

**Prepared for:**

John Sweeney

**September 2021**

**Our reference:**

91104-iba-WestFrontRd

**Location:**

25 West Front Road

Pagham

PO21 4SY



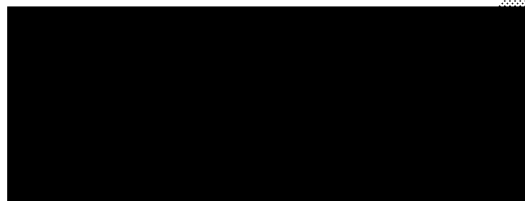
## Document Issue Record

**Project:** Flood Risk Assessment for Planning  
**Client:** Johnn Sweeney  
**Location:** 25 West Front Road, Pagham, PO21 4SY  
**Our reference:** 91104-iba-WestFrontRd  
**Version:** v1.0 290921

**Lead Consultant:** Mrs Emma Jeffery  
**Document Check:** Ms Jacqueline Stone  
**Authorisation:** Mr Edward Bouet

This report (including any enclosures and attachments) has been prepared for the exclusive use and benefit of the commissioning party and solely for the purpose for which it is provided. Unless we provide express prior written consent, no part of this report should be reproduced, distributed or communicated to any third party. We do not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report. Any data and information provided by third parties and referred to herein has not been checked or verified by us unless otherwise expressly stated within this report. This report was checked and approved on the date it was issued and is therefore valid on this date. Understanding, circumstances, regulations and professional standards do change, which could subsequently affect the validity of this report. This report is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Southpoint, Old Brighton Road, Gatwick, West Sussex, RH11 0PR



## Contents

|                                                                      |    |
|----------------------------------------------------------------------|----|
| 1. Key Facts .....                                                   | 4  |
| 1.1 Flood Risk Posed:.....                                           | 4  |
| 1.2 Flood Risk Mitigation:.....                                      | 4  |
| 2. Introduction .....                                                | 5  |
| 3. Existing Situation.....                                           | 6  |
| 3.1 Site Usage:.....                                                 | 6  |
| 3.2 Topography:.....                                                 | 7  |
| 3.3 Geography and Soil:.....                                         | 8  |
| 4. Development Proposal .....                                        | 11 |
| 5. Assessment of Flood Risk.....                                     | 12 |
| 5.1 Flood Zones: .....                                               | 12 |
| 5.2 Tidal .....                                                      | 14 |
| 5.2.1 English Channel.....                                           | 14 |
| 5.2.2 Detailed flood modelling:.....                                 | 14 |
| 5.2.3 Flood defences: .....                                          | 16 |
| 5.2.4 Residual risk (breach or overtopping of flood defences): ..... | 16 |
| 5.2.5 Historical flood events: .....                                 | 17 |
| 5.3 Pluvial (Surface Water): .....                                   | 17 |
| 5.4 Groundwater: .....                                               | 18 |
| 5.5 Sewer Surcharge:.....                                            | 19 |
| 5.6 Other Sources: .....                                             | 19 |
| 6. Flood Risk Management.....                                        | 21 |
| 6.1 Vulnerability to flooding:.....                                  | 21 |
| 6.2 EA Standing Advice:.....                                         | 21 |
| 6.3 Physical Design Measures: .....                                  | 21 |
| 6.4 Safe Escape and Flood Action Plan: .....                         | 22 |
| 6.5 Off-Site Impacts: .....                                          | 24 |
| 6.5.1 Fluvial floodplain storage:.....                               | 24 |
| 6.5.2 Surface Water Drainage: .....                                  | 25 |
| 7. Sequential and Exception Test.....                                | 26 |
| 8. Discussion and Conclusions .....                                  | 27 |
| Appendix .....                                                       | 29 |

# 1. Key Facts

## 1.1 Flood Risk Posed:

- The site is located within Flood Zones 1, 2 and 3 (Low, Medium and High Probability), which means it is defined as land having between a less than 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 65m 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.
- Risk of pluvial flooding would appear to be “Very Low”.
- Risk of groundwater and sewer surcharge flooding would appear to be low.

## 1.2 Flood Risk Mitigation:

- Proposed finished floor levels will be set at 5.70mAOD – which is 0.63m above the defended Higher Central and 0.25m above the Upper End 1:200 year flood level in 2125.
- 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 John Sweeney (hereinafter referred to as “the applicant”) to undertake a Flood Risk Assessment for the proposed development at 25 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 partially 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 residential dwelling. 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:

A topographical site survey has been undertaken in August 2021 by J Brotherton and Partners. Topographic levels on site are shown to range between 3.90mAOD and 5.17mAOD.

Topographic levels in the area of the existing and proposed replacement houses vary between 4.40mAOD to 5.10mAOD.

