ACRA Consulting Civil & Structural Engineer's

FLOOD RISK ASSESSMENT

FOR

PROPOSED NEW DWELLING

AT

ADJOINING 36No. ANSON ROAD HULL

FOR

Innovation Architecture Ltd

Project Ref: FRA-HU130

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APPENDICES

I Site Location, Existing & Proposed Plans

1.0 BRIEF

ACRA Consulting were requested by Innovation Architecture Ltd on behalf of the client to prepare a flood risk assessment for the proposed new dwelling adjoining 36 Anson road, Hull.

The purpose of the assessment is to demonstrate compliance with local planning policy as outlined within the Hull City Council Strategic Flood Risk Assessment (SFRA)¹ and the National Planning Policy Framework (NPPF)².

2.0 <u>DESCRIPTION OF EXISTING SITE</u>

The proposed site is located to the side of 36No. Anson Road, Hull.

The site location plan is included in Appendix I.

The OS National grid reference of the centre of the site is approximately TA 13852 31244.

A large side garden with a drive to a rear garden forms part of number 36.

Road levels are unknown, however from google earth the levels raise from the back of the footpath to the property frontage. A step outside the property as visible estimated to be around 0.150m.

Flood zones will be assessed as part of the FRA with mitigation provided in meter measurement not related to AOD.



Image showing existing site @Google

3.0 PROPOSED DEVELOPMENT

It is proposed to build a single 2 bed dwelling adjoining 36 Anson Rd, Hull.

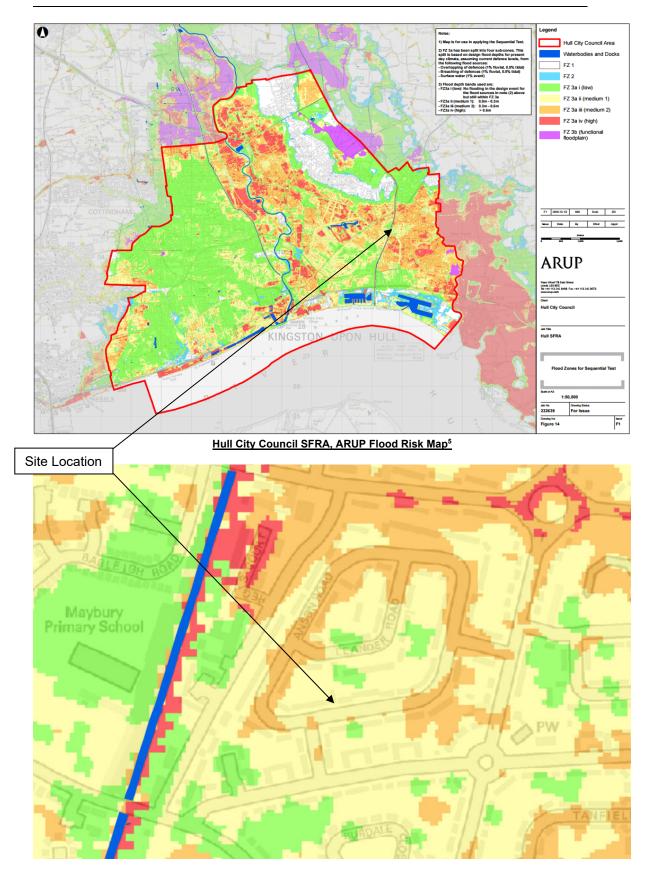
The proposed development is in a known area of flood risk as outlined by the Environment Agency's flood risk map.

A level 1 and 2 Strategic Flood Risk Assessment (SFRA) has been prepared for Hull City Council by Arup December 2016.

As part of the preparation of the SFRA, detailed hydraulic modelling was undertaken. Model results were subsequently used to produce the new Hull Flood Risk Zone Maps.

With reference to the latest SFRA indicative Flood Risk maps, the proposed development site lies within **Flood Zone 3a (ii) 'Medium 1'**.

Table 1 of the NPPF technical guide states all development proposals in this zone should be accompanied by a detailed flood risk assessment.



Extract from Hull City Council SFRA, ARUP map showing the flood risk category on site.

4.0 FLOOD RISK VULNERABILITY CLASSIFICATION OF THE PROPOSED DEVELOPMENT

With reference to Table 2 of the NPPF technical guide³, the proposed use as dwelling are classified as 'More vulnerable'.

