole covers secured;
- Anti-syphon fitted to all toilets;
- Kitchen units of solid, water resistant material at ground floor level;
- Use of MDF carpentry (i.e. skirting, architrave, built-in storage) avoided at ground floor level;
- Stairs of solid construction with wood faces treated to resist water penetration.

A flood proof door should be installed for external ground floor level doors, or demountable flood defence barrier to defend lower ground level doorways and low windows if flood doors are not practical or other planning constraints prevent it.

As such the flood resilience scheme will be designed with a crest to 300mm above defended 1:200yr Upper End climate change flood level (0.65m) above finished ground floor level.

Flood resistance measures (such as demountable flood barriers) are recommended to a maximum height of 600mm above ground level, as depths over 600mm can cause structural problems.

6.4 Safe Escape and Flood Action Plan:

The NPPF requires a route of safe escape for all residents and users to be provided from new residential properties in Flood Zone 3. Safe escape is usually defined as being through slow moving flood water no deeper than 25cm during the 1:200 year tidal plus allowance for climate change flood event.

As such, safe escape will be provided by a flood warning and evacuation plan, which will be prepared in liaison with the Council's Emergency Planners and tied in with the existing emergency plans for the area.

The site will be evacuated on receipt of a flood warning and the occupants will not return until the flood warning has been lifted. Tidal flooding from storm surges is well understood and tidal storm surges are monitored and predicted. As such, it is unlikely that the site would flood unexpectedly without sufficient flood warning for evacuation.

The tidal cycles generally dictate 6 hours between the peak and trough of the tidal cycle, and as such after a likely maximum of 6 hours water will be able to drain from the site. The duration of any tidal flooding would be likely to be limited to a period of a few hours around high water.

Flood warning notices will be erected around the site to inform site users of the risk of flooding, and the flood warning and evacuation measures.

Residents and users should follow the warning and evacuation procedure detailed in the following section.

The EA is responsible for issuing flood warnings. Flood warnings are issued to the emergency services and local authorities. Both private individuals and organisations can sign-up to receive warnings via phone, text or email. This system of receiving warnings is currently voluntary.

Advice regarding severe flood warnings will generally be given during weather forecasts on local radio and TV. In the case of extreme events, warnings can also be disseminated via door to door visits by the police or locally appointed flood wardens.

The applicant has agreed to subscribe to the EA's flood warning service.

The flood warning service has three types of warnings that will help you prepare for flooding and take action:

Flood Warning	Flood Alert	Flood Warning	Severe Flood Warning
			
What it means?	Flooding is possible. Be prepared.	Flooding is expected. Immediate action required.	Severe flooding. Danger to life.
When it's used?	Two hours to two days in advance of flooding.	Half an hour to one day in advance of flooding.	When flooding poses a significant threat to life.
What to do?	Be prepared to act on your flood plan. Prepare a flood kit of essential items. Monitor local water levels and the flood forecast on our website.	Move family, pets and valuables to a safe place. Turn off gas, electricity and water supplies if safe to do so. Put flood protection equipment in place.	Stay in a safe place with a means of escape. Be ready should you need to evacuate from your home. Co-operate with the emergency services. Call 999 if you are in immediate danger.

Table 5: EA Flood Warning Service

The applicant has prepared the following flood plan to protect life and property during a flood event:

Before a flood:

- Find out if you are at risk of flooding.
- Find out if you can receive flood warnings.
- Prepare and keep a list of all your important contacts to hand or save them on your mobile phone.
- Think about what items you can move now and what you would want to move to safety during a flood such as pets, cars, furniture, and electrical equipment.
- Know how to turn off gas, electricity and water supplies.
- Prepare a flood kit of essential items and keep it handy. It can include copies of important documents, a torch, a battery-powered or wind-up radio, blankets and warm clothing, waterproofs, rubber gloves and a first aid kit including all essential medication.
- Consider buying flood protection products such as flood boards and airbrick covers to help reduce flood water getting into your property.

During a flood:

- Tune into your local radio station on a battery or wind-up radio.
- Fill jugs and saucepans with water.
- Grab your flood kit - if you have prepared one.
- Collect blankets, torch, first aid kit, medication and food.
- Move important documents, personal items, valuables, and lightweight belongings upstairs or to high shelves.
- Raise large items of furniture, or put them in large bags if you have them.
- Move people, outdoor belongings, cars and pets to higher ground.
- Switch off water, gas and electricity at mains when water is about to enter your home. Do not touch sources of electricity when standing in water.
- Fit flood protection products, if you have them, for example flood boards, airbrick covers, sandbags.
- Put plugs in sinks and baths. Weigh them down with a pillowcase or plastic bag filled with soil.
- If you do not have non-return valves fitted, plug water inlet pipes with towels or cloths.
- Move your family and pets upstairs or to a high place with a means of escape.
- Listen to the advice of the emergency service and evacuate if told to do so.
- Avoid walking or driving through flood water. Six inches of fast-flowing water can knock over an adult and two feet of water can move a car.

After a flood:

- If you have flooded, contact your insurance company as soon as possible.
- Take photographs and videos of your damaged property as a record for your insurance company.
- If you don't have insurance, contact your local authority for information on grants and charities that may help you.
- Flood water can contain sewage, chemicals and animal waste. Always wear waterproof outerwear, including gloves, wellington boots and a face mask.
- Have your electrics, central heating and water checked by qualified engineers before switching them back on.

6.5 Off-Site Impacts:**6.5.1 Fluvial floodplain storage:**

The NPPF requires that where development is proposed in undefended areas of floodplain, which lie outside of the functional floodplain, the implications of ground raising operations for flood risk elsewhere needs to be considered. Raising existing ground levels may reduce the capacity of the floodplain to accommodate floodwater and increase the risk of flooding by either increasing the depth of flooding to existing properties at risk or by extending the floodplain to cover properties normally outside of the floodplain. Flood storage capacity can be maintained by lowering ground levels either within the curtilage of the development or elsewhere in the floodplain, in order to maintain at least the same volume of flood storage capacity within the floodplain.

In undefended tidal areas, raising ground levels is unlikely to impact on maximum tidal levels so the provision of compensatory storage should not be necessary.

For development in a defended flood risk area, the impact on residual flood risk to other properties needs to be considered. New development behind flood defences can increase the residual risk of flooding if the flood defences are breached or overtopped by changing the conveyance of the flow paths or by displacing flood water elsewhere. If the potential impact on residual risk is unacceptable then mitigation should be provided.

The site is situated within an area at tidal flood risk. In addition, the application is for the change of use of part of the existing structure.

As such, there will be no unacceptable loss of flood storage post development.

6.5.2 Surface Water Drainage:

The proposed development is for the change of use of the existing building on site, and as such there will be no change in the building footprint or impermeable coverage on site post development. Post development there will be no change in the existing drainage arrangements.

7. Sequential and Exception Test

The Sequential Test aims to ensure that development does not take place in areas at high risk of flooding when appropriate areas of lower risk are reasonably available. The site is situated in Flood Zones 2 and 3 when using the Environment Agency Flood Map for Planning (Rivers and Sea).

The proposed development is considered to be “more vulnerable” (residential). The proposed application is considered to be suitable within Flood Zones 2 and 3.

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	✗	✗	✗	✓

Table 6: Flood risk vulnerability and flood zone ‘compatibility’

The Sequential and Exception Tests do not need to be applied to minor developments and changes of use. The proposed application is for the change of use of part of the existing property.

8. Discussion and Conclusions

Unda Consulting Limited have been appointed by Carly Barnes to undertake a Flood Risk Assessment for the proposed development at The Pagham Club, 2 West Front Road, Pagham PO21 4SY. The purpose of the study is to support a planning application for the proposed development. This report presents our findings based on the readily available information and data relating to the site and surrounding drainage area.

The proposed planning application is for the sub division of existing private club to include 1 no. holiday let accommodation.

The existing site usage is classified as "more vulnerable" throughout, as it is Private Club (drinking establishment). Post development, the site will remain "more vulnerable", as the application is for the sub division of existing private club to include 1 no. holiday let accommodation.

Accordingly, it is considered that the vulnerability of the site as a whole will not increase post development, however there will be the introduction of a new residential unit.

The site is located within Flood Zones 2 and 3 (Medium and High Probability), which means it is defined as land having between a 1 in 1000 and at least a 1 in 200 annual probability of tidal flooding.

The risk would appear to be predominantly tidal and originate from the English Channel, which lies approximately 100m to the southeast of the site boundary.

Modelled flood levels have been provided from the River Arun to East Head (2D) coastal modelling, which was completed by JBA Consulting in 2016.