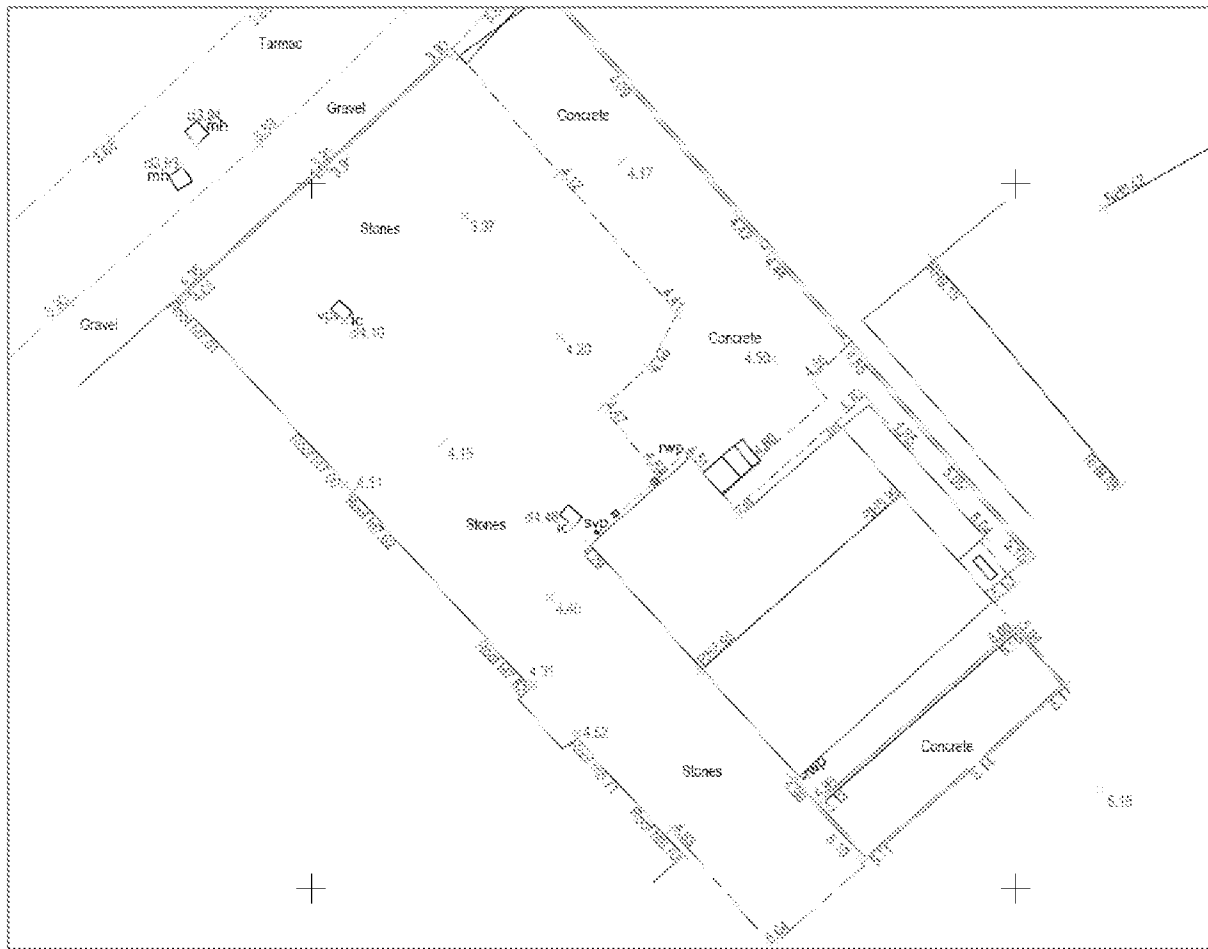


Figure 3: Topographical site survey (Source: J Brotherton and Partners)

### 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.

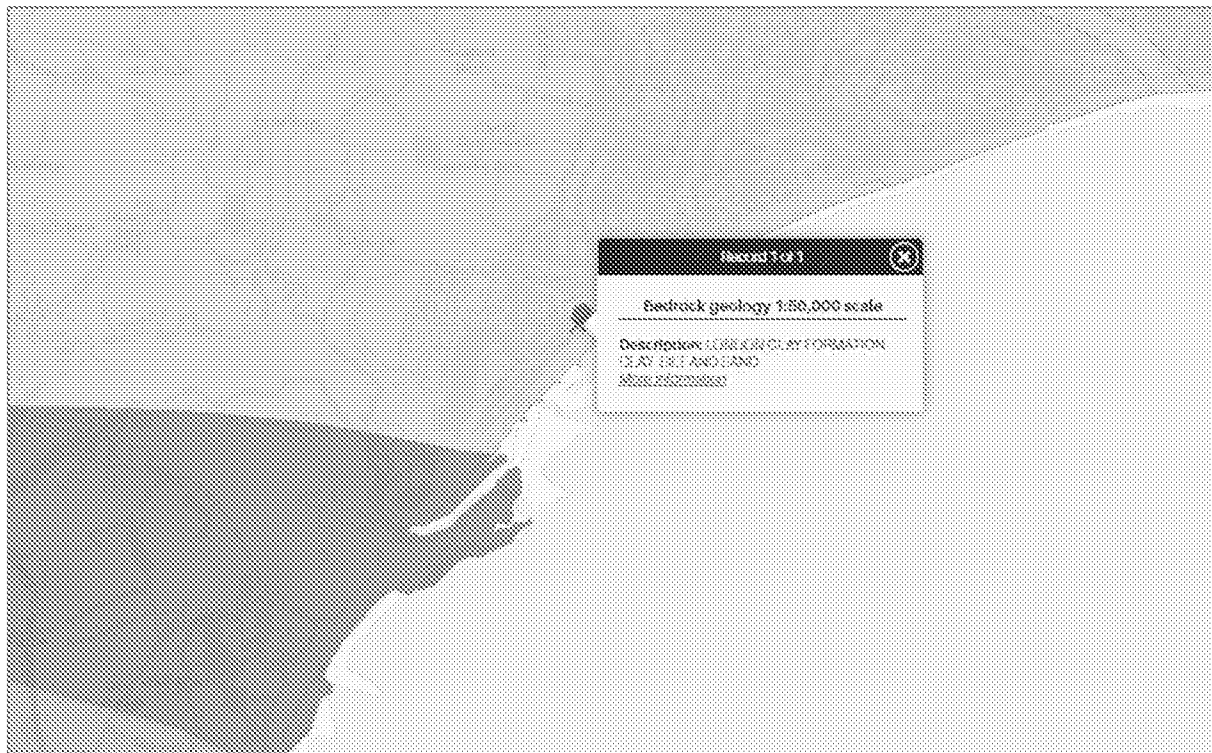


Figure 4: Bedrock Geology (Source: BGS)