With reference to Table 3 of the technical guide³, developments with 'More vulnerable' classifications within flood zone 3a should only be permitted in this zone if the sequential test can be adequately passed.

Table 3: Flood risk vulnerability and flood zone 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	√	√	~	✓	✓
	Zone 2	~	~	Exception Test required	✓	·
	Zone 3a	Exception Test required	~	×	Exception Test required	·
	Zone 3b functional floodplain	Exception Test required	√	×	×	×

Key: ✓ Development is appropriate.

Development should not be permitted.

Therefore, with reference to the current Hull City Council Flood Risk Standing Advice⁴ (FRSA) the development is classified as an '*Operational development*'.

The FRSA has changed from the traditional Matrix previously found as part of the old SFRA. This has now been replaced with a new version as shown below. The Matrix should be read with in conjunction with Figure 13 for the SFRA, for flood depth information.

From Figure 13, the site is states to have a maximum flood depth with climate change of 0.3-0.6m.

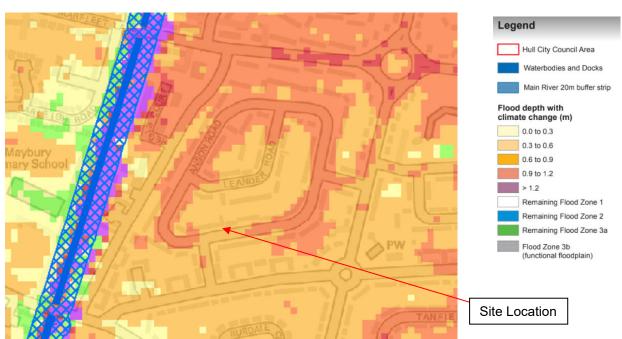
Therefore, with reference to cell B10 of the FRSA Matrix⁴, Mitigation Note 6, should be complied with as follows;

- Flood depths in this area could reach 600mm. In order to exclude potential flood water, finished floor levels shall be raised a minimum of 600mm above average site level or adjacent road frontage level, whichever is higher. An additional 300mm of flood resilience measures above finished floor levels, shall be included to speed the rate of recovery and minimise the impacts should flood waters enter the property.
- The development must incorporate a place of safety at the level shown on SFRA Figure 15. Please refer to the guidance below which details the council's advice on what constitutes an appropriate place of safety.

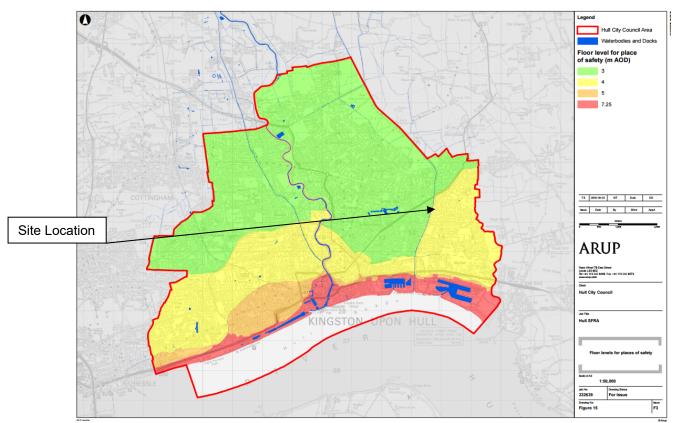
Environment Agency: Local Flood Risk Standing Advice