The site is shown to be entirely outside of the defended 1:200 year flood extent. For the undefended 1:200 year flood event, comparison of the modelled undefended on-site flood level with topographic site levels shows that the site is between 0.15m below and 0.55m above the undefended flood level. The existing finished floor level is 4.30mAOD – which is 0.55m above the 1:200 year flood level. The site is however defended, with an effective crest level of 5.72mAOD (Source: EA).

Comparison of the modelled flood levels with the topographic finished floor level of 4.30mAOD, shows that the floor level is 0.57m below the undefended Higher Central and 0.95m below the Upper End 1:200 year flood level in 2125.

Comparison of the defended Higher Central and Upper End flood levels in 2125 with the topographic finished floor level of 4.30mAOD, shows that the floor level is 0.03m above the defended Higher Central and 0.35m below the Upper End 1:200 year flood level in 2125.

It should be noted however that the site is defended with the primary defence running the length of Pagham being shingle beach defences – both natural and manmade, with an effective crest level of 5.72mAOD. The beach is maintained by Arun District Council and the Shoreline Management Plan Policy for this area of Pagham (unit 4d24) is to Hold the Line.

The EA Risk of Flooding from Surface Water Map suggests that the site lies within an area of "Very Low" risk of flooding from surface water. Beach Road and West Front Road adjacent to the site are shown to be at "Low" risk of flooding from surface water.

Additionally, the risk of flooding posed to the site by groundwater and sewer surcharge flooding would appear to be low.

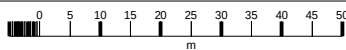
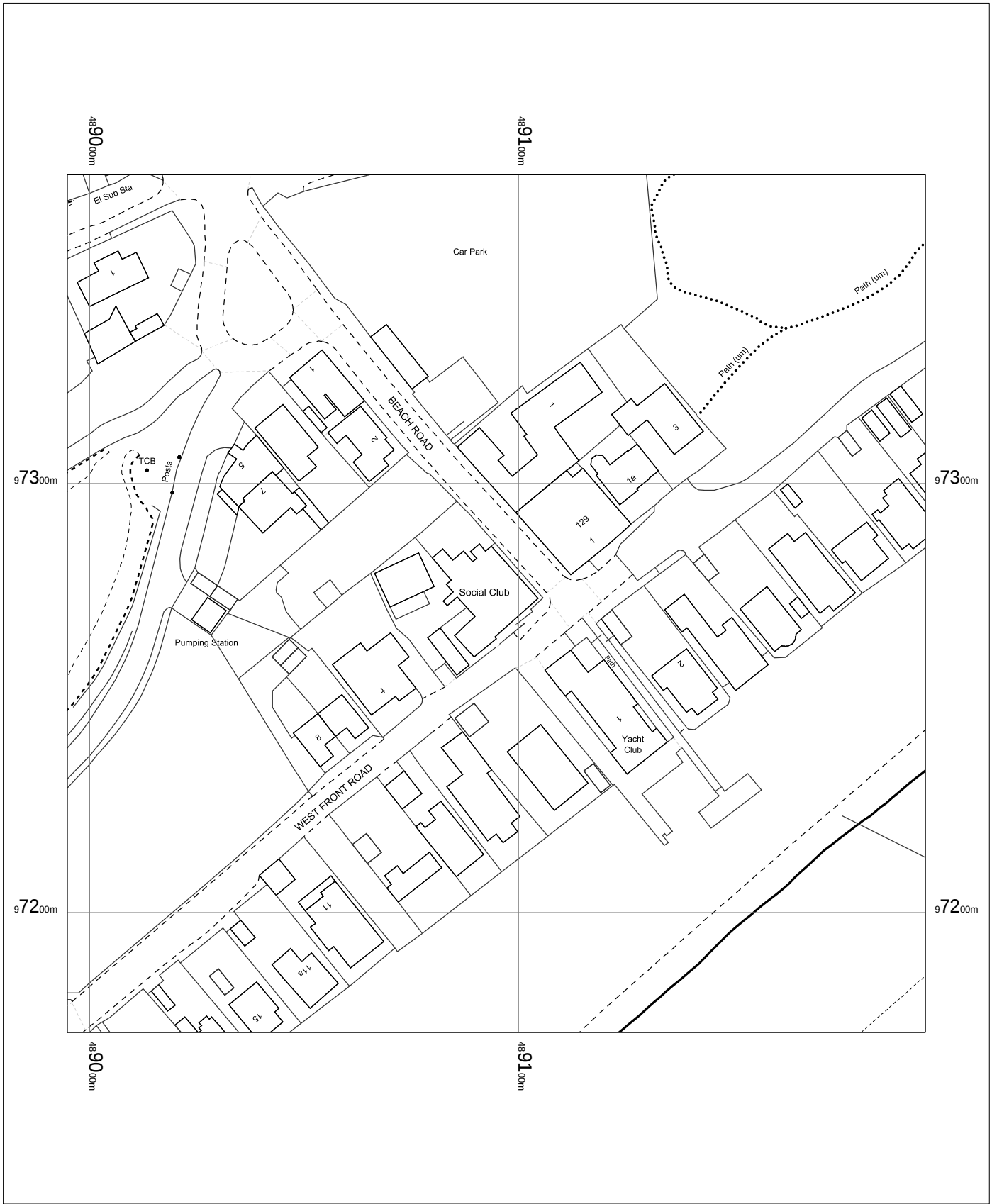
The applicant has confirmed that:

- Change of use of part of an existing building, floor levels cannot therefore be raised above existing levels.
- Flood proofing of the development will be incorporated as appropriate.
- Safe escape will be provided by the implementation of a flood warning and evacuation plan, which will be tied in with the existing emergency plans for the area and prepared in liaison with the Council's Emergency Planners.
- The applicant will register with the Environment Agency Floodline Warnings/Alert Direct service.

Assuming accordance with these flood risk management measures, Unda Consulting Limited consider the proposed application to be suitable in flood risk terms.

9. Appendix

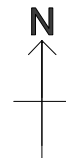
- Existing and proposed plans.
- Environment Agency Product 4 data.



OS MasterMap 1250/2500/10000 scale
 Monday, March 8, 2021, ID: CM-00944467
www.centremapslive.co.uk