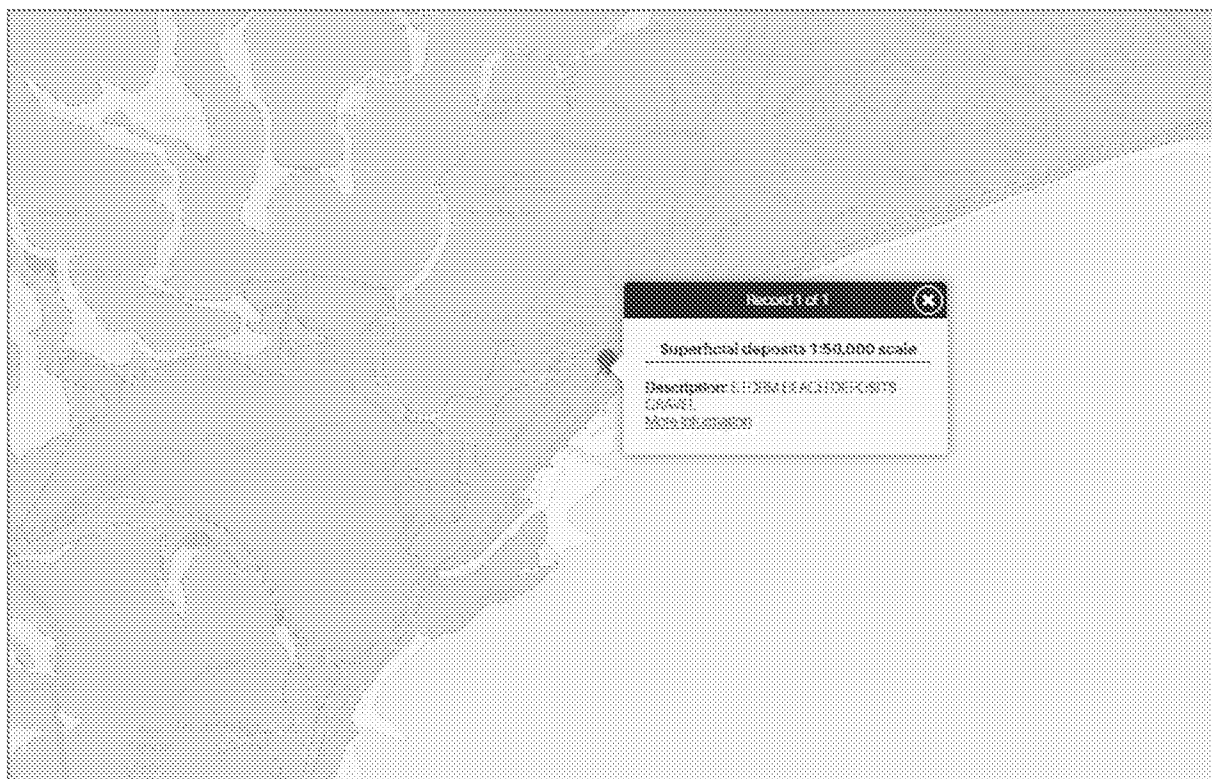


Figure 5: Superficial Deposits (Source: BGS)



Figure 6: Soil type (Source: UK Soils)

## 4. Development Proposal

The proposed planning application is for a replacement dwelling.

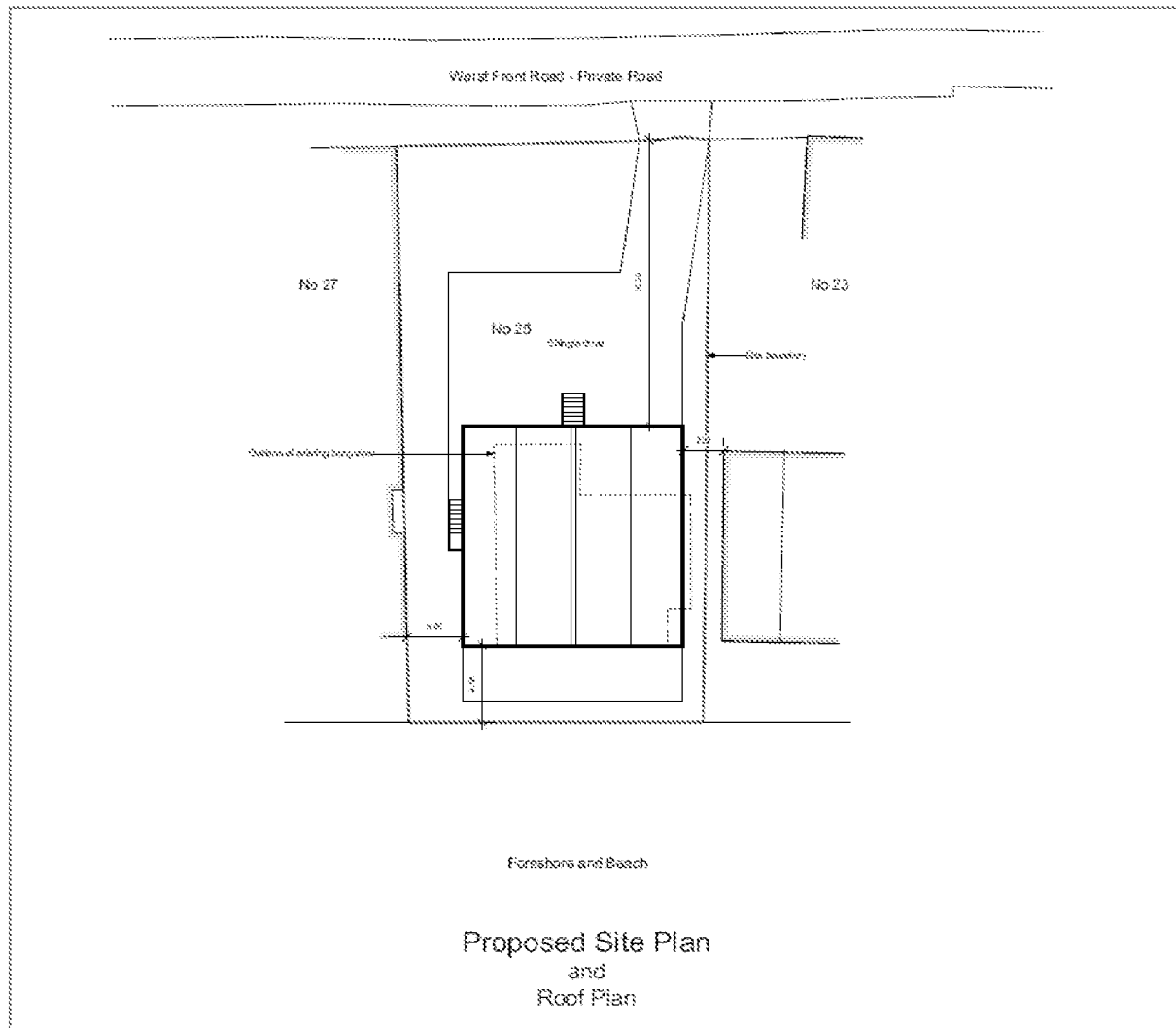


Figure 7: Proposed Ground Floor Plan (Source: Ivon Blumer Architects Ltd)

