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Flood Risk Assessment for 16 Wald Avenue, Fallowfield, Manchester, M14 6TE

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1.0 Introduction

1.1 Background

Peak Associates Environmental Consultants Limited (Peak Associates) was commissioned by Mohammed Helal Uddin to conduct a Flood Risk Assessment (FRA) to support planning application 136914/FH/2023 for 16 Wald Avenue, Fallowfield, Manchester, M14 6TE.

This report is based upon observations made on site during a walkover undertaken on the 2nd of June 2023 and upon data driven research. This FRA includes the analysis of historical maps, geological, hydrogeological, and hydrological data, and other relevant Third-Party environmental information, including Environment Agency's (EA) Product 4 Data. Product 4 data includes detailed FRA maps which show: flood zones, defences and storage areas, areas benefiting from defences, statutory main river designations, historic flood event outlines and more detailed information from the EA's river models. Product 4 data is freely available and can be requested from GOV.UK.

Peak Associates can accept no liability for any inaccuracies contained within the Third-Party information referenced. It should be noted that where screenshots of online mapping tools have been used, these contain public sector information licensed under the Open Government Licence v3.0.

1.2 Description of the Proposed Site

The proposal for the residential dwelling is to add a one and two storey side extension and porch to the property. The side extension will add approximately 13m^2 to the north side of the dwelling (see Plan 2). The extension is under 250m^2, making it very much a 'minor extension' according to The National Planning Policy Framework (NPPF) (Ref 1).

The existing two-storey residential dwelling extends to approximately 64m^2 on a total site area of 235m^2. 16 Wald Avenue currently has a ground floor, first floor, rear extension, driveway and garden. Photographs of the site in its existing condition can be found in Appendix 1. The residential dwelling resides at appoximstely 41.75 mAOD, and the lowest section of the garden resides at approximately 41.5 mAOD (see Appendix 2).

The property is accessed via Wald Avenue off the A34 (see Plan 1). Cringle Brook resides approximately 12m northwest of the property. Mauldeth Road railway station is situated 330m south of the property and railway tracks run adjacent to the property on the northeast side.

1.3 Geology

The geology of the area was investigated using the Geology of Britain Viewer from the British Geological Survey (Ref 2). The bedrock geology of the site is composed of Chester Formation Sandstone. This sedimentary bedrock formed between 250 and 247.1 million years ago during the Triassic period.

In terms of superficial geology, the site is underlain by Till (Devensian – Diamicton). Glacial till includes unsorted material deposited by glaciers. The site's till deposits formed between 116 and 11.8 thousand years ago during the Quaternary period.

1.4 River Catchment and Climate Change Allowances

Cringle Brook which is located approximately 12m northwest of the site is a small watercourse that flows through the highly urbanised area of south Manchester (Ref 3). Between 1962 to 2000 six severe flood events occurred at Cringle Brook which caused properties adjoining the brook to flood. Since then, the Environment Agency has created a flood alleviation scheme for Cringle Brook. Works associated with the alleviation scheme include widening of the channel's capacity, regularly removing debris and blockages, and repairing and maintaining culverts (Ref 3).

Cringle Brook is part of the Upper Mersey catchment area and the Bollin Dean Mersey Upper Operational Catchment (Ref 4). As such, the peak river flow allowances for the Mersey Upper Management Catchment broadly apply to Cringle Brook. The climate change allowances for the Mersey Upper are presented in Table 1. Given the residential dwelling resides in Flood Zone 2, the central and higher central allowances are to be used in this strategic flood risk assessment (Ref 5).

Because the brook is so urbanised in terms of its catchment and culverting, consideration of how to adequately manage flood risk and/or prepare for increased incidents and severity of flooding due to climate change is a matter local residents and the Lead Local Flood Authority need to pay some attention to. Indeed, Manchester City Council's Level 1 SFRA has assigned Cringle Brook, Fallowfield, the Flood Warning 'Code GM13', which denotes a 'Severe' type of warning where there is extreme danger to life and property (Ref 10).

Table 1: Mersey Upper Management Catchment peak rainfall allowances (Ref 6).

3.3% annual exceedance rainfall event		
Timeframe	Central	Upper
2050s	20%	35%
2070s	30%	40%
1% annual exceedance rainfall event		
2050s	25%	40%
2070s	30%	45%

1.5 Data Limitations

Product 4 Data was obtained from the Environment Agency (EA) on the 30th of May 2023 (see Appendix 3). The Product 4 data contains model data taken from the Cringle Brook 2017 study. The Product 4 data includes the 1 in 100 year flood event and an allowance for climate change across defended and undefended scenarios. However, it is important to note that flooding records are often incomplete and the EA's Product 4 data only supplies flood risk data relating to flooding from rivers and/or the sea, not other sources of flood risk.

It is also worth noting that for small watercourses that are partly culverted it is often maintenance-led issues either with debris or silt accumulation or dilapidation issues (rather than soley rainfall issues), that is the principle or contributory cause of any flooding event.

2.0 Sources of Flooding

2.1 General Overview

Flooding can occur from a variety of sources, including fluvial, surface water (pluvial), groundwater, and reservoirs. The residential dwelling is located in Flood Zone 2 (see Figure 1) and as such, has a Medium probability of flooding from rivers and the sea (Ref 7). Each year, the data suggests that in terms of weather related risk, the site has a Low risk (between 0.1% and 1%) of fluvial flooding each year. The property also has a Very Low (less than 0.1%) and Low (between 0.1% and 1%) risk of surface water flooding each year, although sections of Wald Avenue are at Medium (between 1% and 3.3%) risk each year (Ref 8).

The EA's 'Long-Term Flood Risk Map' (Ref 8) identifies the site as at risk of flooding from the Gorton Lower and Upper (Debdale) reservoirs although, with proper reservoir maintaince, the risk of reservoir flooding is reduced. The site is not located in an area at risk of groundwater flooding, nor in an area of shallow groundwater or in an area at risk of groundwater rebound (Ref 9). Table 2 below outlines all the potential sources of flood risk to the proposed development.

Table 2 - Sources of flood risk to the proposed development

Flood Source	Potential Risk					Description
	High	Medium	Low	Very Low	None	
Surface Water			X	X		There is a Very Low (less than 0.1%) to Low (between 0.1% and 1%) risk of pluvial flooding at the property.
Fluvial		X	X			The residential building resides in Flood Zone 2 and has a Medium probability of flooding from rivers and the sea. However, the site has a Low risk (between 0.1% and 1%) of fluvial flooding each year, and is close to Flood Zone 1.
Groundwater					X	The site is not located in an area at risk of groundwater flooding, nor is it located in an area of shallow groundwater or in an area at risk of groundwater rebound.
Reservoirs			X			Fallowfield is located downstream of the Gorton Lower and Upper (Debdale) reservoirs.
Tidal					X	The site is not at risk from tidal flooding.

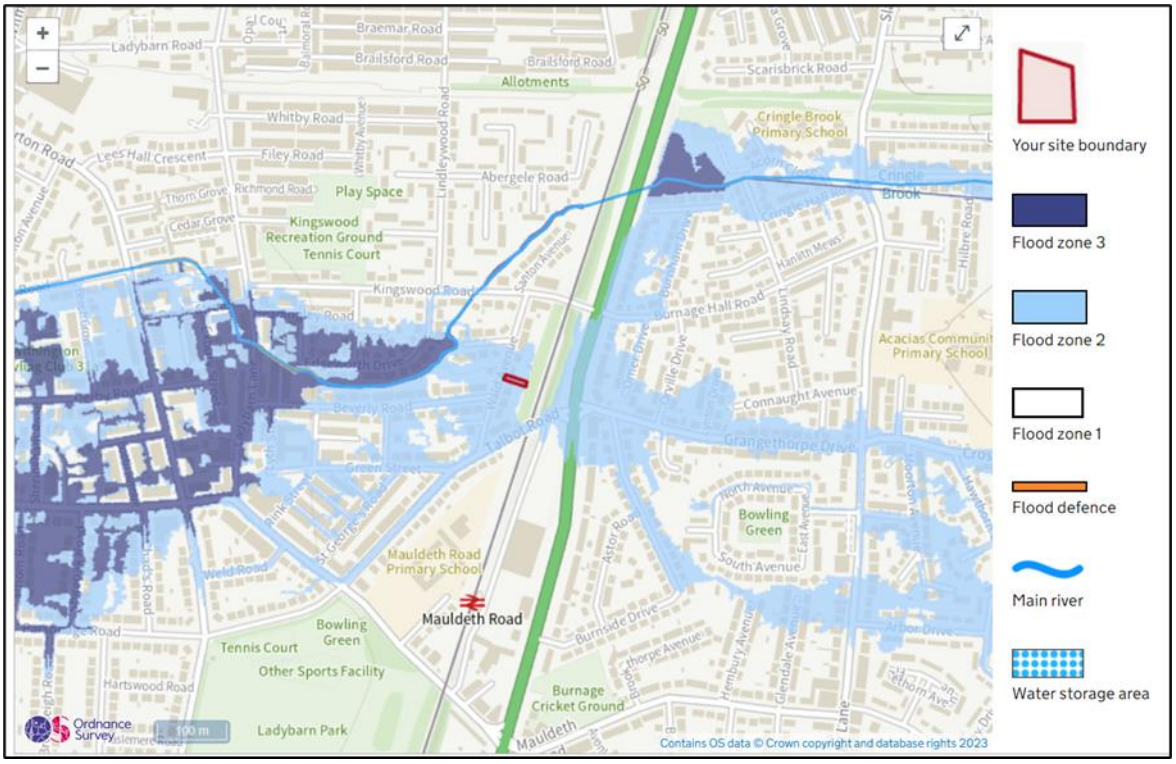

Figure 1 – Flood Zone Map for Site (Ref 7)

2.2 Surface water

Surface water flooding arises during heavy rainfall events where water accumulates on the surface in low lying or obstructed areas. The risk of surface water flooding increases with the amount of urban area drained to a brook and the creation of impermeable hard surfaces. According to Manchester City's SFRA (Ref 10), the wards at highest risk of surface water flooding in Manchester are the City Centre, Levenshulme, Didsbury East, Northenden and Charlestown. The Fallowfield ward, where the property is located, is not listed as a ward at greatest risk of surface water flooding. However, sewer and drainage problems have been identified in Fallowfield during heavy rainfall events (Ref 10).