1:1250 scale print at A4, Centre: 489095 E, 97272 N

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Surveyors and Designers

Building design
 Planning
 Surveys
 Glazed structures

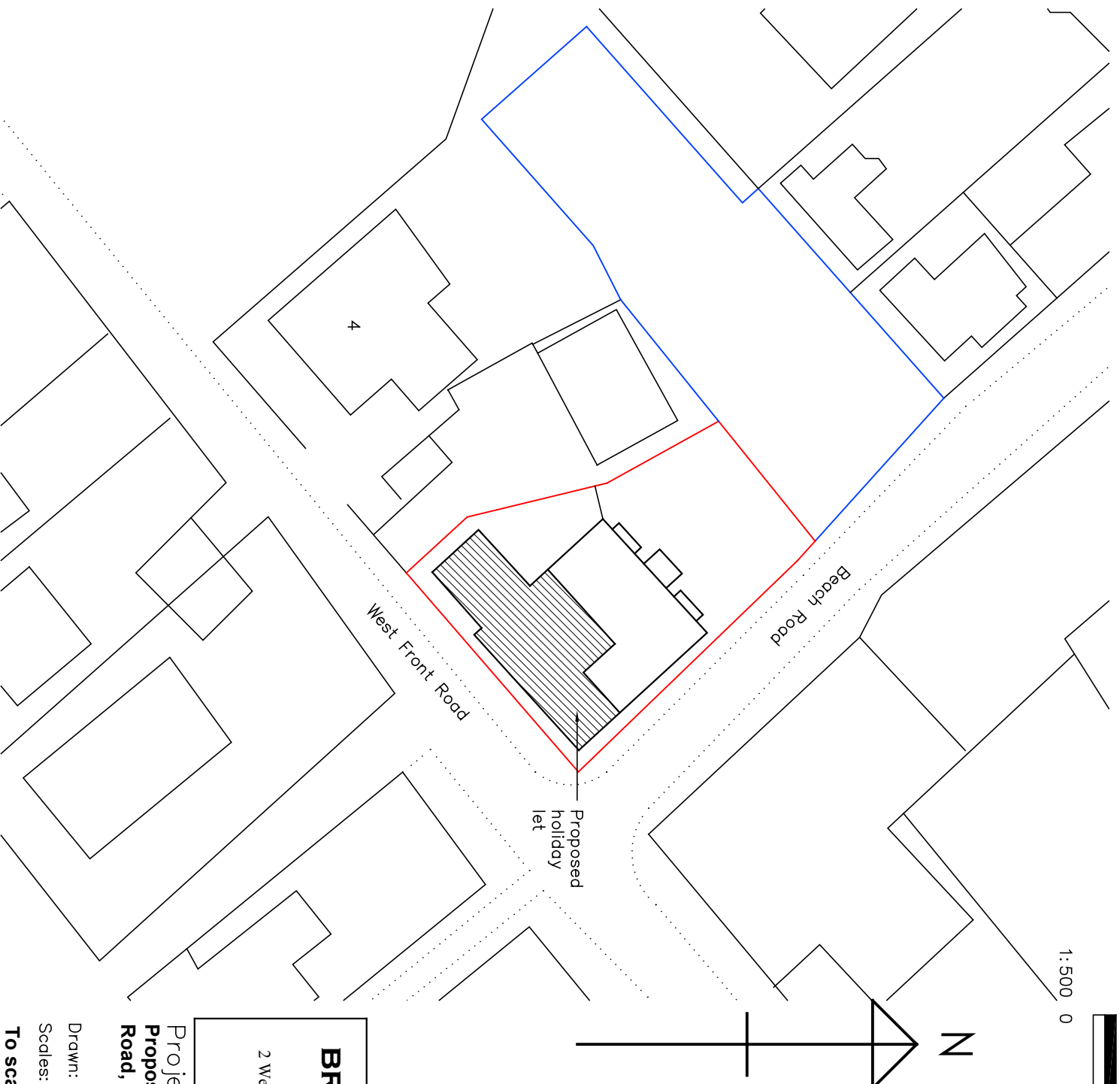


Bryceson Shaw Associates

Tel/Fax 01903 734381
 E-mail brycesonshaw@btinternet.com

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N



BRYCESON SHAW ASSOCIATES

Surveyors and Designers

2 Wellesley Court, Fitzalan Road, Littlehampton, West Sussex BN17 5JW

Tel. 01903 734381 Mobile: 07889 651301

E-mail: brycesonshaw@btinternet.com

Project:

Proposed holiday let; Pagham Beach Club, 2 West Front Road, Pagham PO21 4SY

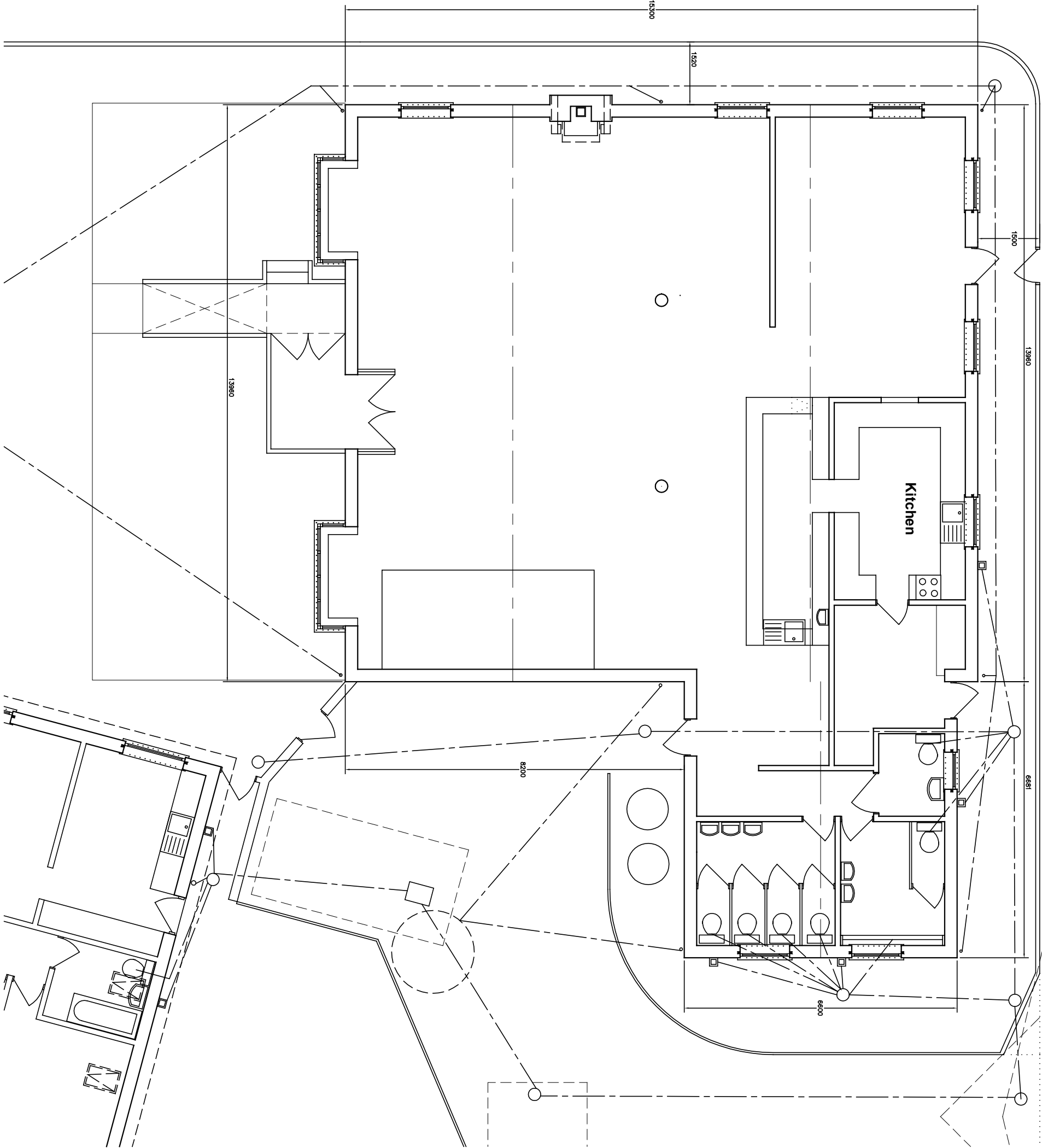
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Date: **March 2021**

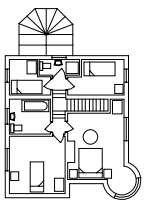
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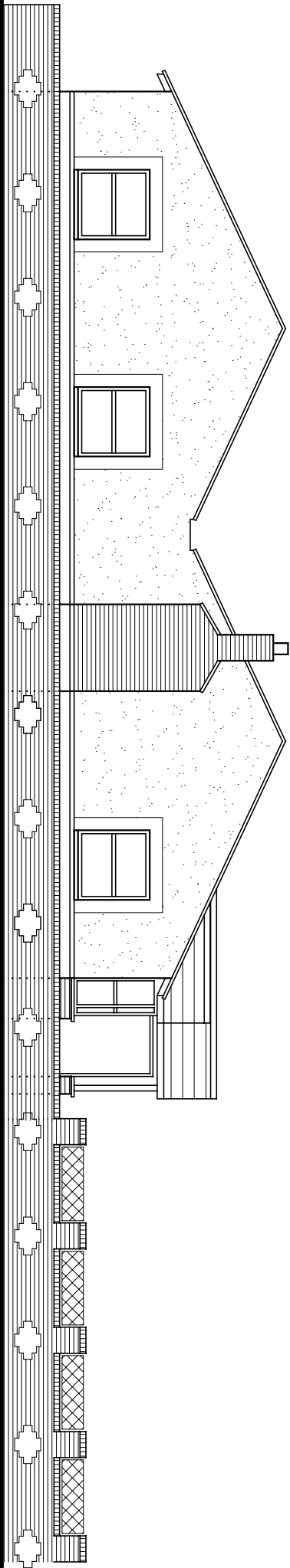
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To scale when printed on A4