## 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.

| <b>Flood Zone</b>                           | <b>Definition</b>                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Zone 1<br><b>Low Probability</b>            | 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<br><b>Medium Probability</b>         | 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<br><b>High Probability</b>          | 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<br><b>The Functional Floodplain</b> | 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)



Figure 9: Zoomed in view of Environment Agency Flood Zone 3 (dark blue) and Flood Zone 2 (light blue) (Source: EA)

The site is located partially within Flood Zones 1, 2 and 3 (Low, Medium and High Probability), which means it is defined as land having between a less than 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 65m 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 km<sup>2</sup>.

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.

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

|                   | <b>1:200 year</b> | <b>1:200 year in 2115</b> | <b>1:1000 year</b> |
|-------------------|-------------------|---------------------------|--------------------|
| <b>Undefended</b> | 3.75mAOD          | 4.84mAOD                  | 3.94mAOD           |
| <b>Defended</b>   | N/A               | 5.04mAOD                  | 5.01mAOD           |

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 (4.40mAOD to 5.10mAOD) shows that the site is entirely above the undefended flood level. The proposed finished floor level is 5.70mAOD.

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 proposed topographic finished floor level of 5.70mAOD, shows that the floor level is entirely above the undefended Higher Central and 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 5.04mAOD has been provided. The defended Higher Central and Upper End flood levels in 2125 are therefore 5.07mAOD and 5.45mAOD respectively.

Comparison of the defended Higher Central and Upper End flood levels in 2125 with the topographic finished floor level of 5.70mAOD, shows that the floor level is 0.63m above the defended Higher Central and 0.25m above 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 event the site is entirely outside of the maximum modelled breach extent. For the present day 1:1000 year event the site is shown to be partially within the maximum modelled breach extent, with a maximum depth of 0.03m.

### 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. West Front Road adjacent to the site is shown to be at "Low" risk of flooding from surface water.



Figure 10: 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 11: 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 a residential house. Post development, the site will remain "more vulnerable", as the application is for a replacement dwelling.

Accordingly, it is considered that the vulnerability of the site as a whole will not increase post development. There will be no introduction of new or separate residential units and no increase in the vulnerability of the site post development.

### 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 250m<sup>2</sup>. It should not be applied if an additional dwelling is being created, e.g. a self-contained annexe or additional commercial unit.

### 6.3 Physical Design Measures:

The finished floor level of the proposed replacement house is 5.70mAOD.

Comparison of these modelled flood levels with the proposed topographic finished floor level of 5.70mAOD, shows that the floor level is entirely above the undefended Higher Central and 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 high level;
- Boilers, control and water storage / immersion installed at high level;
- Gas meter installed at high 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.

## 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                                                                                                                                                                                    |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        |                                                                               |                                                                                       |                                                                                                                      |
| <b>What it means?</b>  | Flooding is possible.<br>Be prepared.                                                                                                                          | Flooding is expected.<br>Immediate action required.                                                                                                                    | Severe flooding.<br>Danger to life.                                                                                                                                                                     |
| <b>When it's used?</b> | 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.                                                                                                                                                       |
| <b>What to do?</b>     | Be prepared to act on your flood plan.<br><br>Prepare a flood kit of essential items.<br><br>Monitor local water levels and the flood forecast on our website. | Move family, pets and valuables to a safe place.<br><br>Turn off gas, electricity and water supplies if safe to do so.<br><br>Put flood protection equipment in place. | Stay in a safe place with a means of escape.<br><br>Be ready should you need to evacuate from your home.<br><br>Co-operate with the emergency services.<br><br>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. As such, there will be no unacceptable loss of flood storage post development.

### **6.5.2 Surface Water Drainage:**

The development will utilise Sustainable drainage systems (SuDS) design in accordance with the NPPF for Planning Applications and the drainage hierarchy as follows:

1. Store rainwater for later use;
2. Infiltration techniques;
3. Attenuate rainwater by storing in tanks for gradual release;
4. Discharge rainwater direct into watercourse;
5. Discharge rainwater into surface water sewer;
6. Discharge rainwater into a combined sewer;
7. Attenuation of rainwater in ponds or open water features with controlled discharge into the local watercourse.

All surface water runoff generated by the proposed development up to 1:100 year rainfall event (plus climate change) will be stored on site, prior to being discharged.

Due to the nature and scale of the development, a full Surface Water Drainage Strategy is not required at this stage of planning.

## 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 1, 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 1, 2 and 3.

| Flood Zones    | Flood Risk Vulnerability Classification |                         |                         |                 |                  |
|----------------|-----------------------------------------|-------------------------|-------------------------|-----------------|------------------|
|                | Essential infrastructure                | Highly vulnerable       | More vulnerable         | Less vulnerable | Water compatible |
| <b>Zone 1</b>  | ✓                                       | ✓                       | ✓                       | ✓               | ✓                |
| <b>Zone 2</b>  | ✓                                       | Exception Test required | ✓                       | ✓               | ✓                |
| <b>Zone 3a</b> | Exception Test required                 | ✗                       | Exception Test required | ✓               | ✓                |
| <b>Zone 3b</b> | Exception Test required                 | ✗                       | ✗                       | ✗               | ✓                |

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

Using the table above, the proposed application is considered to be suitable within Flood Zones 1, 2 and 3, subject to passing the Sequential and Exception Tests.