Refer to SFRA Figure 13 for flood depth information								
	Consult the EA on all development within Flood Zone 3b (Functional Floodplain). In most cases, development should not be permitted.							
Consult the EA on all development lying within 20m of the bank top of a Main River or 20m of the Humber Estuary (As shown on SFRA Figure 13)								
Consult the LLFA on all major developments								
All development shall be provided with a place of safety at the level shown on SFRA Figure 15								
Where relevant, the LPA must satisfy itself that the requirements of the <u>Sequential Test</u> and <u>Exception Test</u> , have been met. See below <u>guidance</u> .								
Do not consult EA on any development lying solely within Flood Zone 1, unless any other consultation trigger is met on our Consultation Checklist								
				-				
	Development		A	В	C Flood Depths <300mm &	D		
	Category	Vulnerability Classification	Flood Depths >600mm	Flood Depths 300-600mm	Remainder of FZ3	Flood Zone 2		
1	Minor Development	All use classes	Mitigation Note 9	Mitigation Note 9	Mitigation Note 9	No consultation		
2		Essential Infrastructure	Consult EA with FRA	Consult EA with FRA	Consult EA with FRA	Consult EA with FRA		
3		Highly Vulnerable (including basements dwellings)	Consult EA with <u>FRA</u> development <u>should not be</u> <u>permitted</u>	Consult EA with <u>FRA</u> development <u>should not be</u> <u>permitted</u>	Consult EA with <u>FRA</u> development <u>should not be</u> <u>permitted</u>	Consult EA with FRA		
4	Change of use or Prior	More Vulnerable	Consult EA with FRA	Mitigation Note 1	Mitigation Note 2	FZ2 Note 1		
5	Approval resulting in	Less Vulnerable	Mitigation Note 3	Mitigation Note 4	Mitigation Note 5	FZ2 Note 2		
6	· · · · · ·	Water Compatible - development includes essential ancillary sleeping or residential accommodation	Consult EA with <u>FRA</u>	Mitigation Note 1	Mitigation Note 2	No Consultation		
7		Other Water Compatible	Mitigation Note 3	Mitigation Note 4	Mitigation Note 5	No Consultation		
8		Essential Infrastructure	Consult EA with FRA	Consult EA with FRA	Consult EA with FRA	Consult EA with FRA		
9		Highly Vulnerable (including basements dwellings)	Consult EA with <u>FRA</u> development <u>should not be</u> <u>permitted</u>	Consult EA with <u>FRA</u> development <u>should not be</u> <u>permitted</u>	Consult EA with <u>FRA</u> development <u>should not be</u> <u>permitted</u>	Consult EA with FRA		
10	Operational	More Vulnerable	Consult EA with FRA	Mitigation Note 6	Mitigation Note 7	FZ2 Note 3		
11	Development	Less Vulnerable	Mitigation Note 8	Mitigation Note 4	Mitigation Note 5	FZ2 Note 2		
12		Water Compatible - development includes essential ancillary sleeping or residential accommodation	Consult EA with <u>FRA</u>	Mitigation Note 6	Mitigation Note 7	No Consultation		
13		Other Water Compatible	Mitigation Note 8	Mitigation Note 4	Mitigation Note 5	No consultation		

Extract from Hull "Environment Agency: Local Flood Risk Standing Advice".



Extract from Hull SFRA "Figure 13 – Exception Test Information".



Extract from Hull City Council SFRA, ARUP, Floor Levels for places of safety, Figure 155

Based on the above information the FFL will need to be raised a minimum 600mm above AOD with 300mm of flood proofing above this level.

A place of safety 4.0m AOD shall be provided by default by means of a first floor.

Following discussion with the client and Architect. Raising the finish floor levels by 0.6m would provide a visually unpleasing elevation against the existing properties to each side.

Window and door heads would look visual out of place against the adjoining properties. Therefore, ACRA Consulting have providing an alternative mitigation which the FRA will be assessed on.

This shall be.

Finish floor levels to match 36 Anson Road.

Incorporating 0.6m of flood proofing in the form of water exclusion strategy.

Additional 0.30m of flood proofing in the form of water entry strategy.

The above proposed mitigation would provide the same level of protection as outline within the matrix.

5.0 **SEQUENTIAL TEST**

The council has asked for the sequential test search area to be extend covering the full ward.

An assessment shall be conducted as set out below;

- Search Area
- Identified Plots
- Current Status
- Flood Risk
- Conclusion

Search Area

The ward to be assessed is 'Ings'.

Identified Plots

From reviewing Hull City Council Local Plan 2016 – 2032, the following have been identified;

22

54

322

325

327

Current Status

Following the identification of the plots located within the ward catchment a search has been conducted to determine the current states;

All the sites either have fulling, pending applications or form part of a wider regeneration programme for the area.

Conclusion

A sequential test has been conducted cover the ward search area as requested by the planning officer.

The outcome of the test concludes than all allocation within the ward are either gained planning, form a large development, or part of a wider regeneration programme.

Additional searches have been conducted using Right Move Search engine, centrally of the ward and 1-mile radius.

No development opportunities where found.

The sequential is therefore passed.

6.0 FLOOD RISK

As part of the production of the SFRA for the Hull City Council⁵, flood risk from numerous sources were modelled and subsequently used to establish the boundaries of each particular flood zone.