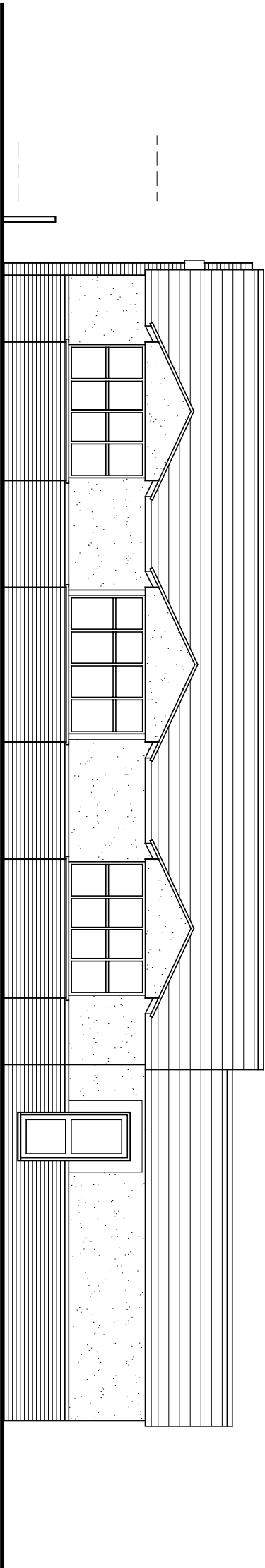


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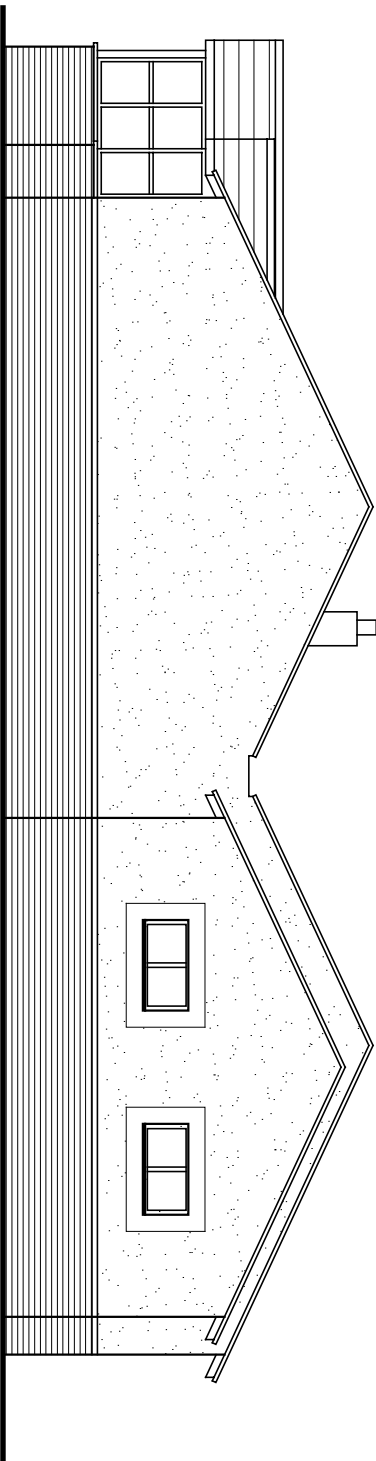
BRYCESON SHAW ASSOCIATES	
Surveyors and Designers	
2 Wellesley Court, Fitzalan Road, Littlehampton, West Sussex BN17 5JW Tel. 01903 734381 Mobile: 07889 651301 E-mail: brycesonshaw@btinternet.com	
	
Project: Proposed holiday let; Pagham Beach Club, 2 West Front Road, Pagham PO21 4SY	
Drawing: Plan as existing	
For: Pagham Beach Club	
Drawn: PKS	Date: February 2021
Scales: 1:100	No: 2730/01/01/A
To scale when printed on A3	



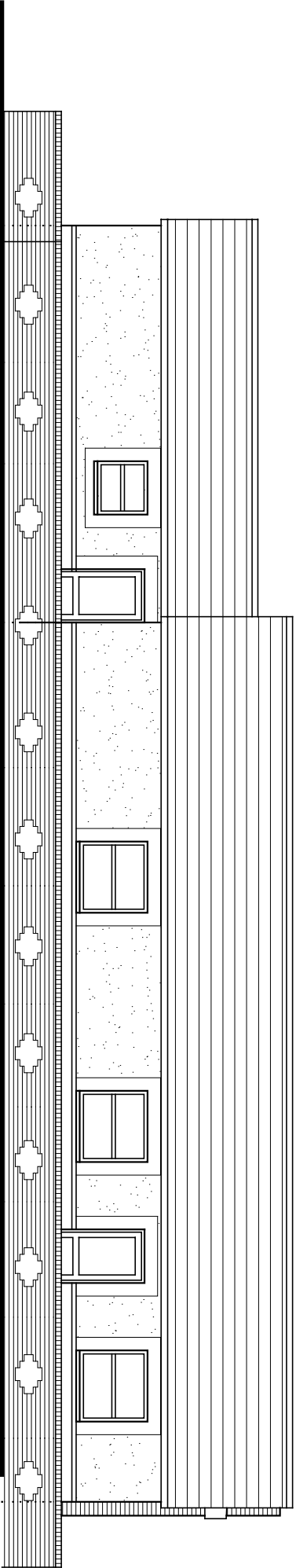
Side - East



Front - North

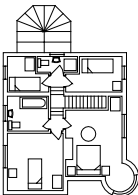


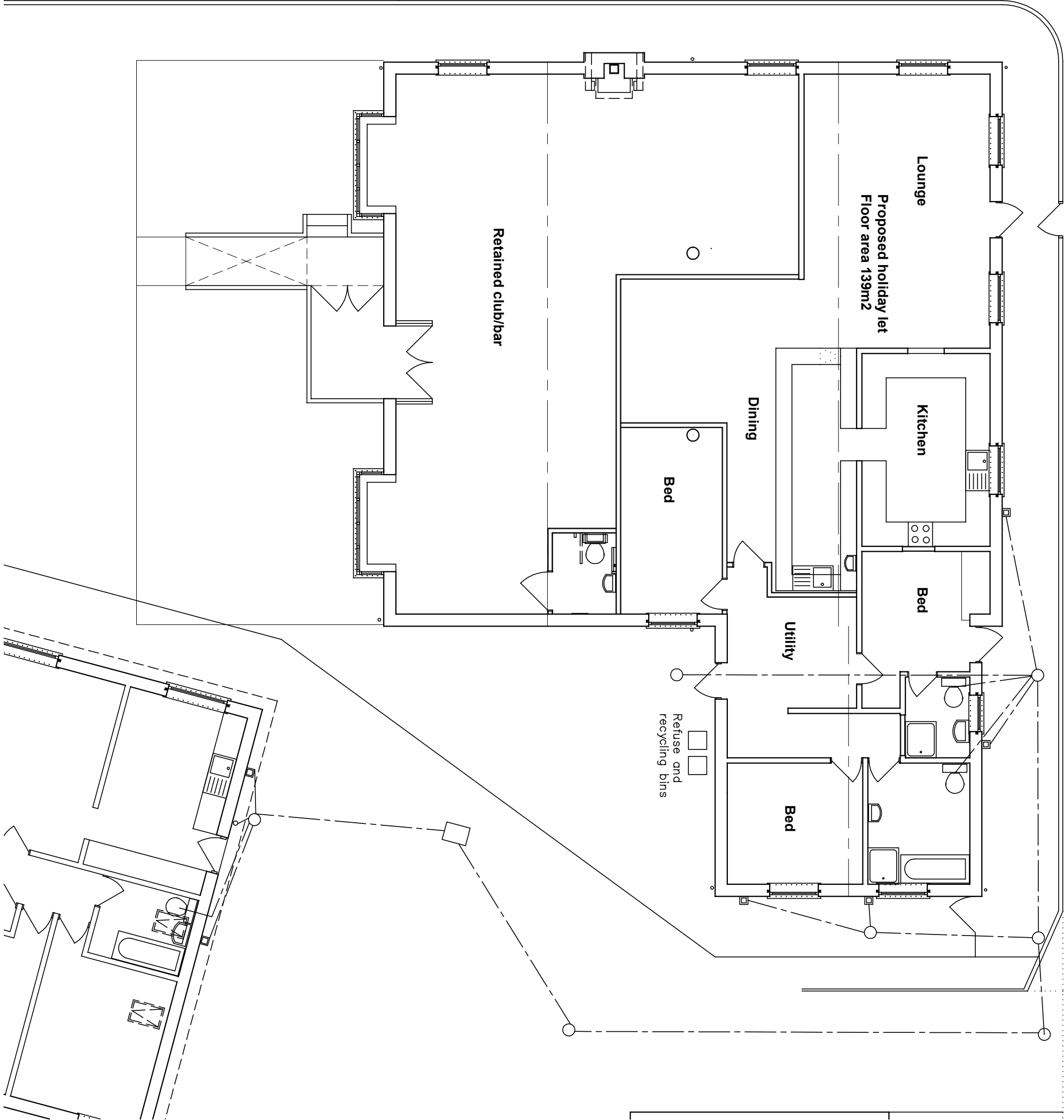
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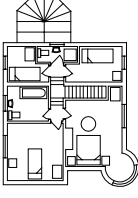
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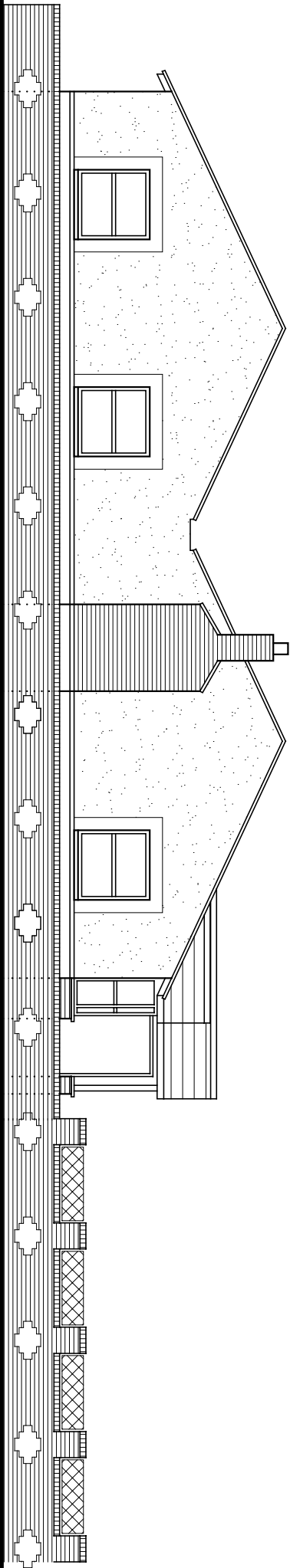
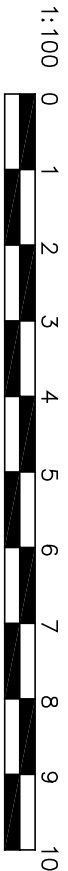
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BRYCESON SHAW ASSOCIATES	
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Tel. 01903 734381 Mobile: 07889 651301	
E-mail: brycesonshaw@btinternet.com	
	