As the proposal is for the erection of a replacement dwelling, finding an alternative site is not likely to be a realistic option.

## 8. Discussion and Conclusions

Unda Consulting Limited have been appointed by John Sweeney to undertake a Flood Risk Assessment for the proposed development at 25 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 a replacement dwelling.

The existing site usage is classified as "more vulnerable" throughout, as it is a residential house. Post development, the site will remain "more vulnerable", as the application is for a replacement dwelling.

Accordingly, it is considered that the vulnerability of the site as a whole will not increase post development. There will be no introduction of new or separate residential units and no increase in the vulnerability of the site post development.

The site is located within Flood Zones 1, 2 and 3 (Low, Medium and High Probability), which means it is defined as land having between a less than 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 65m 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 (3.75mAOD) with topographic site levels (4.40mAOD to 5.10mAOD) shows that the site is entirely above the undefended flood level. The proposed finished floor level is 5.70mAOD.

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 proposed topographic finished floor level of 5.70mAOD, shows that the floor level is entirely above the undefended Higher Central and 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 5.70mAOD, shows that the floor level is 0.63m above the defended Higher Central and 0.25m above 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. West Front Road adjacent to the site is 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:

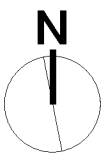
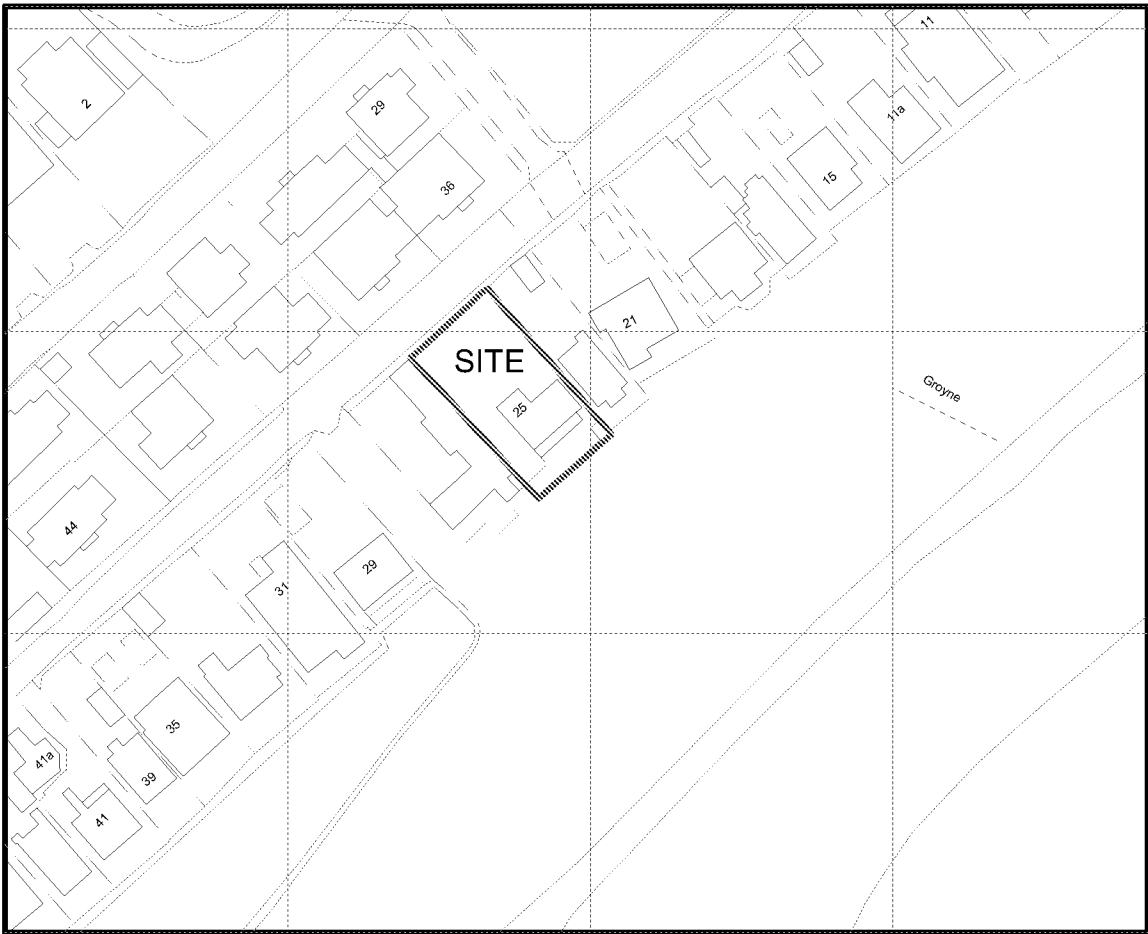
- Proposed finished floor levels will be set at 5.70mAOD – which is 0.63m above the defended Higher Central and 0.25m above the Upper End 1:200 year flood level in 2125.
- Flood proofing of the development will be incorporated as appropriate.
- Safe escape will be provided by the implementation of a 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.**