The site has a Very Low to Low risk of flooding from surface water, which means the area has a chance of flooding of less than 0.1% or between 0.1% to 1% each year (see Figure 2). In the Low-risk scenario, surface water depths vary between below 300mm to up to 900 mm (see Figure 4). In the High-risk scenario, there is no estimated flood depth (see Figure 6).

Figure 2 shows surface water accumulates along Wald Avenue and the garden area of the property. This highlights how the EA's flood maps (based on levels taken from LiDAR data), have identified low-lying points on the site where surface water is most likely to accumulate. According to LiDAR data (see Appendix 2), the building resides at approximately 41.75 mAOD and sections of the garden reside at 41.5 mAOD. Hence, any surface water flooding that does occur on site should accumulate predominately in the garden area, which matches what the surface water flood maps show.

In the Low-risk velocity scenario, surface water flows at over 0.25 m/s, predominantly along Wald Avenue to the north and northeast (see Figure 3). In the High-risk velocity scenario, the

flood velocity is not shown for the property (see Figure 5). Surface water travels along Wald Avenue, Beverly Road, and Kingswood Road. Hence, Manchester City Council and/or United Utilities have a responsibility to maintain the surface water drains along the residential roads near Cringle Brook and ensure they remain unblocked to allow for the free flow of surface water down-gradient of the site (see Photo 6).

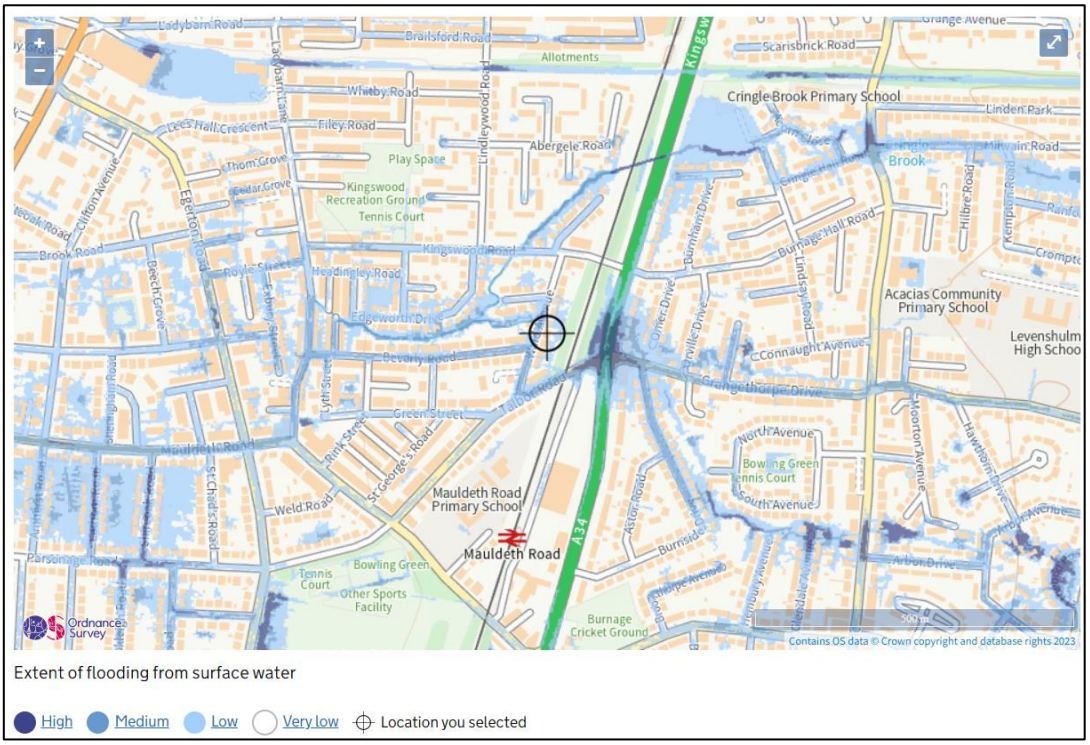

Figure 2 – Extent of Surface Water Flooding (Ref 8)

Figure 3 – Low Risk Surface Water Velocity Map (Ref 8)

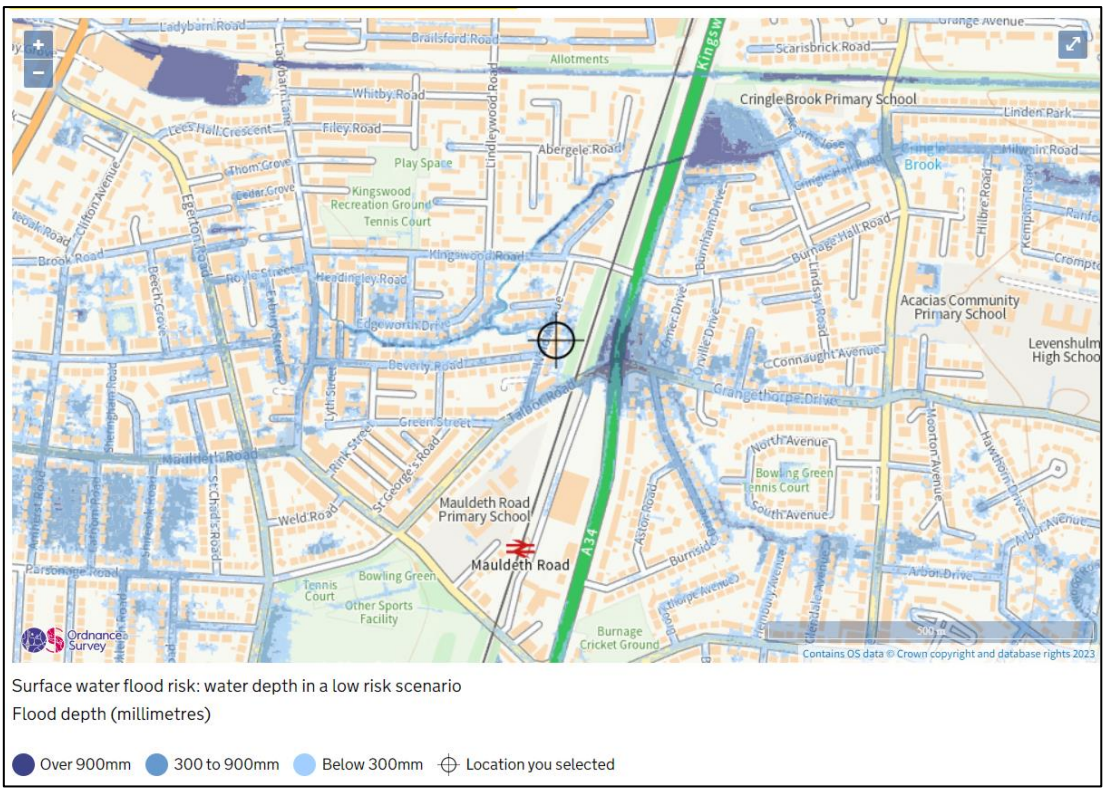

Figure 4 – Low Risk Surface Water Depth Map (Ref 8)

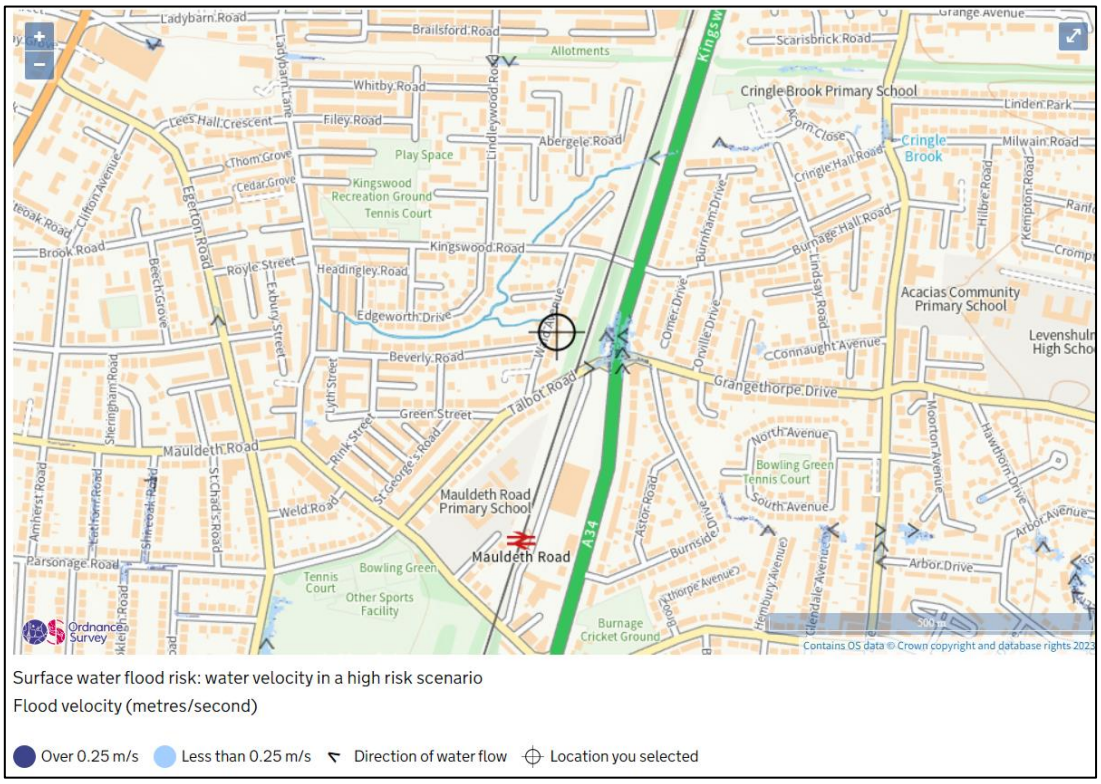

Figure 5 – High Risk Surface Water Velocity Map (Ref 8)