Project:	
Proposed holiday let; Pagham Beach Club, 2 West Front Road, Pagham PO21 4SY	
Drawing:	
Elevations as existing	
For:	
Pagham Beach Club	
Drawn:	Date:
PKS	February 2021
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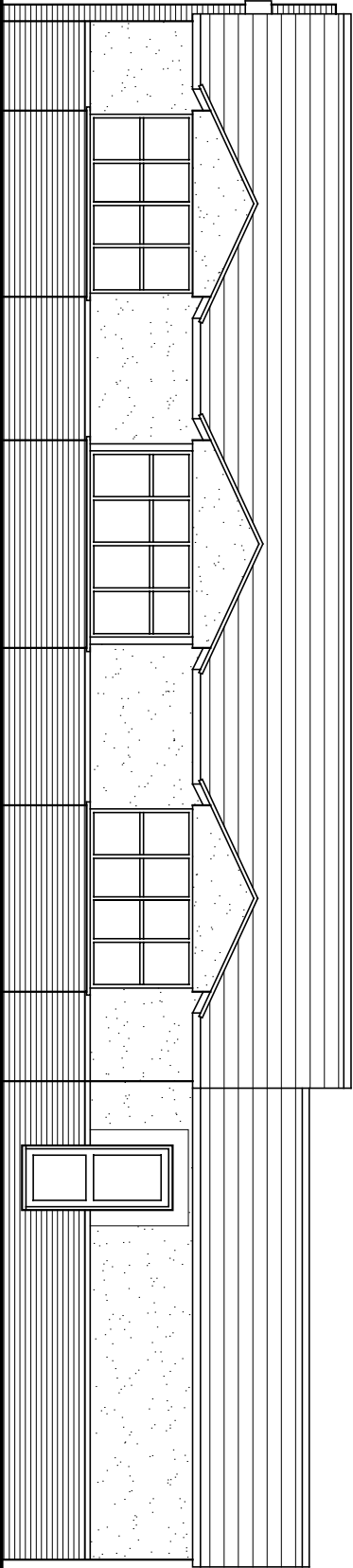


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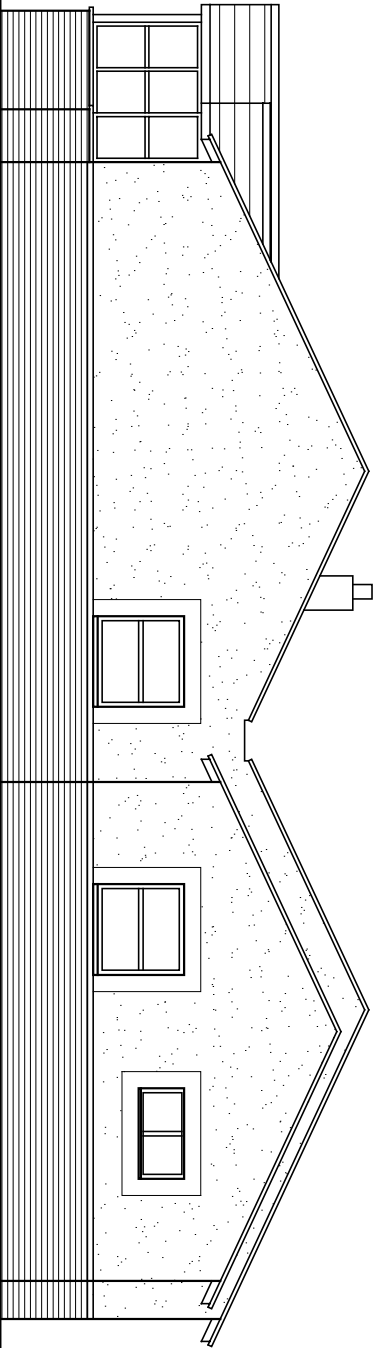
BRYCESON SHAW ASSOCIATES	
Surveyors and Designers	
2 Wellesley Court, Fitzalan Road, Littlehampton, West Sussex BN17 5JW	
Tel. 01903 734381 Mobile: 07889 651301	
E-mail: brycesonshaw@btinternet.com	
	
Project: Proposed holiday let; Pagham Beach Club, 2 West Front Road, Pagham PO21 4SY	
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For: Pagham Beach Club	
Drawn: PKS	Date: February 2021
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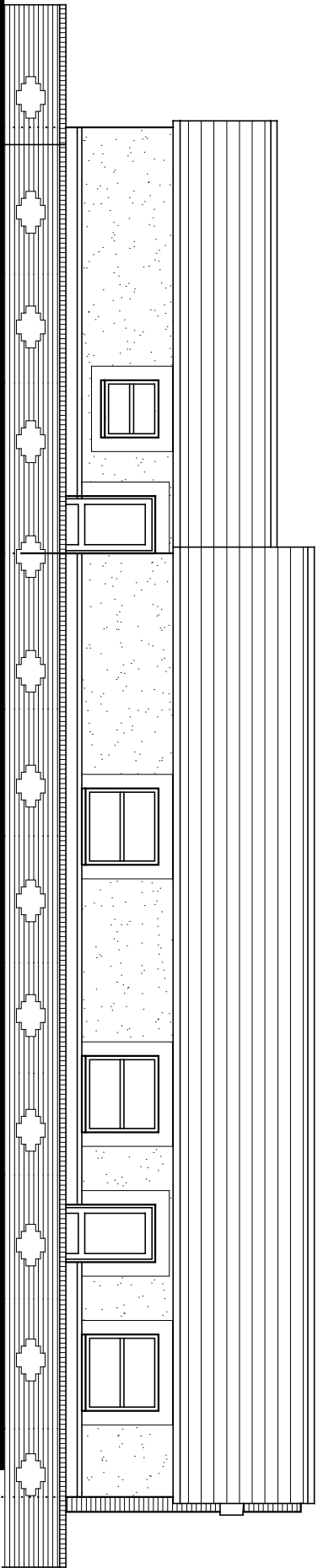
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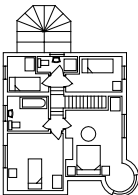


Side - West



Rear - South

Amendments: –

BRYCESON SHAW ASSOCIATES	
Surveyors and Designers	
2 Wellesley Court, Fitzalan Road, Littlehampton, West Sussex BN17 5JW	
Tel. 01903 734381 Mobile: 07889 651301	
E-mail: brycesonshaw@btinternet.com	
	
Project: Proposed holiday let; Pagham Beach Club, 2 West Front Road, Pagham PO21 4SY	
Drawing: Elevations as proposed	
For: Pagham Beach Club	
Drawn: PKS	Date: February 2021
Scales: 1:100	No: 2730/01/04/A
To scale when printed on A3	

Jackie Stone
UNDA Consulting Limited

Our ref: SSD223670
Your ref: 90799
Date: 06/07/2021

Dear Jackie Stone,

**Enquiry Regarding Product 4 for Flood Risk Assessment for The Pagham Club,
2 West Front Road, Pagham, PO21 4SY.**

Thank you for your enquiry which was received on 14 June 2021.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004. The information is attached.