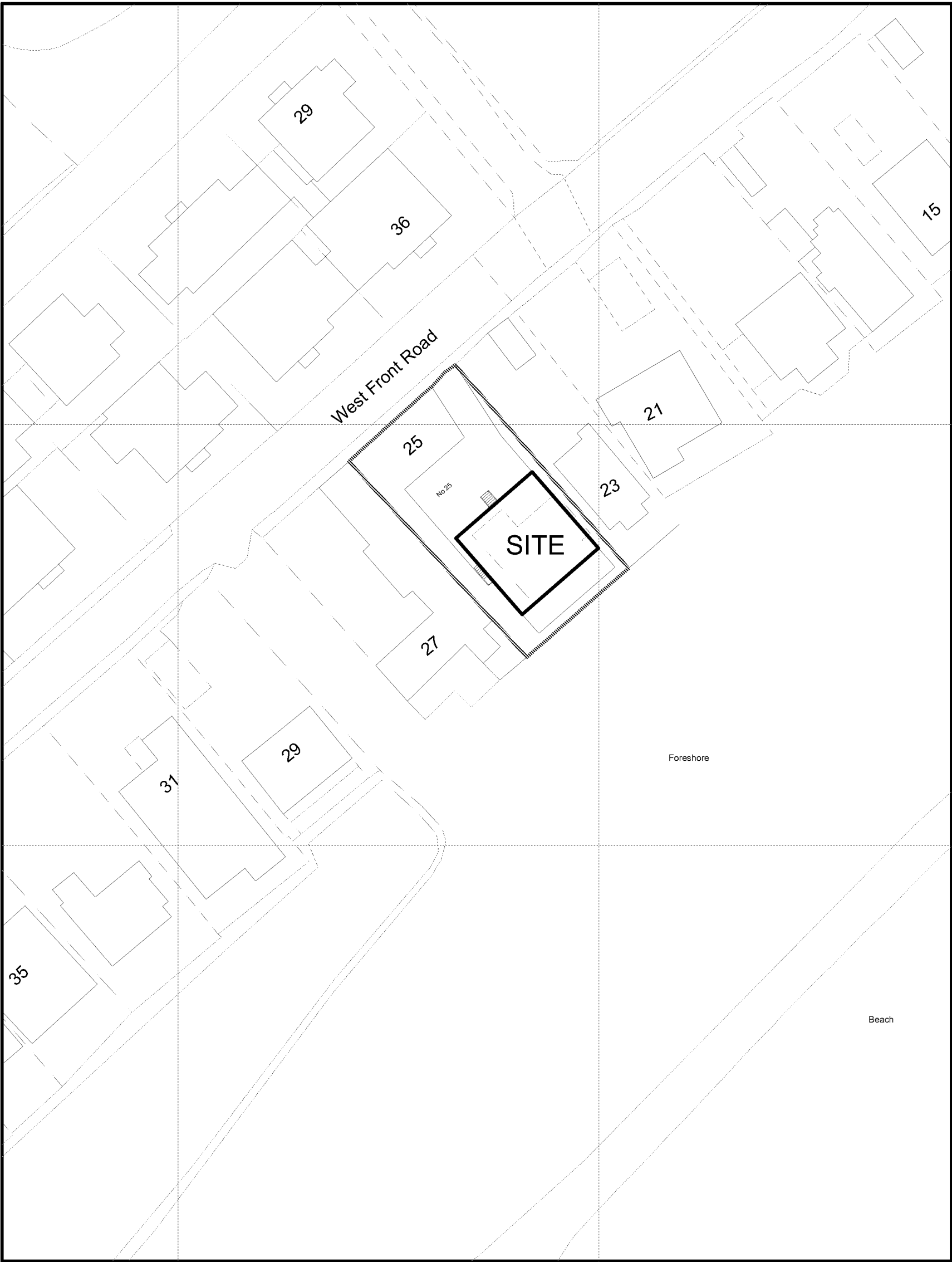
## 9. Appendix

- Topographical site survey.
- Existing and proposed plans.





Location Plan  
Scale 1 : 1250

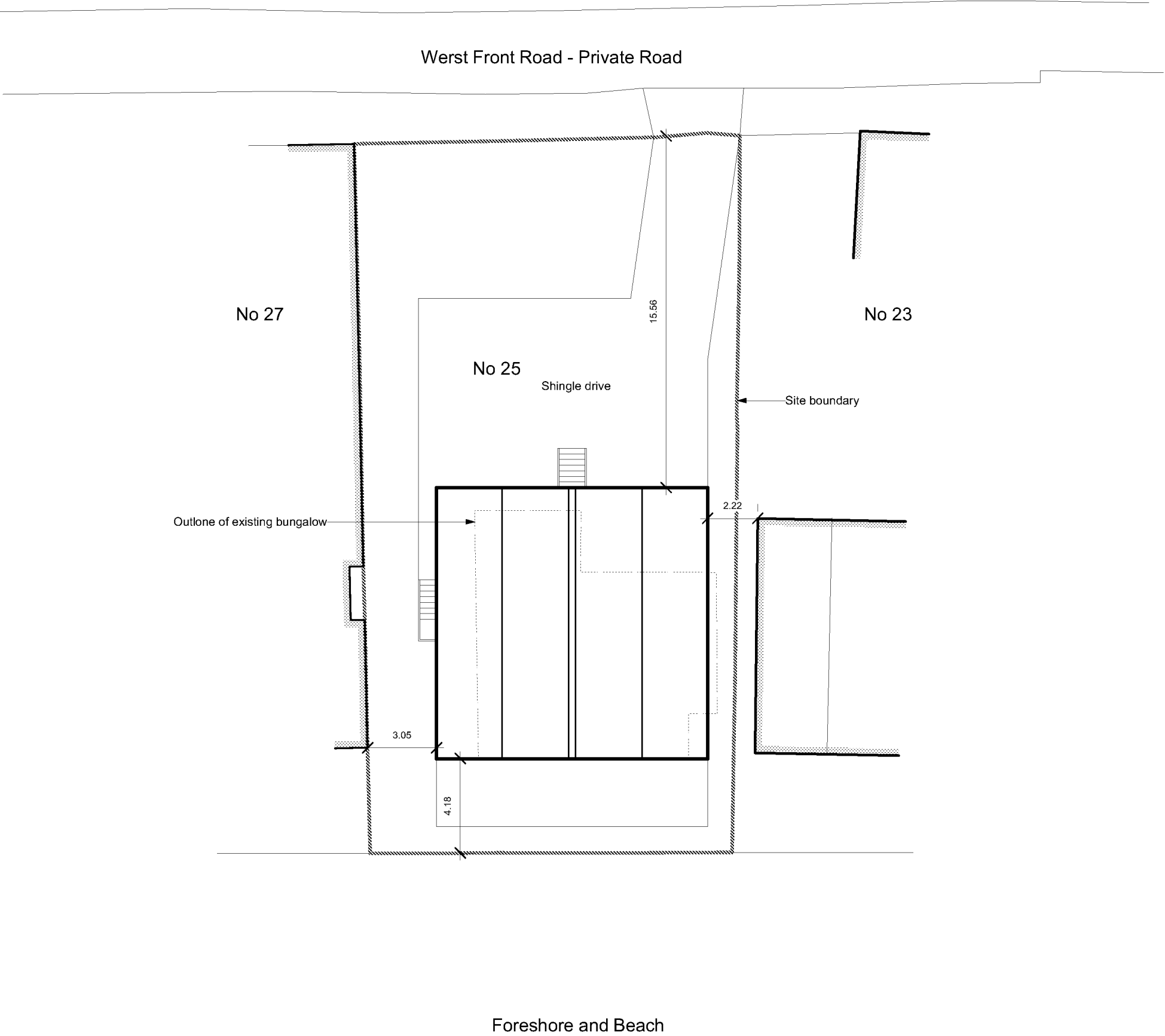
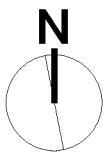