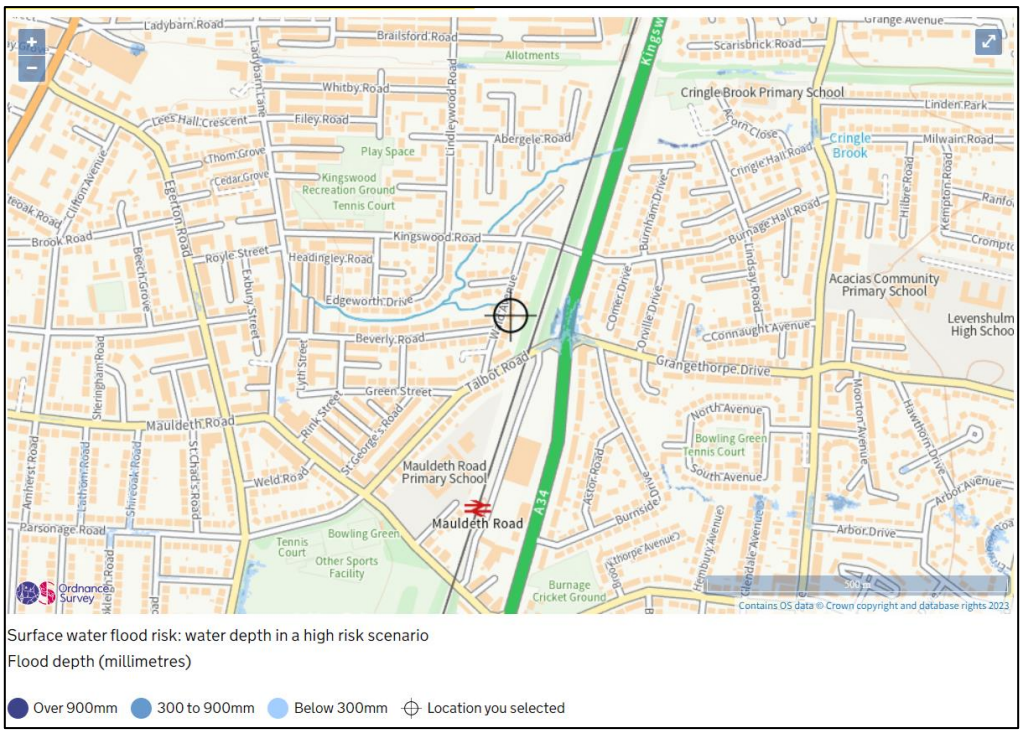

Figure 6 – High Risk Surface Water Depth Map (Ref 8)

2.3 Fluvial

Fluvial flooding occurs when the flow capacity of a watercourse is reached, causing water to flood nearby areas. As previously mentioned, the residential dwelling is located in Flood Zone 2 and has a Medium probability of fluvial flooding (Ref 7). However, the risk of flooding each year is Low. 'Low' risk means that each year, the area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) (Ref 8).

The main source of fluvial risk is from Cringle Brook, which is located approximately 12m northeast of the site. The site is protected to a degree from flooding via Cringle Brook due to the presence of natural high ground between Edgeworth Drive and Beverly Road and engingereed high ground adjacent to Santon Ave (Asset ID 8871 and 9636 on the Product 4 data, respectively). However, the levels and velocity reached at Cringle Brook in the defended and undefended scenarios on the Product 4 data are the same which, could be a limitation of the data or alternatively, reflect that the high ground is not designated (formally) as an effective flood defence structure.

In the EA's Product 4 data (see Appendix 3), the site is closest to node point 3 (ea013_0238_CRIN01_2102d). At node point 3 in the undefended 1 in 100-year flooding scenario, Cringle Brook is predicted to reach 40.64 mAOD at 5.42 m^3/s. With a 35% increase in flow to account for climate change in the undefended 1 in 100-year scenario, the brook reaches 40.70 mAOD at 6.49 m^3/s and with a 70% increase in flow, Cringle Brook reaches 40.72 mAOD at 7.76 m^3/s. Across all of these scenarios, 16 Wald Avenue is protected from

fluvial flooding given the property resides at 41.75 mAOD. 16 Wald Avenue resides between 1.11 - 1.03 mAOD above the estimated flood levels across all 1 in 100-year flood scenarios.

Even in the 1 in 1000-year + 30% increase in flow scenario, Cringle Brook only reaches 40.81 mAOD at node point 3. 16 Wald Avenue resides 0.94 mAOD above the depth estimated in the 0.1% AEP + 30% increase in flow scenario at node point 3. Given the site is protected in this 1 in 1000-year scenario, it could be argued the site is in reality close to being located in Flood Zone 1. Areas deemed to be in Flood Zone 1 have been shown to be at less than 0.1% chance of flooding in any year, this is sometimes known as having a 1:1000 year chance.

The front of the property, labelled Map Reference '5' on the Product 4 data (see Appendix 3), is relatively more protected from flooding than the back of the property (Map Reference '6'). The 2D levels at the front of the property show that flooding reaches depths of 41.48 mAOD in the 1 in 1000-year +30% increase in flow, which is 0.27 mAOD below the floor level 16 Wald Avenue resides at.

However, the 2D levels at the back of the property show that flooding reaches depths up to 41.71 mAOD, which is just 0.04 mAOD below the floor level of the house at 41.75 mAOD. Given the garden area at the back of the property resides at 41.5 mAOD, it is likely that the garden would begin to flood in the 0.1% AEP + 30% increase in flow scenario. However, the proposed extension is not located in this section of the back garden and, therefore, is not viewed as being at an unacceptable risk of such fluvial flooding.

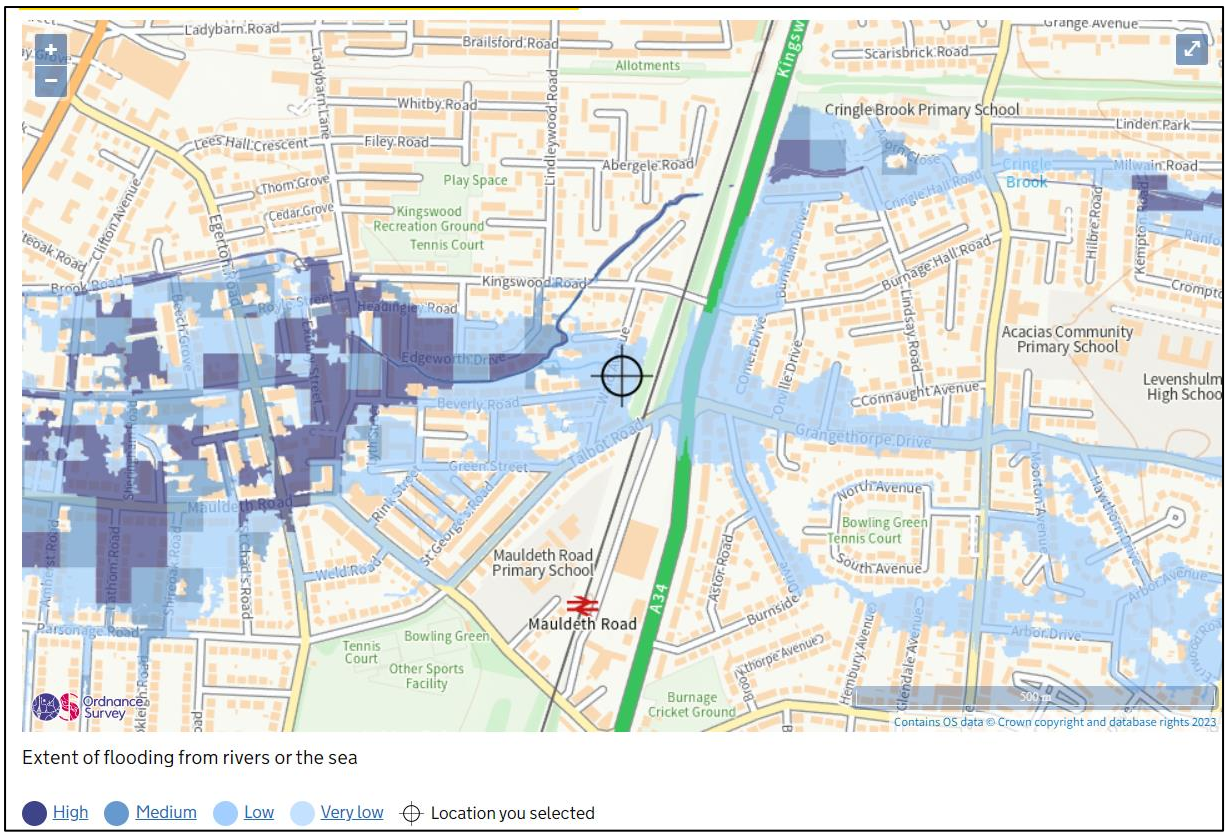

Figure 7: Fluvial flood risk map (Ref 8).

2.4 Reservoirs

The EA's 'Long-Term Flood Risk Map' (Ref 8) identifies the site as at risk of flooding from the Gorton Lower and Upper (Debdale) reservoirs, which are managed by United Utilities (UU). 16 Wald Avenue is located approximately 4km southwest and downstream of the Gorton reservoirs. As such, residents situated downstream of the Gorton reservoirs may wish to request the UU's emergency flood plans and evacuation procedures.

Flooding from the Gorton reservoirs may come from overtopping due to greater inflows than outflows, or from full or partial failure of the dam walls. The Gorton's water level management strategy of the dam is unconfirmed. However, it is assumed that UU regularlu undertakes work to better manage the reservoir and its associated structures.

The site's relatively close proximity to the Gorton reservoirs means there is an obvious risk of reservoir flooding from dam failure or overtopping of the reservoir. As previously mentioned, it is the responsibility of UU to provide emergency flood and evacuation plans to the relevant persons who have an interest in the reservoir. Furthermore, inspections are to be undertaken by an independent qualified civil engineer and a report completed which includes any maintenance works required, the time of the next inspection, and any safety measures that need to be completed in a designated timeframe. Maintenance and inspections of the Gorton reservoirs are the responsibility of the UU and reservoir engineers.