The information on Flood Zones in the area relating to this address is as follows:

The site is in an area located within Flood Zones 2 & 3 as shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named property is in and is not specific to the property itself as it is influenced by factors such as the height of door steps, air bricks or the height of surrounding walls. We do not have access to this information and is not currently used in our flood modelling.

Flood Zone definitions can be found at www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones

Flood Defences

There is a beach maintained by Arun District Council (Asset ID: 133883). It has an effective crest level of 5.72m.

Model Information

The model used was the River Arun to East Head Coastal Modelling (2D) which was completed by JBA Consulting in 2016.

Flood History

We hold no record of previous flooding events affecting this site.

Please note our records are not comprehensive and may not include all events. I recommend contacting the Lead Local Flood Authority, **West Sussex County Council** or the Local Authority, **Arun District Council** for a more comprehensive flood history check.

[FRA advisory text](#)

Name	Product 4
Description	Detailed Flood Risk Assessment Map for The Pagham Club, 2 West Front Road, Pagham, PO21 4SY.
Licence	Open Government Licence
Information Warnings	The flood risk data provided is based on existing EA hydraulic models for existing 0.5% annual probability events with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 17 December 2019. You should refer to 'Flood risk assessments: climate change allowances' for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
Information Warning - OS background mapping	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2021 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

- Flood Map For Planning ([Flood Zone 2](#), [Flood Zone 3](#), [Flood Storage Areas](#), [Flood Defences](#), [Areas Benefiting from Defences](#))
- [Risk of Flooding from Rivers and Sea](#)
- [Historic Flood Map](#)
- [Current Flood Warnings](#)

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

Yours sincerely,

Edward Conway

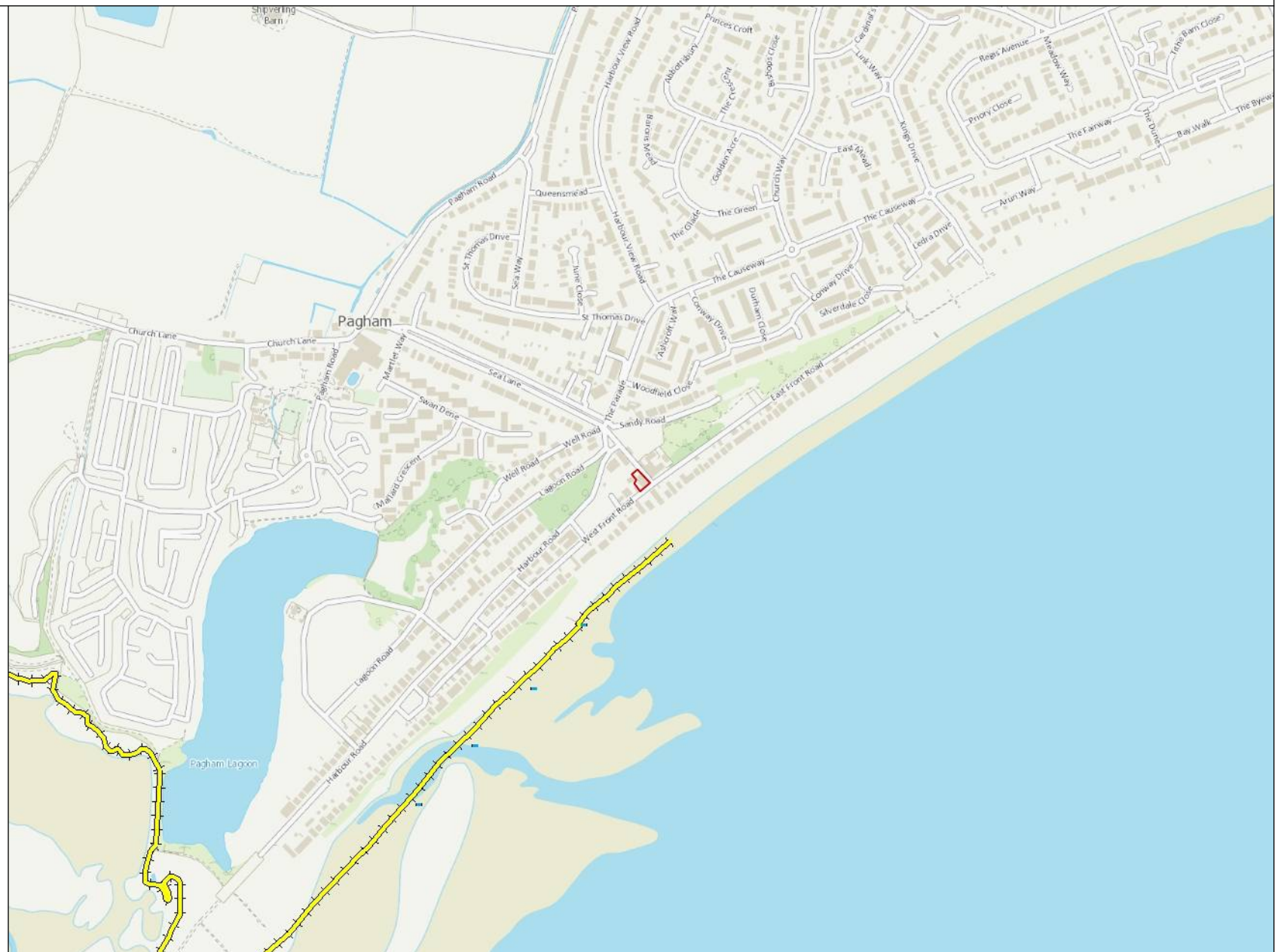
Partnership and Strategic Overview - West Sussex

Environment Agency, Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD

AIMS Flood Defences. Centred PO21 4SY. Created 06/07/2021.

Legend

Please see page 2 for asset symbology



1: 10,000

0 250
Metres



Structures

-  Control Gate
-  Draw Off Tower
-  Fish Pass
-  Hydrobrake
-  In Channel Stoplogs
-  Inspection Chamber
-  Jetty
-  Outfall
-  Screen
-  Spillway
-  Stilling Basin
-  Weir

Beach Structures

-  Breakwater
-  Ramp
-  Slipway
-  Steps
-  Groyne

Instruments

-  Active Monitoring
-  Passive Monitoring

Channel Crossings

-  Bridge
-  Utility Services

Aids to Navigation

-  Beacon
-  Buoy
-  Dolphin
-  Signage
-  Signal

Building Assets

-  Pump House

Major Civils

-  Abutment
-  Central Pier

Defences

-  Embankment
-  Wall
-  Flood Gate
-  Demountable defence
-  Bridge abutment
-  High Ground
-  Beach
-  Barrier Beach
-  Promenade
-  Quay
-  Cliff
-  Dunes