Modelling outputs/mapping etc. from the SFRA have been produced using recognised hydraulic theory. The maps shall therefore be used as a means of assessing flood risk to the site.

Other sources of information, including The Environment Agency, and the British Geological Survey shall also be used to assess the flood risk to the site.

The Flood Risk to the site can be divided into 5 main elements;

- 1. Overtopping of the River Humber defences
- 2. A breach of the River Humber defences
- 3. Overtopping of the River Hull defences
- 4. A breach of the River Hull defences
- 5. Pluvial flooding

6.1 Overtopping of the River Humber defences

The highest recorded tide level in the River Humber near Hull is 5.80mAOD¹². Therefore, in theory, the site is at risk from tidal flooding. This explains the classification by the Environment Agency and Hull City Council as Zone 3a for the site.

The River Humber is approximately 0.8km to the south of the site.

River Humber defences south of the site are at a level of 6.100m AOD.

Modelled levels for the River Humber are as follows (Node H131-Humber Sea Terminal & H155-Hull King George) highest level noted below;

1:100	5.43mAOD – H155
1:200	5.57mAOD – H155
1:1000	5.93mAOD - H155

The site is therefore considered to be at minimal risk.

Modelling undertaken as part of the SFRA (Fig 3b)⁵, which takes flood defences into consideration, shows that the proposed site could be affected by a potential overtopping scenario when allowing for the unlikely combination of a 1:100-year fluvial flood with a 1:200-year tidal flood whilst also taking climate change into account.

The figure (as below) shows the site being subject to a flood depth of <0.15m.

The Environment Agency has also committed to ensuring that the City of Hull's flood defences are maintained, and raised, to ensure that the current level of protection is maintained with climate change¹³.

Work is also ongoing throughout the Humber which will help to further mitigate the effects of climate change. Flood storage schemes such as those at Alkborough, Barton-on-Humber and Paull are some examples.

By incorporating 0.60m of flood exclusion, the theoretically flood risk will be reduced to 0.00m.

The risk posed by overtopping of the river Humber defences is therefore considered to be very low, when considered with mitigation.



 $\underline{\text{Extract from Hull SFRA - (Fig 3b) Flood depths with defences + climate change \& 50\% Upper end fluvial } \\ \underline{\text{flow}^5}$

6.2 A Breach of the River Humber defences

The River Humber defences immediately to the south of the site are 'hard defences'. The defences form part of the extensive Hull Docks. The defences in this area offer a between 1 in 100, and 1 in 200 years standard of protection¹ and are described as being in 'very good' condition¹.

The defences in this location comprise robust purpose-built concrete defences with wavereturn walls.

The possibility of a breach of such a defence is minimal. This was proven in December 2013 when the defences were overtopped in some areas.

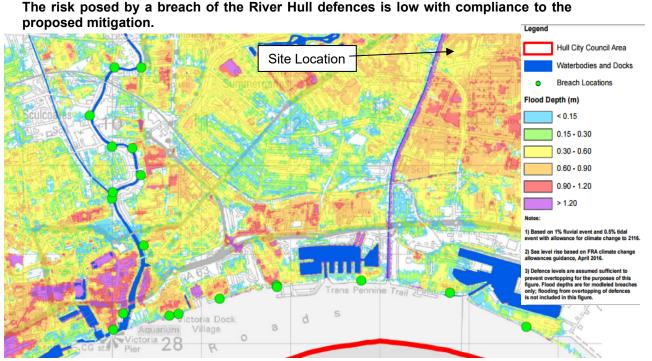
Modelling undertaken as part of the SFRA (Fig 6b)⁵, which takes a breach of the flood defences into consideration.

The mapping covers breach locations from both the river Hull & Humber.

From review the mapping, it is reasonable to assume the breach depth is from the River Humber.

The proposed mapping shows that the proposed site would be susceptible to a flood depth of 0.3m - 0.6m by a potential breach scenario when allowing for the unlikely combination of a 1:100-year fluvial flood with a 1:200-year tidal flood whilst also taking climate change into account.

By incorporating 0.60m of flood exclusion the property will not be affected during these unlikely events.



Extract from Hull SFRA – (Fig 6b) Flood depths for modelled breaches with climate change

6.3 Overtopping of the River Hull defences

The River Hull is generally protected to a standard of at least 1 in 200 years⁵. The Eastern bank extending from the River Humber to a point extending as far north as North Bridge, is quoted as offering a 1 in 200 years standard of protection¹.