Manchester City Council's Level 1 and Level 2 SFRA states that inundation mapping is not available for public release on the basis of national security and subsequently, there are no further analyses of reservoir flooding within the SFRAs (Ref 10). Nonetheless, this FRA takes the view that as long as the UU and other independent engineers regularly maintain and monitor the Gorton reservoirs and dams properly, the risk of reservoir flooding at 16 Wald Avenue is reduced. For this reason, this FRA has classified the risk of reservoir flooding as Low, although it is important to note the EA's flood maps do not categorise reservoir flooding in terms of High to Low risk.

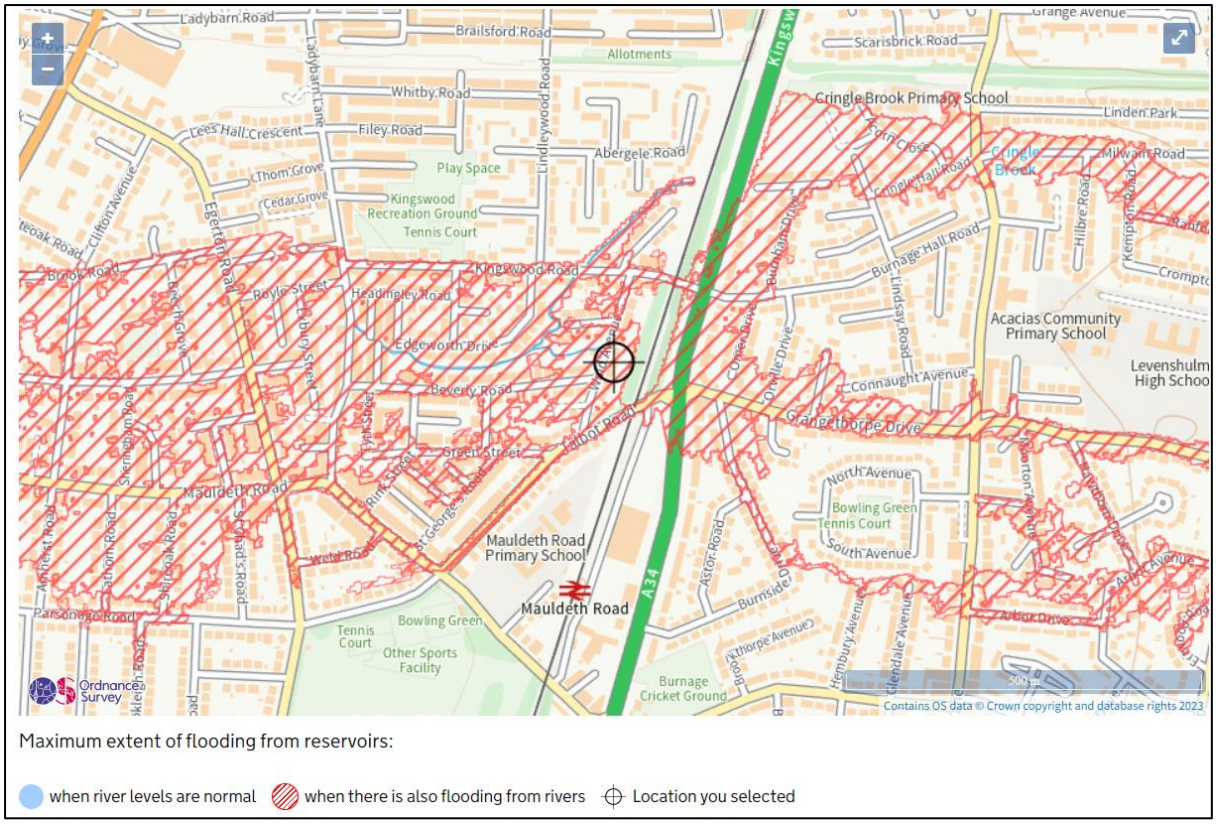

Figure 8 – Extent of Flood Risk From Reservoirs (Ref 8)

2.5 Groundwater

Groundwater flooding occurs when water stored beneath ground level rises to breach the surface. According to Manchester City Council's SFRA (Ref 10), there are no known reports of groundwater flooding in the Manchester, Trafford and or the Salford authorities. However, there are sections of Trafford with high water tables and increasing water tables. In addition, minewater rebound is a potentiall issue for all three districts (Ref 10).

Nonetheless, Manchester City Council's SFRA groundwater map indicates that 16 Wald Avenue is not located in an area at risk of groundwater flooding, nor is it located in an area of shallow groundwater or in an area at risk of groundwater rebound (see Figure 9). As mentioned in sub-section 1.3, the site resides on a bedrock composed of sandstone, which should easily drain groundwater. For these reasons, this FRA has not identified groundwater flooding as a risk to 16 Wald Avenue. Groundwater is viewed as likely to be in hydraulic continuity with Cringle brook.

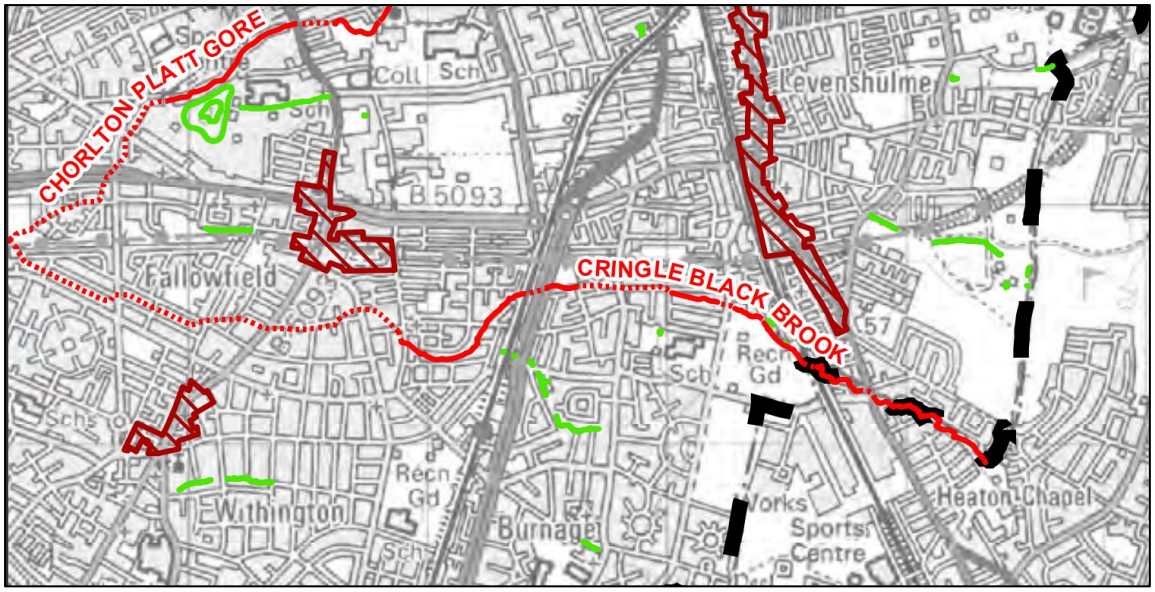

Figure 9: Areas Susceptible to Groundwater flooding in Manchester City (Ref 9). Note: 16 Wald Avenue is located in a grey area on the map which is not at risk of groundwater flooding.

2.6 Tidal

The site is not at risk from tidal flooding, and therefore, analysis is not applicable.

3.0 Accounting for Flooding Within the Proposed Development

The NPPF classifies the proposed development as a 'More Vulnerable' development (Ref 1) given the use of the dwelling is residential. However, the proposed extension is well under 250m^2, which is considered a 'minor extension' (Ref 1). For these reasons, the sequential and exception test are not required for the site.

As outlined in Section 2.0, the site has a Very Low (less than 0.1%) and Low (between 0.1% and 1%) risk of surface water flooding each year. Sections of Wald Avenue are at Medium (between 1% and 3.3%) risk of pluvial flooding each year as surface water tends to concentrate and travel along Wald Avenue and nearby residential roads (Ref 8).

To protect 16 Wald Avenue from surface water flooding, it is imperative that Manchester City Council and/or United Utilities keep the roadside drains clear and well maintained. In addition, the property owners at 16 Wald Avenue should seek to keep the property's drains free from debris to prevent surface water gathering on site. Any surface water flooding that does occur at 16 Wald Avenue should naturally infiltrate into the ground in the garden area or into the drains situated along Wald Avenue.

In terms of fluvial flood risk, although the site is located in Flood Zone 2, which has a Medium probability of flooding (Ref 7) the site from the Product 4 data looks to be very close to being in Flood Zone 1. Once the elevation of the house above natural ground level is considered, the risk of fluvial flooding at the property each year is probably towards the lower end of the probability for Flood Zone 2 and, therefore, at a level of around 1:1000 years. Cringle Brook, which is the small watercourse that is located approximately 12m northeast of the property, has a history of flooding, and as such, the Environment Agency has created a flood alleviation scheme for the brook. During the site visit a resident in the local area recalled that the EA regularly visits the brook to remove debris and de-sludge the brook. This, combined with maintaince of high ground defences and walls, should all help to protect 16 Wald Avenue from flooding.

At node point 3 on the Product 4 data (see Appendix 3), Cringle Brook reaches 40.64 mAOD in the 1% AEP scenario, 40.70 mAOD in the 1% AEP + 35% increase in flow scenario, and 40.72 mAOD in the 1% AEP + 70% increase in flow scenario. The property, which resides at 41.75 mAOD, resides between 1.11 - 1.03 mAOD above the estimated flood levels at node point 3 across all 1 in 100-year scenarios.

Even in the 0.1% AEP + 30% increase in flow scenario, the front of the property at 2D Map Reference '5' experiences flooding to a depth of 41.48 mAOD which is still 0.27 mAOD below the level of the residential dwelling. In the 0.1% AEP + 30% increase in flow scenario, the back of the property at 2D Map Reference '6' where the garden resides is likely to flood given depths reach 41.71 mAOD and the garden resides at 41.5mAOD. However, the extension is

not planned for this area of the site and the water should naturally infiltrate into the ground in the garden.