Channels

-  Open channel
-  Simple culvert
-  Complex culvert

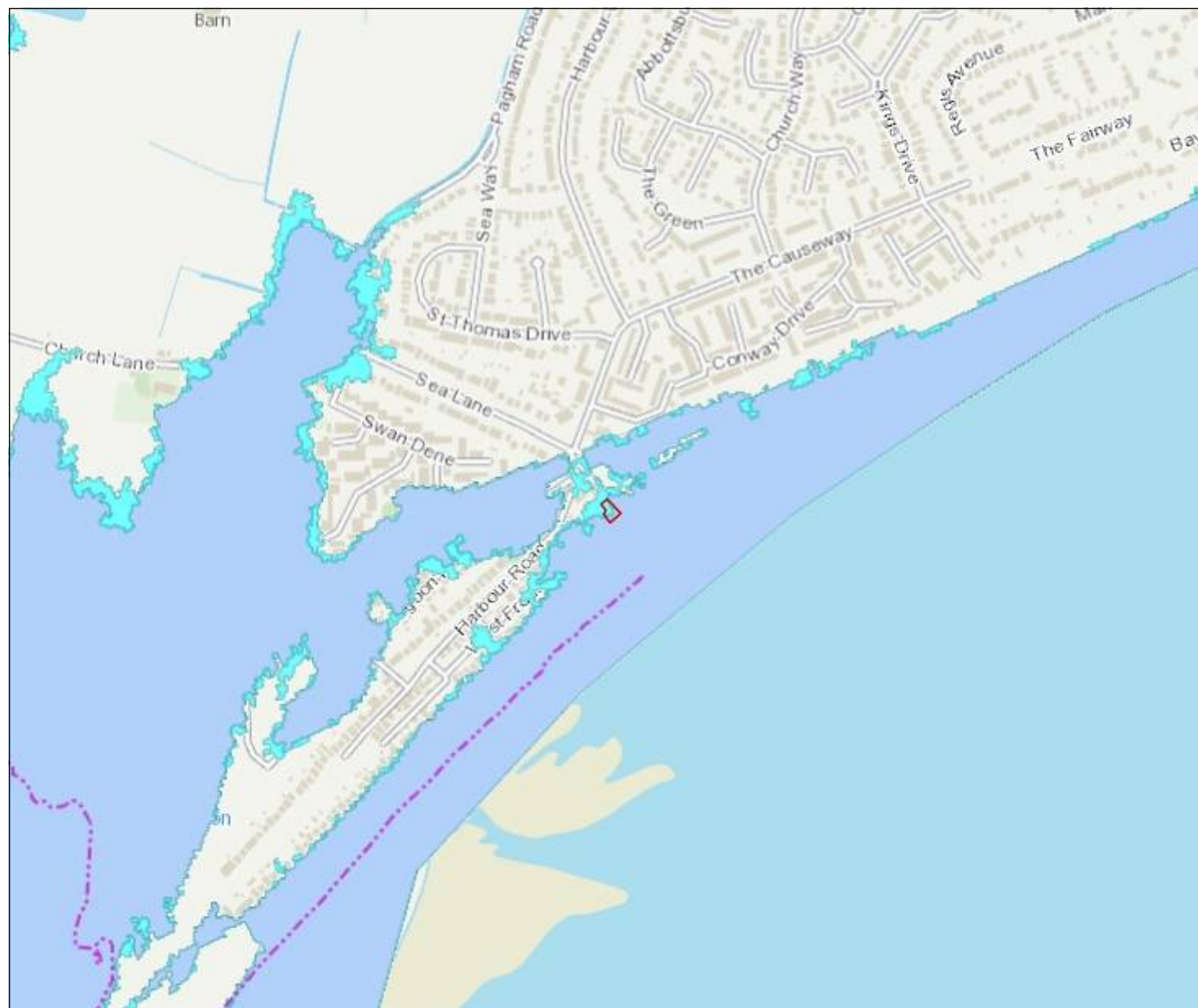
Land

-  Mudflats
-  Saltmarsh
-  Washland

Sites

-  Amenity
-  Control Structure
-  Erosion Protection
-  General
-  Harbour
-  Monitoring
-  Navigation Lock
-  Pumping Station
-  Reservoir
-  Tidal Barrier

Flood Map for Planning (Rivers and Sea). Centred PO21 4SY. Created 06/07/2021.



1: 10,000

0 Metres 250



Flood Map for Planning (Rivers & Sea)

- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

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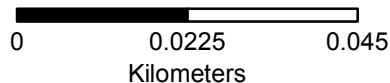


Legend

-  Site Nodes
-  Site Boundary

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:1,000





Product 4 Flood Risk Data Requested by: UNDA Consulting Limited

Site: The Pagham Club, 2 West Front Road, Pagham, PO21 4SY

Table 1: Water Levels: Tidal Undefended

	NGR		Modelled Flood Levels in Metres AOD			
			Undefended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	489089	97280	-	4.24	4.83	-
2	489091	97265	3.75	4.24	4.84	3.94
3	489100	97273	3.75	4.24	4.84	3.94

Table 2: Water Levels: Tidal Defended

	NGR		Modelled Flood Levels in Metres AOD			
			Defended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	489089	97280	-	-	4.24	-
2	489091	97265	-	-	4.24	-
3	489100	97273	-	3.41	4.24	-

Table 3: Water Depths: Tidal Undefended

	NGR		Modelled Flood Depths in Metres			
			Undefended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	489089	97280	-	0.34	0.93	-
2	489091	97265	0.11	0.60	1.20	0.30
3	489100	97273	0.46	0.95	1.55	0.65

Office Address: Guildbourne House, Chatsworth Road, Worthing BN11 1LD.
 Customer services line: 03708 506 506. Email: enquiries@environment-agency.gov.uk
www.gov.uk/government/organisations/environment-agency

Table 4: Water Depths: Tidal Defended

	NGR		Modelled Flood Depths in Metres			
			Defended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	489089	97280	-	-	0.34	-
2	489091	97265	-	-	0.74	-
3	489100	97273	-	0.21	1.01	-

All levels taken from: River Arun to East Head Coastal Modelling (2D) (2016)

Produced on: 06/07/2021

The flood risk data provided is based on existing EA hydraulic models for existing 0.5% annual probability events with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 17 December 2019. You should refer to 'Flood risk assessments: climate change allowances' for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

There is no additional information or health warnings for these levels/depths or the model from which they have been produced.

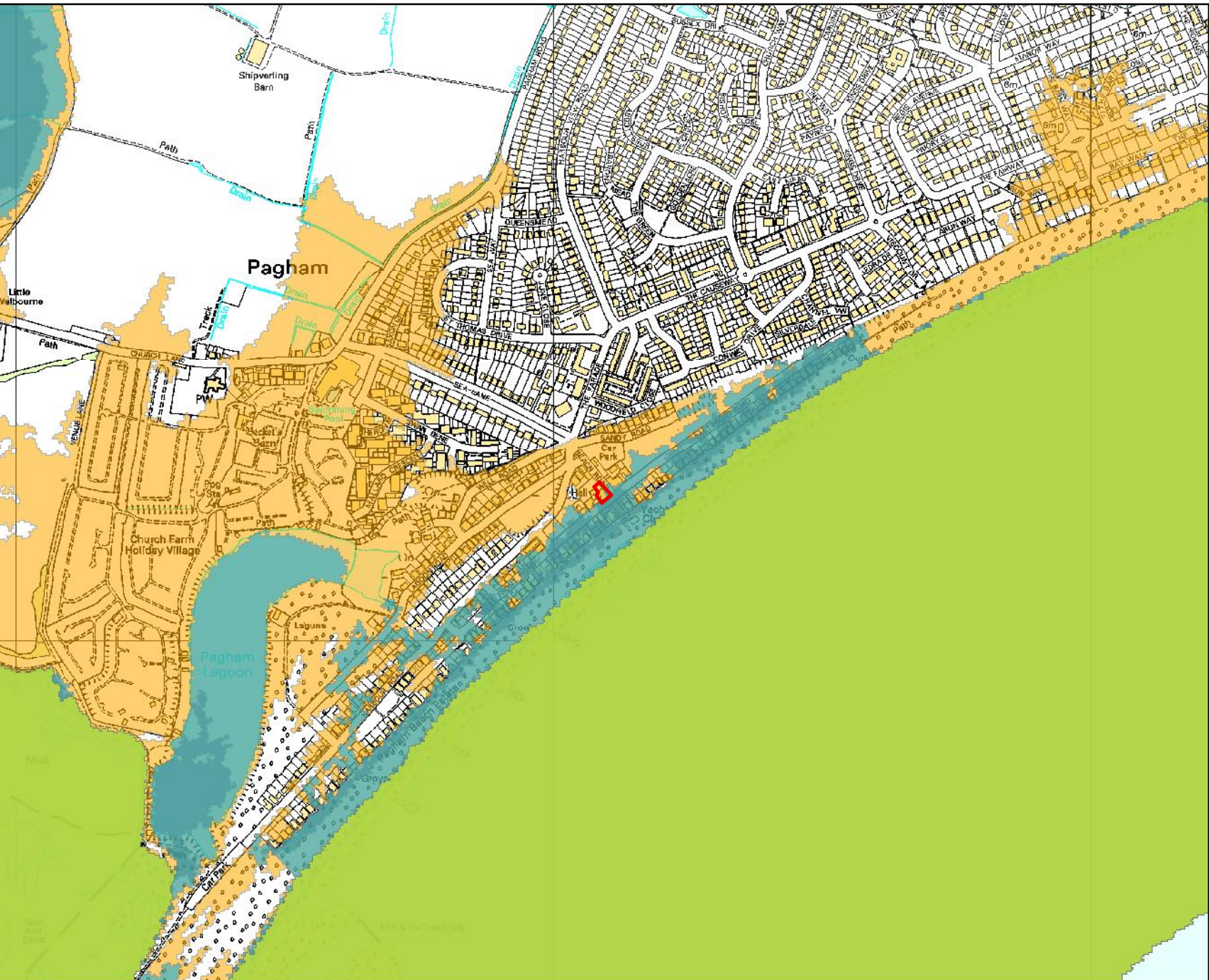
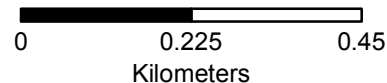