Block Plan  
Scale 1 : 500

IVON BLUMER ARCHITECTS LTD

|         |                       |           |            |
|---------|-----------------------|-----------|------------|
| PROJECT | 25 West Front Road    | DATE      | 06/09/21   |
| TITLE   | Location & Block Plan | DRG NO    | IBA/553/01 |
| SCALE   | As Noted              | REVISIONS |            |





Proposed Site Plan  
and  
Roof Plan

IVON BLUMER ARCHITECTS LTD

|         |                         |           |            |
|---------|-------------------------|-----------|------------|
| PROJECT | 25 West Front Road      | DATE      | 06/09/21   |
| TITLE   | Site Plan and Roof Plan | DRG NO    | IBA/553/02 |
| SCALE   | 1 : 200                 | REVISIONS |            |

The Studio • 41 West Drive • Aldwick Bay • West Sussex • PO21 4LZ  
www.ivonblumerarchitects.com • ivon@ivonblumerarchitects.com  
Tel • 01243 262987  
© Ivon Blumer Architects 2017





Foreshore - Beach

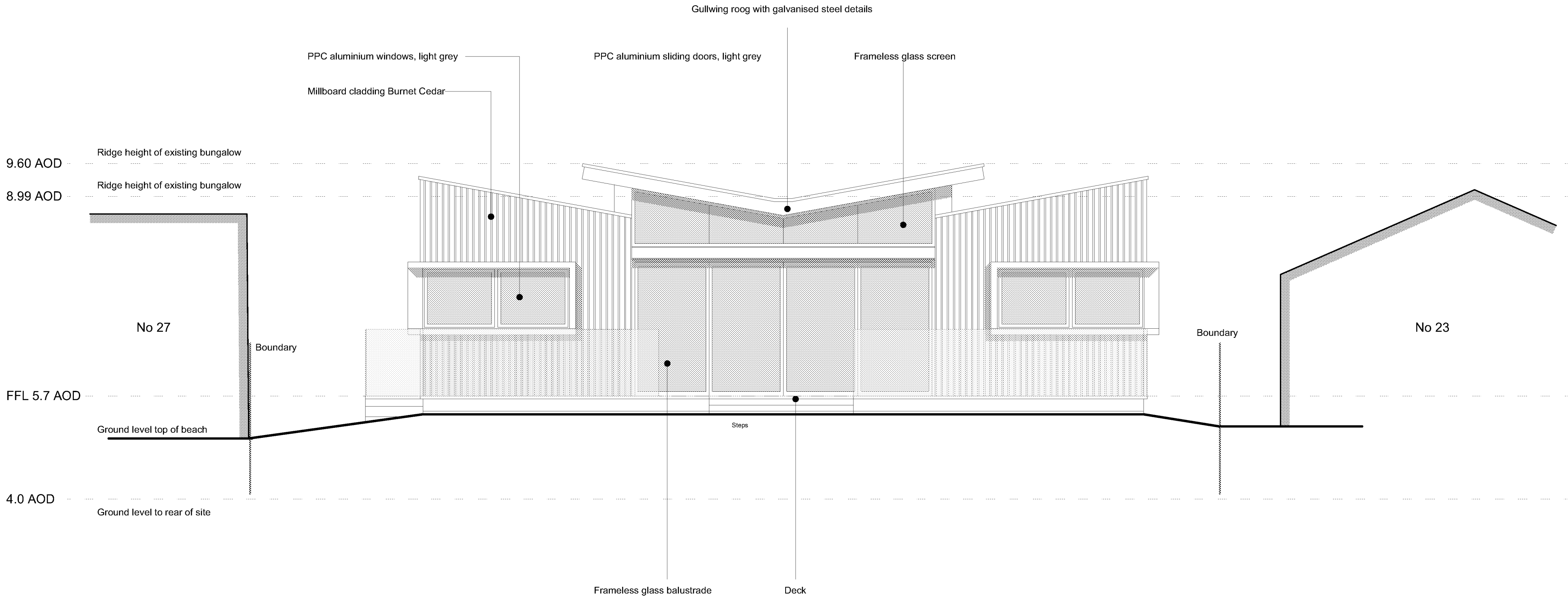
Proposed Ground Floor Plan

IVON BLUMER ARCHITECTS LTD

PROJECT 25 West Front Road DATE 06/09/21  
TITLE Floor Plan DRG NO IBA/553/03  
SCALE 1 : 50 REVISIONS