The site is not located in an area at risk of groundwater flooding, nor is it located in an area of shallow groundwater or in an area at risk of groundwater rebound. Similarly, although 16 Wald Avenue is located approximately 4km southwest of the Gorton Lower and Upper (Debdale) reservoirs, reservoir failure is unlikely given United Utilites should be regularly working on and monitoring the reservoirs.

The risk of flooding is dependent on the maintenance and upkeep of the reservoir by UU. As a United Utilities owned asset, Gorton reservoirs will be managed and assessed to the highest standards in the UK under the Reservoir Act of 1975. Hence, this FRA has classified the risk of reservoir flooding the property as low. Nonetheless, the residents of 16 Wald Avenue and other residential areas situated downstream of the Gorton reservoirs should follow the 'Framework for Reservoir Inundation Preparedness Planning' (Ref 11) which can be accessed via the GOV.UK website.

It is the view of this FRA that it is appropriate for the proposed development to proceed as planned. The dwelling at 41.75 mAOD is between 1.11 - 1.03 mAOD above the estimated flood levels at node point 3 across all 1 in 100-year scenarios, including an allowance for climate change. The dwelling is protected from fluvial flooding and is it not required (nor economical or practical) to change the existing level of the dwelling.

Nonetheless, due to the likelihood of surface water flooding along Wald Avenue and the site's proximity to Cringle Brook, it would be appropriate for the site's occupiers to monitor the flood warnings of the nearby area (Ref 12) and evacuate, should the entrance to Wald Avenue appear likely to become flooded and blocked (see Figure 10).

Similarly, the site's occupiers and other residents in the local area might wish to monitor Cringle Brook and report any debris and obstructions at Cringle Brook to the EA. This will ensure the flood alleviation scheme at Cringle Brook is being regularly monitored and maintained by the EA. A residents flood forum in the area could be a method of liaising with the LLFA and EA if, for example, siltation or debris build up started to cause an increase in flooding in the area.

Figure 10: The area near the site that should be monitored for flood alerts and warnings. Note: The area covered broadly equates to the area where the risk of flooding in any year is greater than 1% (Ref 12).

4.0 Conclusions and Recommendations

The proposed extension at 16 Wald Avenue is considerably less than 250m^2 and is considered a 'minor extension'. The dwelling resides in Flood Zone 2 (very close to Flood Zone 1) with a Medium probability of flooding and has a Low risk of fluvial flooding each year.

Surface water flooding may gather along Wald Avenue and in the back garden of the site, both of which reside at lower elevations relative to the residential dwelling. However, the garden is not being developed and is not at high risk because water should naturally infiltrate into the ground and/or towards areas of even lower elevation.

Across all 1 in 100-year flood risk scenarios, including up to a 70% increase in flow to account for climate change, the property resides above the elevation of node point 3 at Cringle Brook and is therefore protected from fluvial flooding.

The site is at no risk of groundwater flooding and the property is underlain by sandstone bedrock which should easily drain water away. The site's risk of reservoir flooding is directly related to the level of reservoir maintaince and upkeep Gorton reservoir receives from United Utilities. Under the Reservoir Act of 1975, United Utilities regularly monitors and maintains the site, meaning 16 Wald Avenue is at a reduced risk of reservoir flooding.

For these reasons, there is no requirement to raise the floor levels of the development. The development is higher than the highest flood level at node point 3 in all 1 in 100-year scenarios. However, it is worth noting that at 2D Map Reference '6' the garden area of the site may flood in the 1 in 1000-year + 30% increase in flow scenario. Given the garden area should naturally drain away and this area is not being developed, this is not cause for concern.

Nonetheless, it is the view of this FRA that it is appropriate for the proposed development to proceed as planned. This FRA makes the following recommendations to reduce the chance of flooding at the property:

1. Surface water drains on the property should be maintained by the property owners. It is the responsibility of the property owners to remove any drain blockages on their property. Working drains should prevent the accumulation of surface water on site.

2. The property owners should monitor the roadside drains on Wald Avenue and inform the appropriate authorities in the event of a roadside drain blockage. It is the responsibility of Manchester City Council and/or United Utilities to maintain the roadside drains and prevent flooding along Wald Avenue.

3. The site's occupiers should monitor flood alerts and warning systems for the wider residential area surrounding Cringle Brook. If Wald Avenue appears likely to flood, inhibiting site access, the site's occupiers might also seek to evacuate.

4. The site's occupiers and other residents in the local area might wish to monitor Cringle Brook and report any debris and obstructions at Cringle Brook to the EA. This will ensure the flood alleviation scheme at Cringle Brook is being regularly monitored and maintained by the EA. A residents flood forum in the area would be a method of liaising with the LLFA and EA if, for example, siltation or debris build up started to cause an increase in flooding in the area. The development at 16 Wald Avenue is, however, at the margins of the area most at risk of flooding from Cringle Brook.

5.0 References

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Plan 1: Site Location Plan

Ordnance Survey®

Siteplan® 1:1250

16 WALD AVENUE

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20 0 20 40 60 80

Metres

N

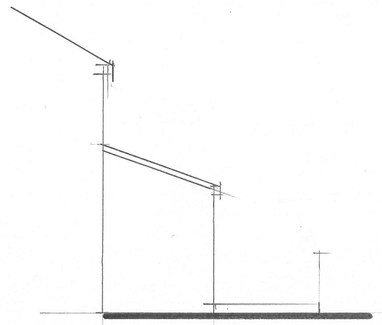
Centre Coordinates: 386300 393421

National Grid sheet reference at centre of this Siteplan: SJ6693SW

Supplied by: Blackwells
Serial Number: 00376200

Plan 2: Proposed Development Plan

rear



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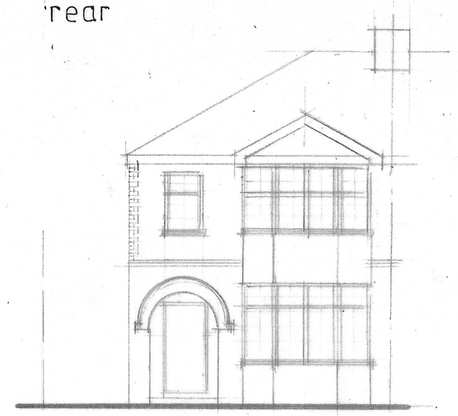

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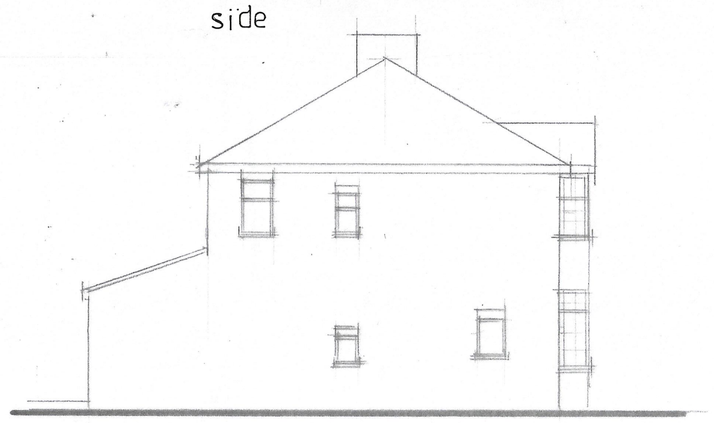

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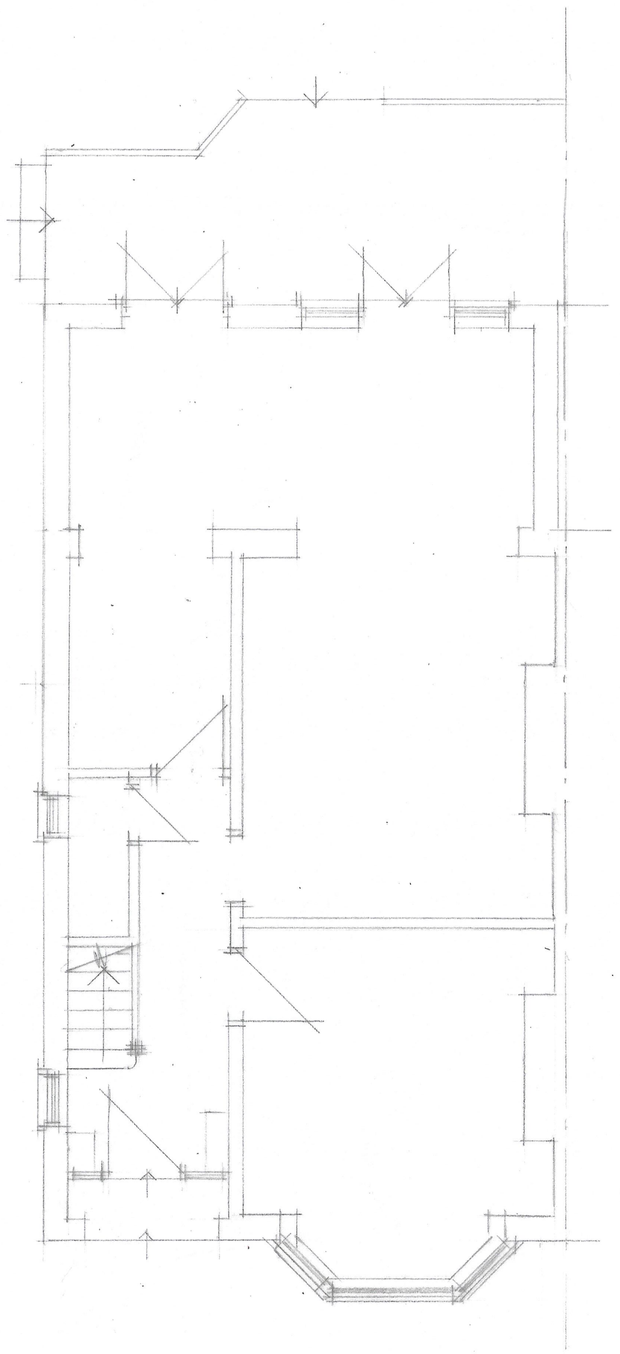