The specified values of flood defence are reliant upon the satisfactory operation of the Hull tidal surge barrier which has been operational since 1980 to prevent high sea levels caused by surge tides overwhelming the river defences.

The Tidal surge barrier has proven reliable, with the highest Humber tide experienced – and resisted – to date being 5.80m AOD¹². The Barrier has recently undergone a full refurbishment, which includes the ability to be closed by hand in the event of a power failure.

The Environment Agency has also committed to ensuring that the City of Hull's flood defences are maintained, and raised, to ensure that the current level of protection is maintained with climate change¹³.

The risk posed by overtopping of the River Hull defences is therefore considered to be very low, when considered with mitigation.

6.4 A Breach of the River Hull defences

In order for a breach to form, it is generally accepted that water must flow over the embankment and cause erosion to the landward face which subsequently weakens the structure causing eventual collapse.

It has been demonstrated above, that the risk of overtopping is minimal.

The has been showing in section 6.2 that the site is not subjected to flood depth during a breach event of either the River Humber or Hull.

The risk posed by a breach of the river Humber defences is low with compliance to the proposed mitigation.



Extract from Hull SFRA – (Fig 6b) Flood depths for modelled breaches with climate change

6.5 Pluvial/Surface Water Flooding

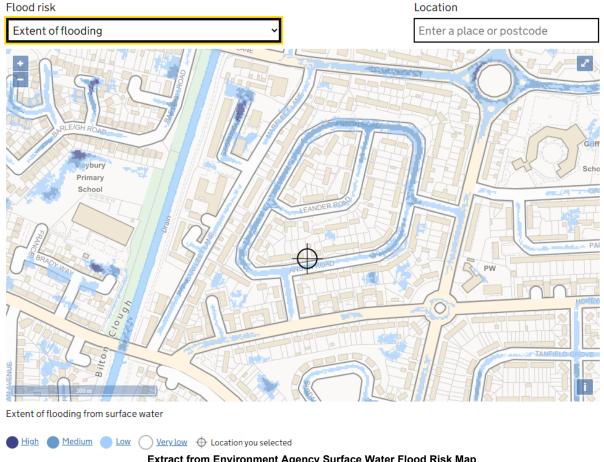
Surface water flood risk has recently been assessed on a national level by The Environment Agency. Maps were released in December 2013, which are some of the most comprehensive surface water flood risk maps in the world.

'The Surface Water mapping involves cutting edge technology, with flood experts using models to observe how rainwater flows and ponds. Then producing maps that take local topography, weather patterns and historical data into account.'

The Environment Agency surface water flood risk map shown below shows the site, to be at **low** risk of surface water flooding along the road.

The Hull SFRA Fig 11 1:1000 yr AEP surface water flood depth map indicates that the site is not at risk of surface water flooding.

With reference to the National Surface Water Flood Risk map, flood risk to the site negligible.



Extract from Environment Agency Surface Water Flood Risk Map



Extract from SFRA Fig 11 1:1000 yr Surface Water Flood Depth

7.0 FINISHED FLOOR LEVEL/FLOOD RESILIENCE PROPOSALS

With reference to the current Hull City Council Flood Risk Standing Advice⁴ (FRSA) the development is classified as an '*Operational development*'.

The FRSA has changed from the traditional Matrix previously found as part of the old SFRA. This has now been replaced with a new version as shown below. The Matrix should be read with in conjunction with Figure 13 for the SFRA, for flood depth information.

From Figure 13, the site is states to have a maximum flood depth with climate change of 0.3-0.6m.

Therefore, with reference to cell B10 of the FRSA Matrix⁴, Mitigation Note 6, should be complied with as follows;

- Flood depths in this area could reach 600mm. In order to exclude potential flood water, finished floor levels shall be raised a minimum of 600mm above average site level or adjacent road frontage level, whichever is higher. An additional 300mm of flood resilience measures above finished floor levels, shall be included to speed the rate of recovery and minimise the impacts should flood waters enter the property.
- The development must incorporate a place of safety at the level shown on SFRA Figure 15. Please refer to the guidance below which details the council's advice on what constitutes an appropriate place of safety.

Based on the above information the FFL will need to be raised a minimum 600mm above AOD with 300mm of flood proofing above this level.