Foreshore - Beach





Proposed Elevation to Beach

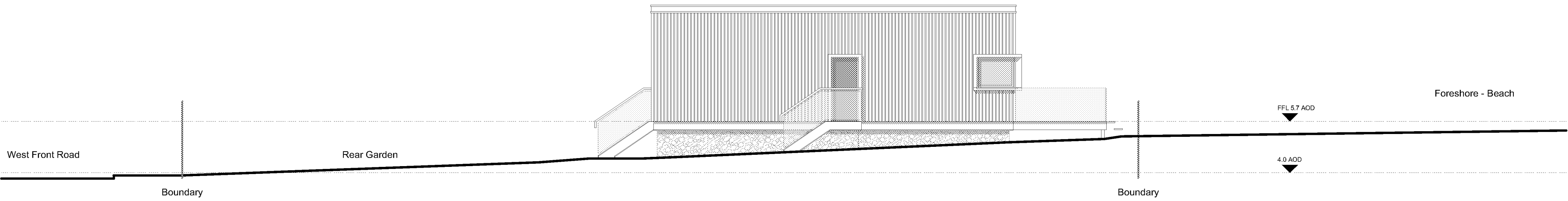
External Materials Schedule

|                       |                                              |
|-----------------------|----------------------------------------------|
| Walls                 | Backened timber                              |
| Roof                  | Metal decking                                |
| Windows               | PPC Aluminium – Grey                         |
| Rooflights            | PPC Aluminium – Grey                         |
| Gutters               | Galvanised steel                             |
| Rainwater pipes       | Galvanised steel                             |
| Deck steelwork/detail | Galvanised steel                             |
| Decking               | Composite decking Envirobuilt - Silver Birch |
| Glass balustrading    | Clear frameless glass                        |
| Facia boards          | Eternit Facia system - Grey C05              |
| Sofit boards          | Eternit Sofit system - Grey C05              |

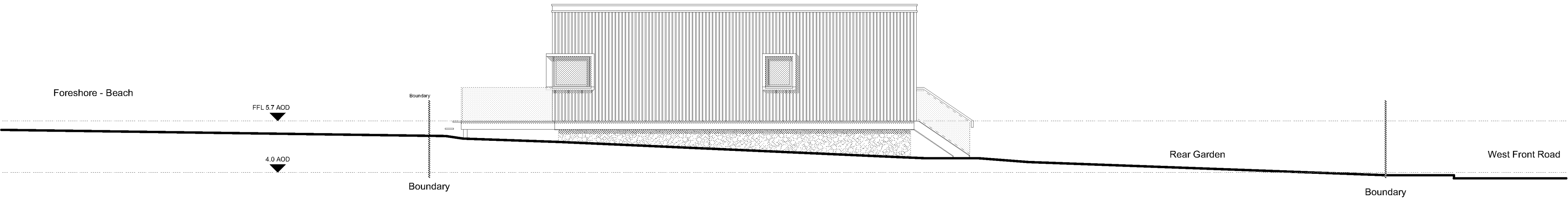
IVON BLUMER ARCHITECTS LTD

|         |                    |           |            |
|---------|--------------------|-----------|------------|
| PROJECT | 25 West Front Road | DATE      | 06/09/21   |
| TITLE   | Elevations Sheet 1 | DRG NO    | IBA/553/04 |
| SCALE   | 1 : 50             | REVISIONS |            |

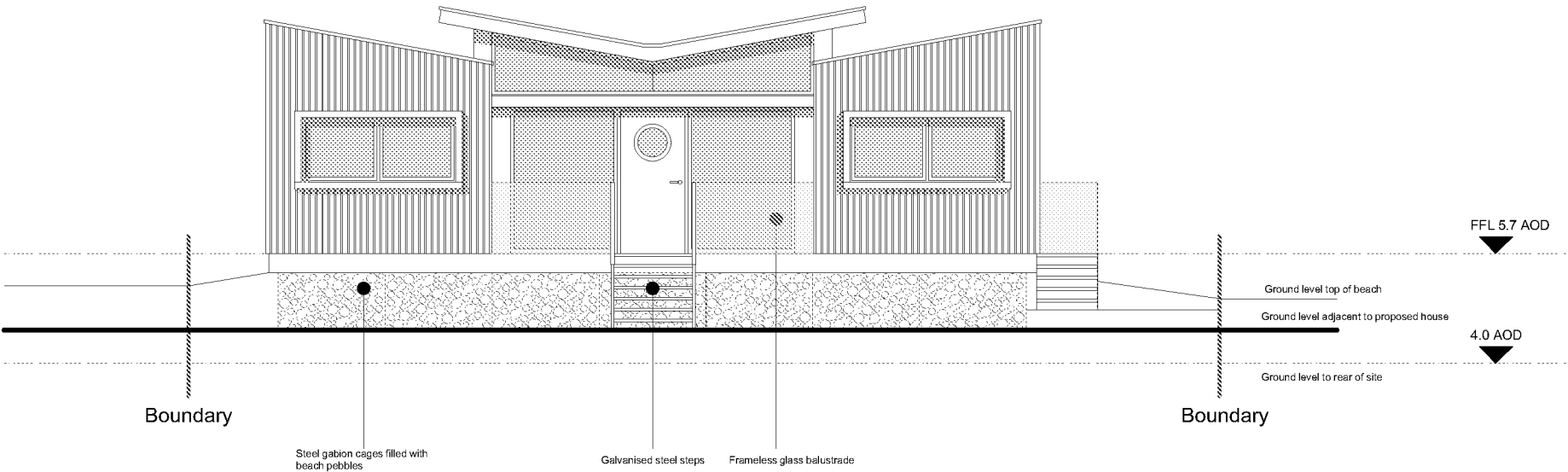




Proposed West Elevation



Proposed East Elevation



Proposed Rear Elevation

IVON BLUMER ARCHITECTS LTD

|         |                    |           |            |
|---------|--------------------|-----------|------------|
| PROJECT | 25 West Front Road | DATE      | 06/09/21   |
| TITLE   | Elevations Sheet 2 | DRG NO    | IBA/553/05 |
| SCALE   | 1 : 100            | REVISIONS |            |

The Studio • 41 West Drive • Aldwick Bay • West Sussex • PO21 4LZ  
www.ivonblumerarchitects.com • ivon@ivonblumerarchitects.com  
Tel • 01243 262987  
© Ivon Blumer Architects 2017