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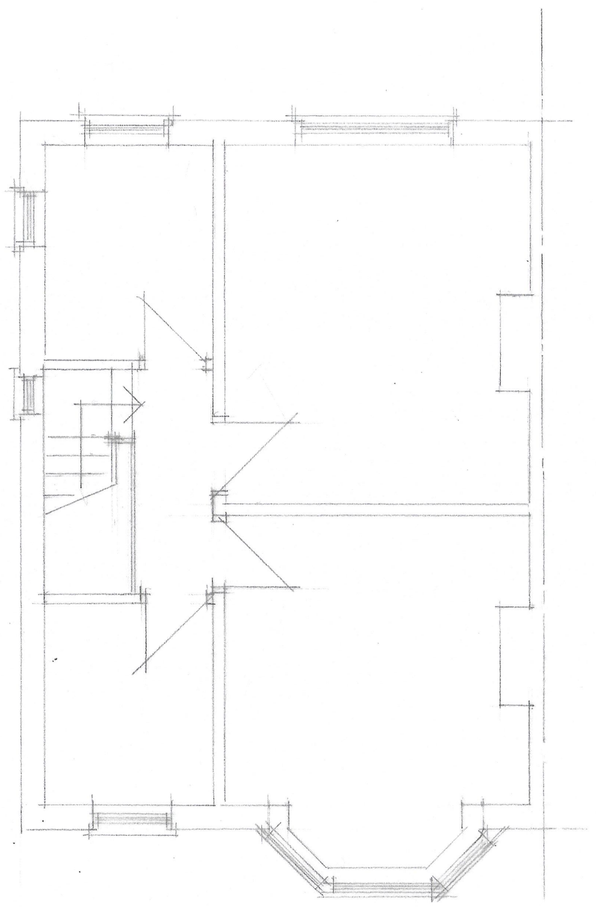


FIRST

CLIENT
MRS N BEGUM
16 WALD AVENUE
FALLOWFIELD M14 6TE

JOB TITLE
PROPOSED ONE & TWO STOREY
SIDE EXTENSION AND PORCH

DRG. TITLE
PLANS AND ELEVATIONS
AS EXISTING

HOLBOROW
ORMESHER +
Limited

architectural & interior design

15 OVERTON CLOSE
MIDDLEWICH
CHESHIRE CW10 0PZ

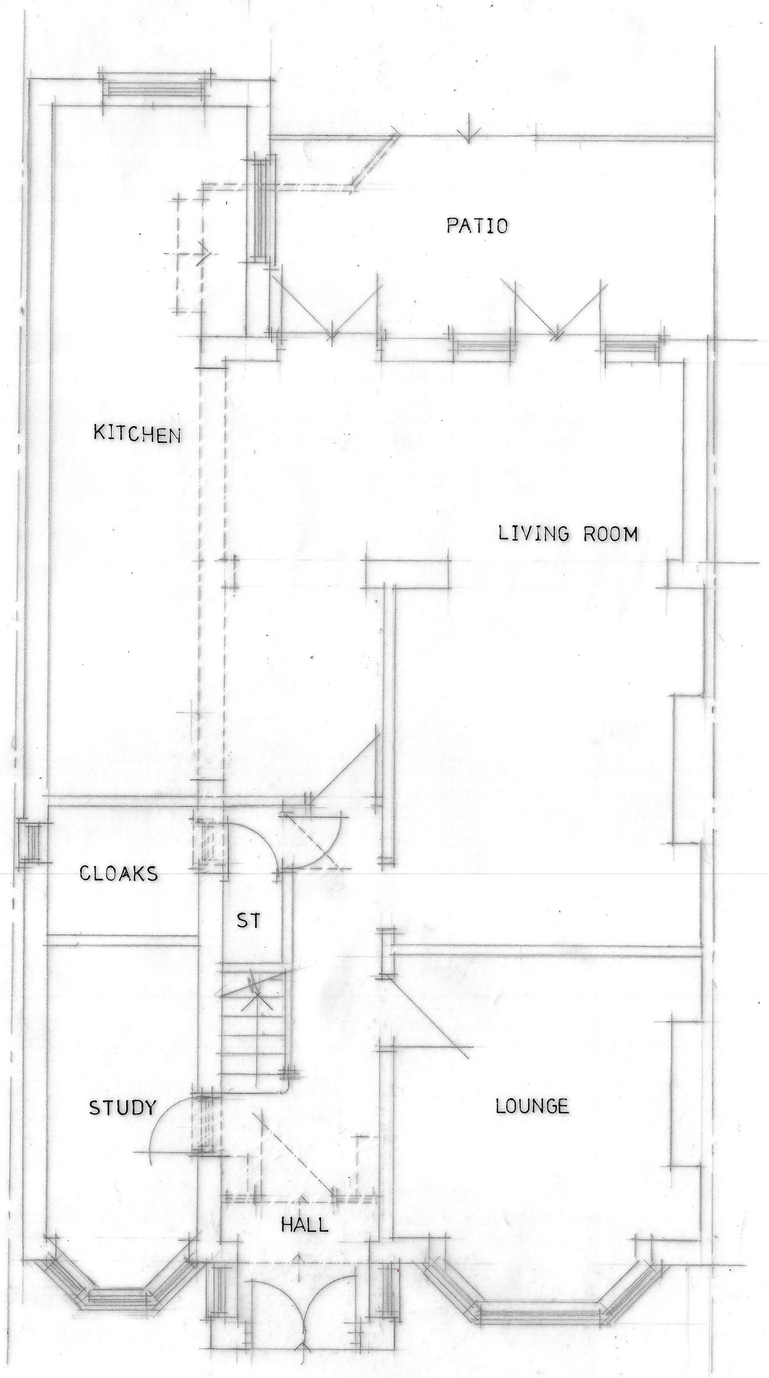
phone: 07770 834939

ISSUE	ORIGINAL	1	2	3	4	5	6	7
REVISION		A						
DATE		Nov 25						
DRAWN		DJO						
CHECKED								
APPROVED								

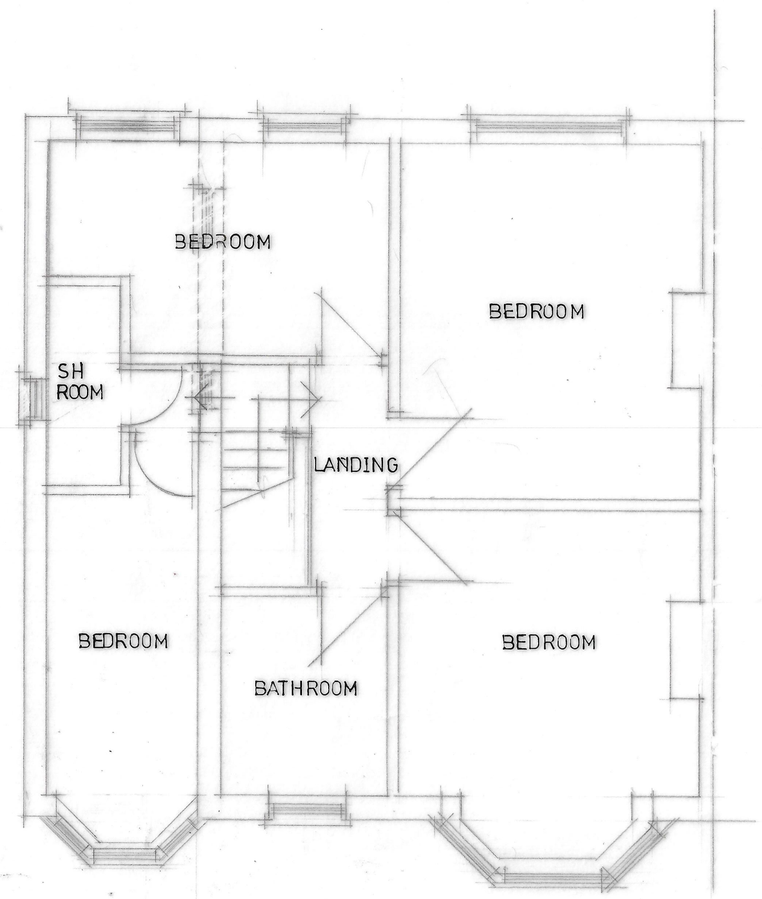
SCALE 1:50 & 1:100 at A1

DRAWING NUMBER 2293/23/01 A

M 512650 R



GROUND



FIRST

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CHESHIRE CW10 0PZ
phone: 07770 834939

ISSUE	ORIGINAL	1	2	3	4	5	6	7
REVISION		A						
DATE		NOV 23						
DRAWN		PO						
CHECKED								
APPROVED								

SCALE 1:50 & 1:100 at A1

DRAWING NUMBER 2293/23/02^A

M 313650 R

Appendix 1: Site Photographs Obtained 02/06/2023

Photo 1: Front View of 16 Wald Avenue.

Photo 2: Front View and Driveway of 16 Wald Avenue.

Photo 3: North Side View of 16 Wald Avenue.

Photo 4: Back View of 16 Wald Avenue.

Photo 5: Garden located at the back of 16 Wald Avenue.

Photo 6: Surface water drain located on Wald Avenue adjacent to the property. Note: the roadside drain appears clear and well-maintained.

Photo 7: Location of Cringle Brook (as taken approximately 12m northwest of 16 Wald Avenue). Note: the brook is out of sight behind the wall and fence, and runs underneath the road (see Photo 8).

Photo 8: Cringle Brook (as seen approximately 12m northwest of 16 Wald Avenue).

Photo 9: Cringle Brook (as seen from behind Hayward Court, located on Beverly Road).

Photo 10: Cringle Brook (as seen from Kingswood Road). Note: the brook is inaccessible and cannot be seen from Kingswood Road behind the metal fencing.