A place of safety 4.0m AOD shall be provided by default by means of a first floor.

Following discussion with the client and Architect. Raising the finish floor levels by 0.6m would provide a visually unpleasing elevation against the existing properties to each side.

Window and door heads would look visual out of place against the adjoining properties. Therefore, ACRA Consulting have providing an alternative mitigation which has concluded the property would remain safety during the assessed flood events.

Consequently, proposed floor levels are as follows.

FFL: Match 36. Anson Rd, Hull (No Lower)

Flood proofing should be provided up to 0.6m above FFL (Water exclusion)

Additional 0.3m Flood proofing should be provided (Water Entry)

A place of Safety shall be provided above 4.000m AOD

Guidance relating to flood proofing/resilience methods can be found in the EFRA/CLG/Environment Agency publication; *improving the flood performance of new buildings: flood resilient construction*;

8.0 SUMMARY AND RECOMMENDATIONS

It has been demonstrated that the Sequential Test can be adequately passed.

The FRA proves that the risk to the site from all sources of flooding is very low. Following the assessment, it has been concluded that the greatest risk been a potential breach of the River Humber with a resultant flood depth of 0.3m - 0.6m.

The potential risk, cannot however be ignored and mitigation measures should be included. An alternative mitigation has been assessed as part of this FRA to provide a more in keeping visual appearance along Anson road. This mitigation provides the same level of protection as outline below,

FFL: Match 36. Anson Rd, Hull (No Lower)

Flood proofing should be provided up to 0.6m above FFL (Water exclusion)

Additional 0.3m Flood proofing should be provided (Water Entry)

A place of Safety shall be provided above 4.000m AOD

Given the current construction it is deemed to be feasible to introduce the following Flood Proofing measures.

- 1. Plasterboard laid Horizontal up to 0.9m above FFL.
- 2. All electrical sockets and fittings shall be placed above 0.9m above FFL.
- 3. Any external airbricks shall be fitted with flood protection devices.
- 4. New floor finishes shall be tiles with water resistant grout.
- 5. All new internal drainage fittings shall be fitted with anti-flood valves.
- 6. Flood doors with a minimum protection of 0.6m shall be installed (Passive)

It is recommended that all property owners sign up to the EA flood warning system. https://www.gov.uk/sign-up-for-flood-warnings

In additional the owners should prepare a personal flood plan, where a template can be found at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/444659/LIT_4112.pdf