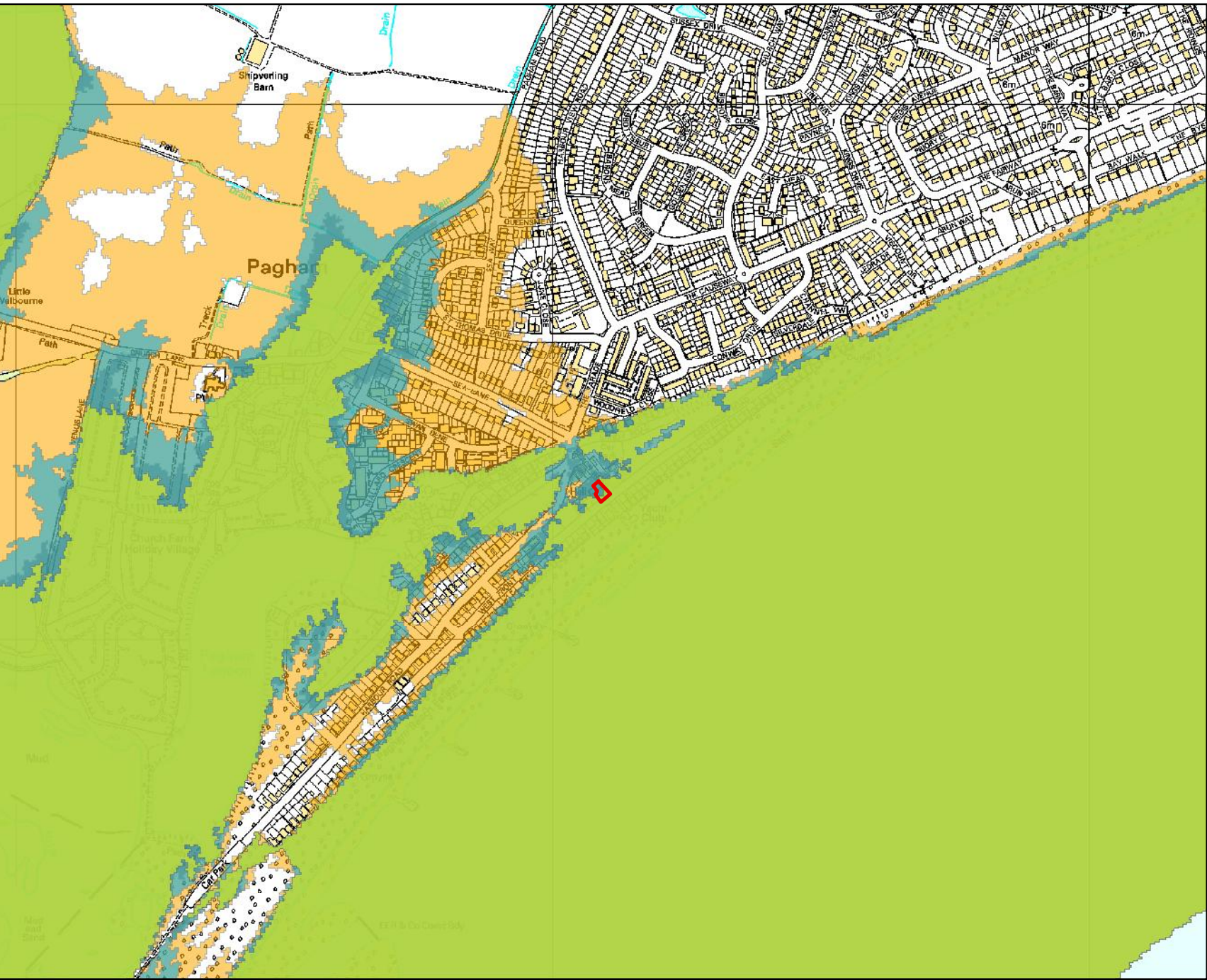
Legend

-  Site Boundary
-  0.5% AEP (Defended Tidal)
-  0.5% AEP (2070) NPPF (Defended Tidal)
-  0.5% AEP (2115) NPPF (Defended Tidal)
-  0.1% AEP (Defended Tidal)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000

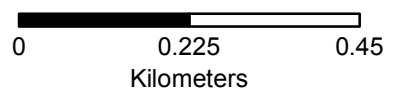




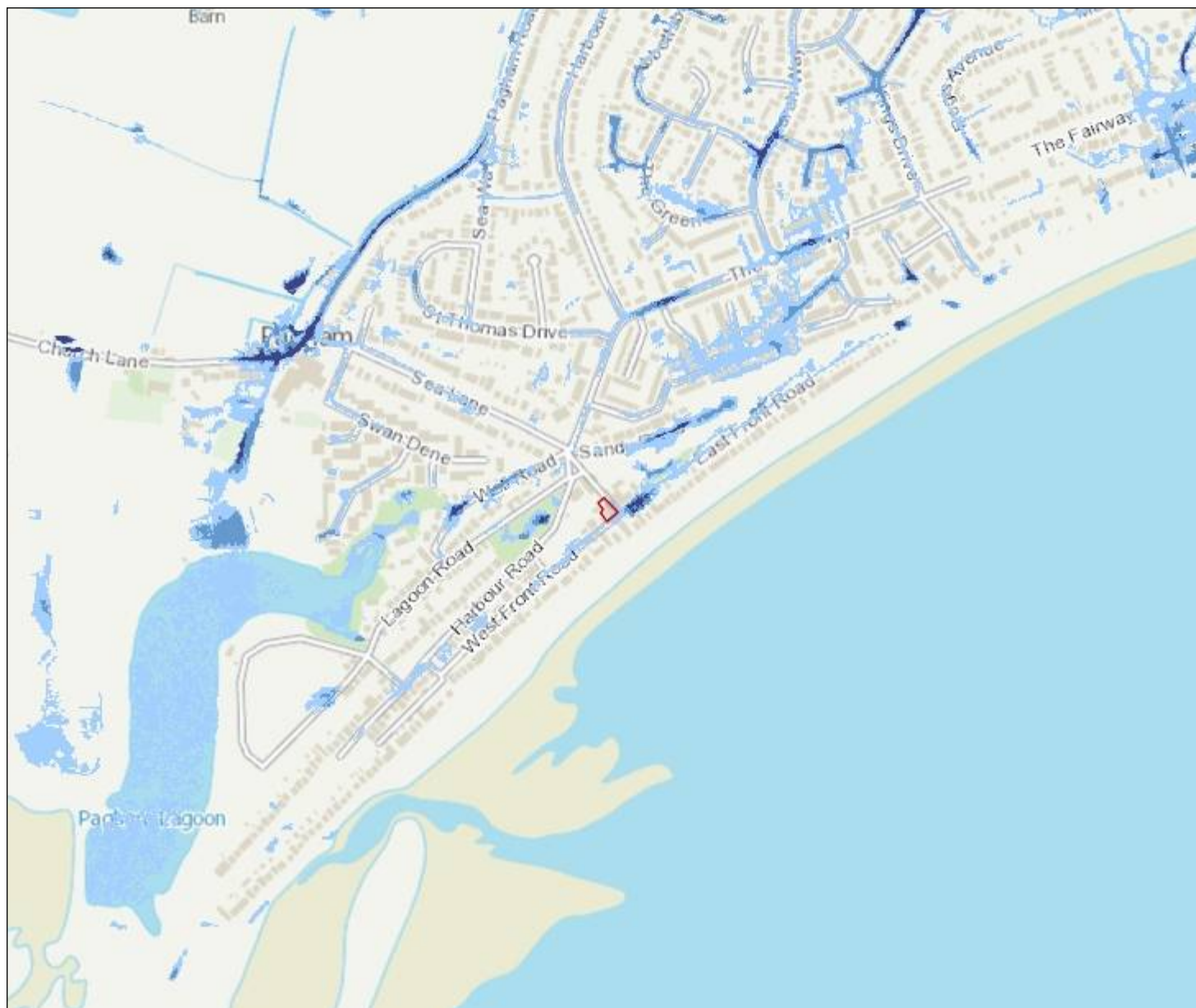
- Legend**
- Site Boundary
 - 0.5% AEP (Undefended Tidal)
 - 0.5% AEP (2070) NPPF (Undefended Tidal)
 - 0.5% AEP (2115) NPPF (Undefended Tidal)
 - 0.1% AEP (Undefended Tidal)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000



Risk of flooding from Surface Water. Centred PO21 4SY. Created 06/07/2021.



1: 10,000

0 Metres 250



Likelihood of flooding from Surface Water

- High ($\geq 3.3\%$)
- Medium (3.3% - 1%)
- Low (1% - 0.1%)
- Very Low
- Flood Extent 1 in 30
- Flood Extent 1 in 100
- Flood Extent 1 in 1000

Likelihood of flooding from Surface Water

- High:** Greater than or equal to 3.3% (1 in 30) chance in any given year
- Medium:** Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
- Low:** Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
- Very Low:** Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on GOV.UK.

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