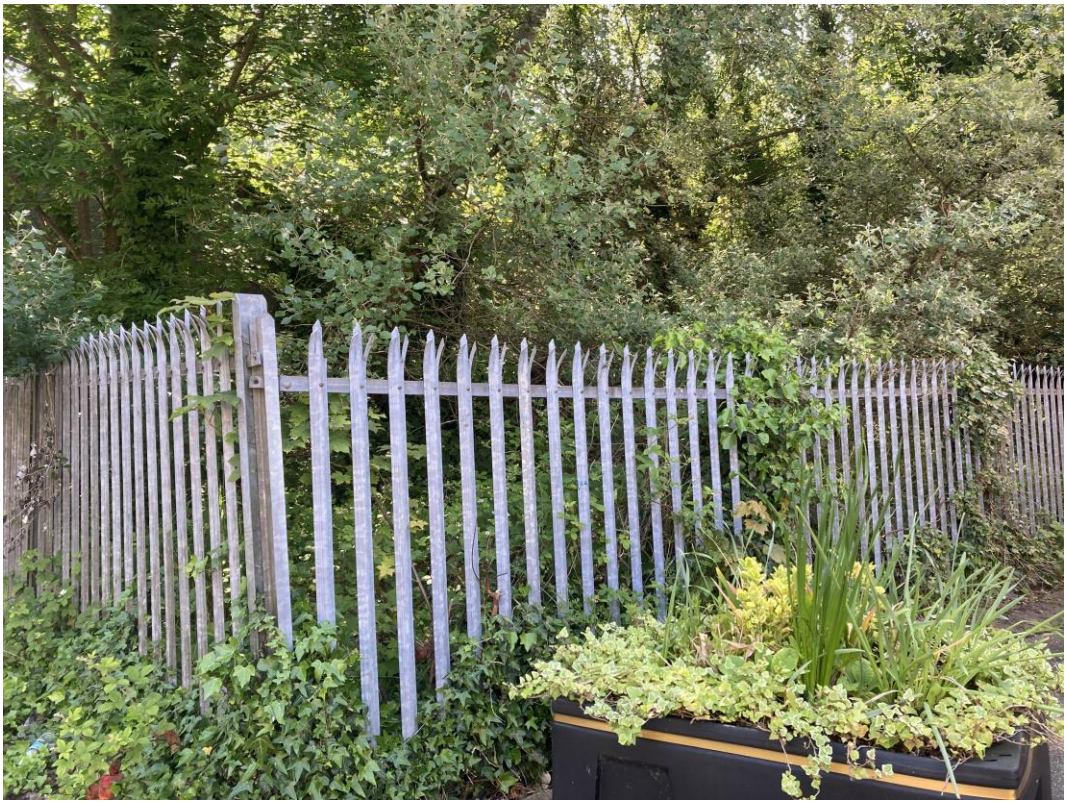


Photo 11: Fencing surrounding the railway situated northeast to 16 Wald Avenue.

Photo 12: Kingswood Road at Burnage bridge (STY/42).

Appendix 2: LiDAR Topographic Data

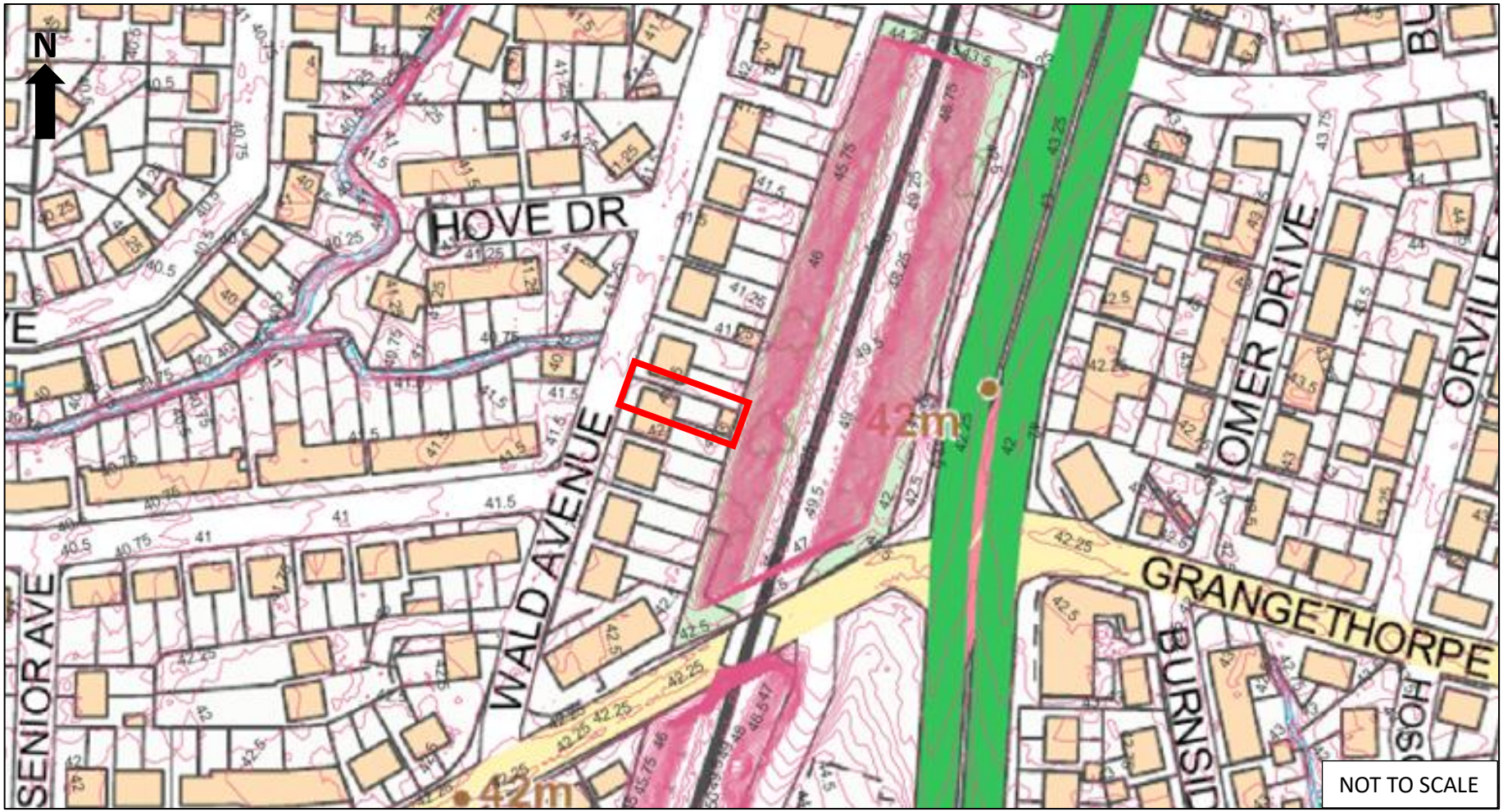
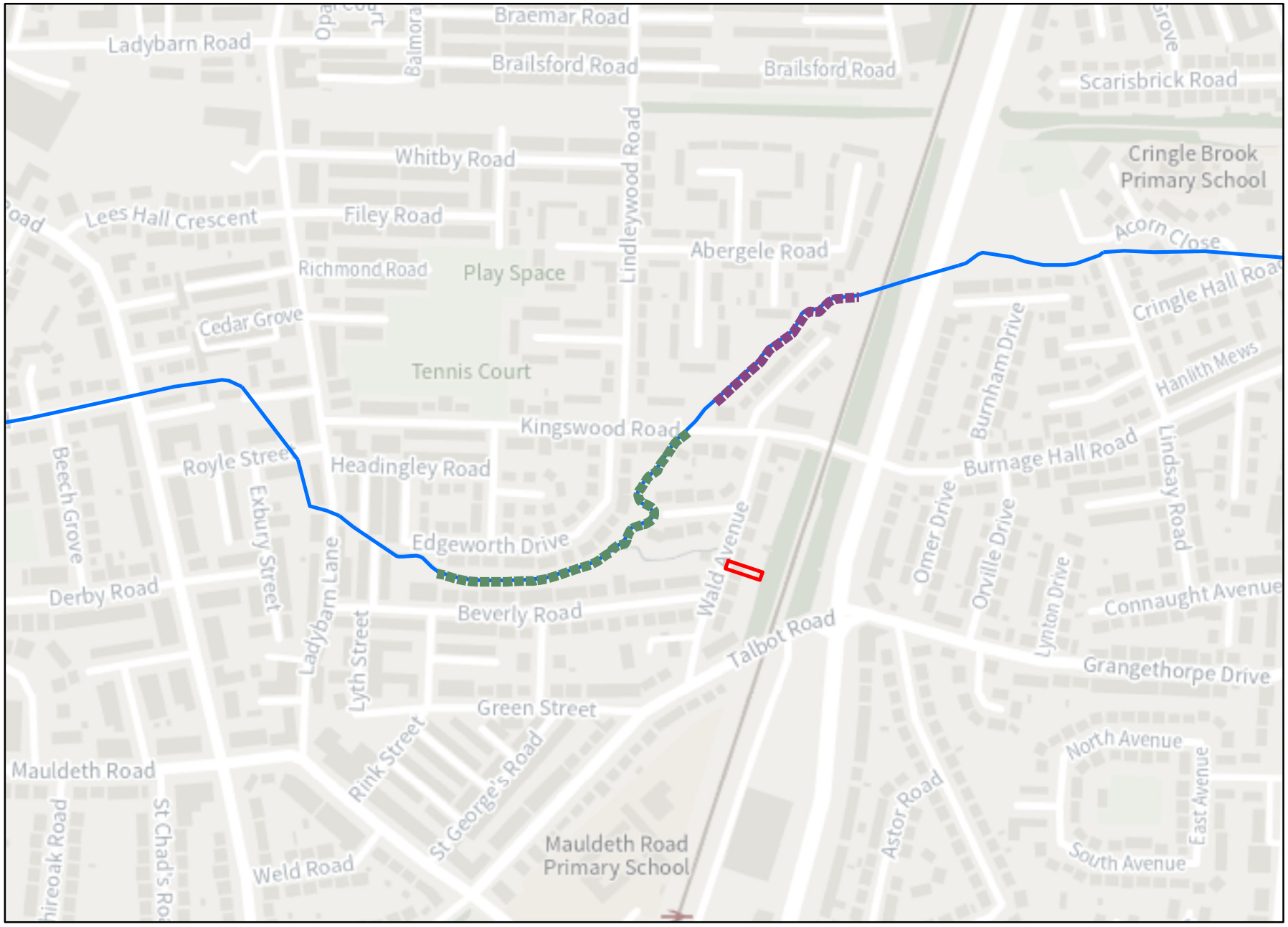