For Innovation Architecture Ltd

Report Written by:-

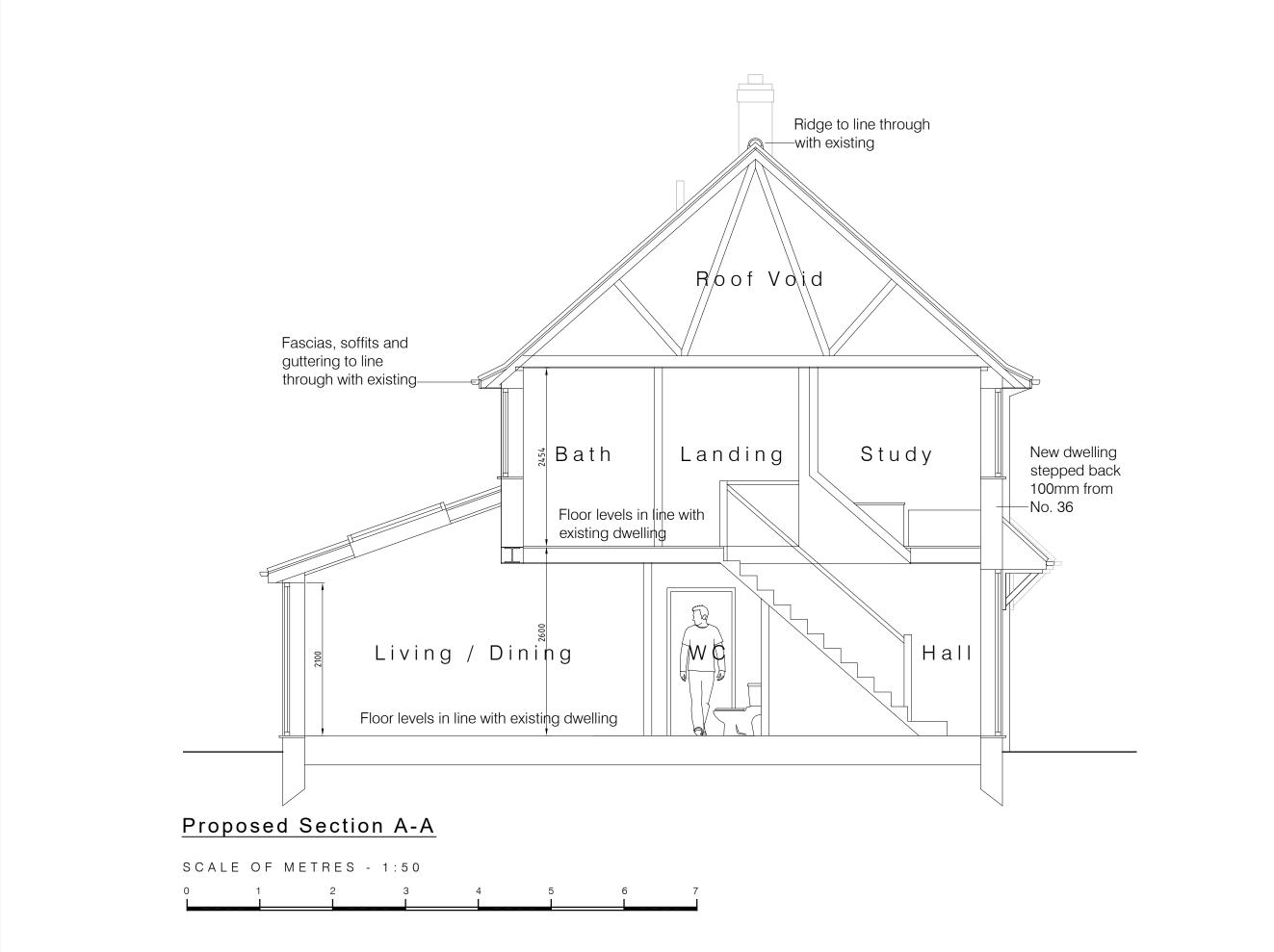
J H Collins BSc., (Hons), MCIWEM

Civil Engineer

Hallins

APPENDIX I

Site Location / Layout Plan



All dimensions must be checked on site and not scaled from this drawing, any discrepancies to be reported

The Contractor shall make a survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper construction of works as indicated.

Please note that this drawing is COPYRIGHT and shall not be used or copied for purposes un-authorised by Innovation Architecture Ltd.

Ordanance Survey - 100059706

PICKERING

PROPOSED NEW

36 ANSON ROAD, HULL, HU9 4SN

Drawing Title

PROPOSED SECTION

Innovation architecture



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Revisions	Date	Description	DR	Ċ
Α	01.12.20	Revised for client	RL	
В	08.12.20	Revised for planning	JG	

PLANNING

30/11/20 A3 - 1:50

Drawing No 645/04

Rev B



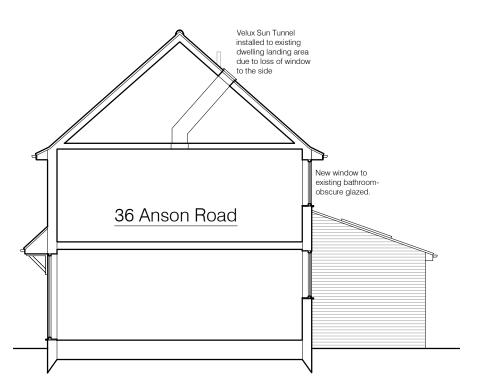
Proposed West (Side) Elevation



Proposed North (Rear) Elevation

Proposed South (Front) Elevation

SCALE OF METRES - 1:100 13



Proposed East (Side) Sectional Elevation Cutting through No. 36

All dimensions must be checked on site and not scaled from this drawing, any discrepancies to be reported

The Contractor shall make a survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper construction of works

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Ordanance Survey - 100059706

PICKERING

PROPOSED NEW DWELLING

36 ANSON ROAD, HULL, HU9 4SN

Drawing Title

PROPOSED ELEVATIONS





01482 650215

Revisions	Date	Description	DR	CH		
Α	01.12.20	Revised for client	RL			
В	08.12.20	Revised for planning	JG			

PLANNING

Rev B

Drawing No. 645/03