Figure 2a: LiDAR Topographic Map for Site. *Note: 16 Wald Avenue is marked on the map in red. The dwelling resides at 41.75 mAOD and the garden area of the site at 41.5 mAOD.*

Appendix 3: Environment Agency Product 4 Data

Flood Defence Map Centred on Wald Avenue, Manchester, M14 6TE.
Created 26/05/2023 [GMMC311608AB]



Environment Agency

1:5,000

N

Legend

Site Location

Main River

Defences

Asset ID

8871

9636

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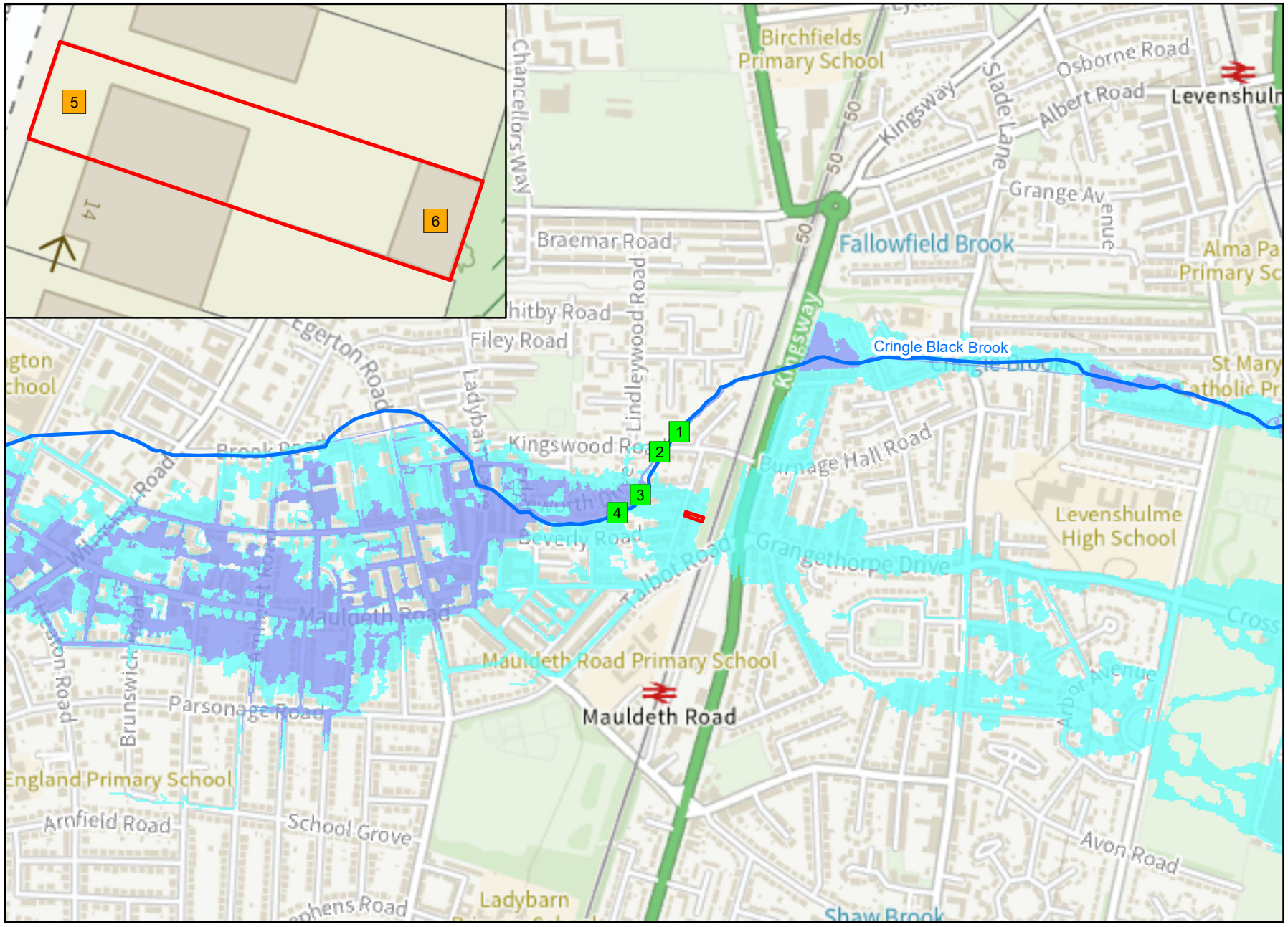
Detailed Flood Map Centred on Wald Avenue, Manchester, M14 6TE.
Created 26/05/2023 [GMMC311608AB]



Environment Agency

1:10,001

N

Legend

- Site Location
- Model Measurements
- 2D Measurements
- Main River
- Flood Zone 3
- Flood Zone 2

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					Undefended														Defended															
Map Reference	Model Node Reference	Easting	Northing	Data	50 % AEP (1 in 2 year)	20 % AEP (1 in 5 year)	10 % AEP (1 in 10 year)	5 % AEP (1 in 20 year)	4 % AEP (1 in 25 year)	2 % AEP (1 in 50 year)	1.33 % AEP (1 in 75 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + 30% Increase in flow	1 % AEP (1 in 100 year) + 35% Increase in flow	1 % AEP (1 in 100 year) + 70% Increase in flow	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% Increase in flow	50 % AEP (1 in 2 year)	20 % AEP (1 in 5 year)	10 % AEP (1 in 10 year)	5 % AEP (1 in 20 year)	4 % AEP (1 in 25 year)	2 % AEP (1 in 50 year)	1.33 % AEP (1 in 75 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + 30% Increase in flow	1 % AEP (1 in 100 year) + 35% Increase in flow	1 % AEP (1 in 100 year) + 70% Increase in flow	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% Increase in flow
1	ea013_0238_CRINO1_2260	386266	393526	Modelled Water Level (m aodN)	40.41	40.54	40.75	40.85	40.87	40.93	40.97	40.99	41.08	41.09	41.17	41.04	41.30	41.36	40.41	40.54	40.75	40.85	40.87	40.93	40.97	40.99	41.08	41.09	41.17	41.04	41.30	41.36
				Modelled Flow (cumecs)	2.01	2.56	3.23	3.55	3.62	3.91	4.08	4.16	4.53	4.58	4.77	4.37	4.87	4.97	2.01	2.56	3.23	3.55	3.62	3.91	4.08	4.16	4.53	4.58	4.77	4.37	4.87	4.97
2	ea013_0238_CRINO1_2210d	386230	393489	Modelled Water Level (m aodN)	40.27	40.40	40.56	40.63	40.64	40.68	40.70	40.71	40.75	40.76	40.79	40.74	40.84	40.88	40.27	40.40	40.56	40.63	40.64	40.68	40.70	40.71	40.75	40.76	40.79	40.74	40.84	40.88
				Modelled Flow (cumecs)	2.15	2.72	3.47	3.80	3.86	4.11	4.29	4.37	4.73	4.79	5.06	4.57	5.54	5.78	2.15	2.72	3.47	3.80	3.86	4.11	4.29	4.37	4.73	4.79	5.06	4.57	5.54	5.78
3	ea013_0238_CRINO1_2102d	386194	393410	Modelled Water Level (m aodN)	40.13	40.26	40.41	40.51	40.53	40.60	40.62	40.64	40.69	40.70	40.72	40.67	40.78	40.81	40.13	40.26	40.41	40.51	40.53	40.60	40.62	40.64	40.69	40.70	40.72	40.67	40.78	40.81
				Modelled Flow (cumecs)	3.03	3.70	4.57	4.83	4.87	5.10	5.29	5.42	6.33	6.49	7.76	5.97	10.89	13.25	3.03	3.70	4.57	4.83	4.87	5.10	5.29	5.42	6.33	6.49	7.76	5.97	10.89	13.25
4	ea013_0238_CRINE1_2045	386152	393377	Modelled Water Level (m aodN)	39.95	40.06	40.19	40.26	40.27	40.32	40.34	40.35	40.42	40.43	40.50	40.40	40.62	40.71	39.95	40.06	40.19	40.26	40.27	40.32	40.34	40.35	40.42	40.43	40.50	40.40	40.62	40.71
				Modelled Flow (cumecs)	3.03	3.70	4.58	5.07	5.17	5.54	5.71	5.81	6.38	6.47	7.27	6.16	9.18	10.45	3.03	3.70	4.58	5.07	5.17	5.54	5.71	5.81	6.38	6.47	7.27	6.16	9.18	10.45

					Undefended		Defended	
Map Reference	Model Node Reference	Easting	Northing	Data	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% Increase in flow	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% Increase in flow
5	2D Levels	386260	393374	Modelled Water Level (m aodN)	41.47	41.48	41.47	41.48
6		386306	393365	Modelled Water Level (m aodN)	41.67	41.71	41.67	41.71

Model data taken from Cringle Brook 2017

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

Notes: *Climate Change Scenario - 30%, 35% and 70% increases in flow calculated for the 2080's (2070 - 2115). Please see https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances for more information regarding the new climate change guidance. The location of the site and the type (vulnerability) of development determine the climate change allowances to consider in any flood risk assessment.

Flood Defences

Start Date	Asset Type	Asset ID	Standard of Protection	Upstream Actual Crest Level (m aod)	Downstream Actual Crest Level (m aod)
01/01/2004	Natural High Ground	8871	100	41.17	39.56
01/01/2004	Wall	32357	100	40.97	40.67
01/01/2004	Wall	32358	100	40.71	40.72
01/01/2004	Wall	8870	100	39.83	39.84
01/01/2004	Engineered High Ground	9636	100	41.26	43.83