



Flood Risk Assessment

Woodhead Road,
Holmbridge, HD9 2NW
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North East (Head Office)
The Old School, Simpson Street,
Sunderland, SR4 6DR

North West
Room 107, Ulverston Business
Centre, Ulverston, LA12 7LQ

T: 0191 535 6189
E: durham@bdn ltd.com
W: www.bdn ltd.com

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Client: Nicola Orme

Prepared: Robbie Lash

Checked: Calvin Agar

Approved: Andrew Webb

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1.0 Background

1.1 Brief

BDN Ltd. has been commissioned by Nicola Orme to undertake a Level 1 Flood Risk Assessment (FRA) for the site which is to be developed for 4No. semi-detached residential development plots. The site is centered around Ordnance Survey Grid Ref: SE 12384 06938 with the nearest post code of HD9 2NW. This site-specific FRA has been completed to support the planning application. The site location plan presented in Figure 1.1 indicates the development boundary (red).

Developments have the potential to be at risk of a range of flooding mechanisms and increase the potential flood risk to the development and the surrounding area. As such flood risk is assessed with respect to risk to human life, damage to properties and the effect the development may have on surrounding watercourses, bodies of water and drainage systems. This Level 1 FRA has been prepared to examine the possible sources of flooding, within the context of the National Planning Policy Framework (NPPF) and Technical Guidance.

Consultation will be undertaken with the Environment Agency (EA), Yorkshire Water (YW) and Kirklees Borough Council (KBC) as part of the planning application. Data has also been gathered from a number of other sources including National Soil Research Institute (NSRI), local ground investigations, aerial photographs, Ordnance Survey (OS), evidence obtained from the EA online tools and anecdotal evidence.



Figure 1.1 Ordnance Survey Map – Site Location

1.2 Report Scope

The Objectives of this report are as follows: The Level 1 FRA is based on readily available existing information, including reference to Kirklees Borough Council Strategic Flood Risk Assessment (SFRA) to confirm the extent of flood risk at the site. The report includes the review of site information and likely extent of any flood risk on the site; identification of whether there are any flooding or surface water management issues related to the development that may warrant further consideration; identification and scoping of other flood risks as required i.e. groundwater flooding; and determining whether further assessment is required i.e. a Level 2 FRA.

An FRA should consider a range of flooding mechanisms to satisfy the following three key objectives:

- To assess flood risk to the proposed development and to demonstrate whether any residual risk to the development and its user would be acceptable.

- To assess the potential impact of the proposed development on flood risk elsewhere and to demonstrate that the development would not increase flood risk elsewhere; and
- To satisfy the requirements of national planning policy.

Flood risk should be considered alongside other spatial planning matters such as transport, housing, economic growth, natural resources, regeneration, biodiversity, the historic environment, and the management of other hazards. Policies should recognize the positive contribution that avoidance and management of flood risk can make to the development of sustainable communities, including improving local amenities and better overall quality of life.

An FRA should be carried out to an appropriate degree at all levels of the planning process. It should assess the risks of all forms of flooding to and from development, considering climate change, and should inform the application of the sequential approach if applicable.

CIRIA C624 “Development and Flood Risk – Guidance for the Construction Industry” recommend a phase approach with three levels of assessment as define below:

- Level 1: Screening Study to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. The screening study will ascertain whether a Level 2 or 3 FRA is required.
- Level 2: Scoping Study to be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding, or that the site may increase flood risk due to increase run-off. This study should confirm the sources of flooding which may affect the site.
- Level 3: Detailed Study to be undertaken if the Level 2 study concludes that the quantitative analysis is required to assess the flood risk related to the development site.

2.0 Relevant Policy, Legislation and Guidance

2.1 Potential Flood Mechanisms

The Level 1 FRA has been undertaken using the following legislation and guidance: National Planning Policy Framework

- Flood and Water Management Act
- Kirklees Borough Council Strategic Flood Risk Assessment
- Kirklees Borough Council Local Flood Risk Management Strategy
- Calder Catchment Flood Management Plan

2.2 National Planning Policy Framework

The NPPF published in December 2023, is a key part of the government's reform to make the planning system less complex and more accessible; to protect the environment and to promote sustainable growth.

In addition, the Technical Guidance to the NPPF published by the Department for Communities and Local Government has also been reviewed in relation to flood risk. This document provides additional guidance to ensure the effective implementation of the planning policy set out in the NPPF on development in areas at risk of flooding.

The NPPF aims to prevent inappropriate development in areas at risk of flooding and to ensure that, where development is necessary in areas at risk of flooding, it is safe without increasing flood risk elsewhere. Local Authorities should only consider development in flood risk areas appropriate where informed by a site-specific FRA, based upon the EA's Standing Advice on flood risk.

The NPPF requires that a site-specific FRA is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the EA); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding. This means that the FRA should identify and assess the risks of all forms of flooding to and from the development and demonstrate how flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account.

Development should be directed as far as practicable towards Flood Zone 1 areas (Low Probability (< 0.1% Annual Exceedance Probability (AEP) of fluvial/ sea flooding)) to avoid fluvial flood risks wherever this is possible. For development proposed in Flood Zone 1, if the development area is greater than 1 hectare an FRA will still be required to address design issues related to the control of surface water runoff and climate change, as well as considering any other potential sources of flood risk for the development site.

2.3 The Flood and Water Management Act 2010

The Flood and Water Management Act 2010 determined the need for flood risk to be managed within the framework of National Strategies for England and Wales and within Local Strategies for each Local Flood Authority Area. The national strategy for England sets out the principles for flood risk management and which organisations are responsible for implementation.

In accordance with the national strategy for England, Lead Local Flood Authorities (LLFAs) have been allocated responsibility for developing independent Local Flood Risk Management Strategy's (LFRMS's) to address sources of local flooding. Each LFRMS identifies which local organisation is accountable for

managing flood risk and establishes partnership agreements, as well as undertaking an assessment of flood risk and developing plans / actions, for tackling these risks.

2.4 Kirklees Borough Council Level 1 Strategic Flood Risk Assessment

This level 1 Strategic Flood Risk Assessment (SFRA), dated July 2016, is a joint study with Wakefield Council and Calderdale Council. It should be read in conjunction with the National Planning Policy Framework (NPPF) and associated National Planning Practice Guidance (NPPG).

The Level 1 SFRA is focused on collecting readily available flood risk information from a number of key stakeholders, the aim being to help identify the number and spatial distribution of flood risk sources present throughout the Kirklees authority area to inform the application of the Sequential Test.

2.5 Kirklees Borough Council Local Flood Risk Management Strategy

The flood and Water Management Act 2010 requires that every lead local flood authority develops and maintains a local flood risk management strategy. The focus in the Kirklees LFRMS is to reduce flood risk from local sources where it threatens property and public infrastructure. The Council is also committed to maximising opportunities to carry out flood risk reduction in ways which are sustainable in terms of affordability, environmentally and socially.

The Kirklees LFRMS develops as new evidence, expertise and resources influence the measures outlined in the strategy. The measures identified in the Kirklees LFRMS provide a long-term programme of works and initiatives, such as planning controls, community engagement and improvement and maintenance work, which will be prioritised and programmed to deliver affordable reductions in local flood risk.

2.6 Calder Catchment Flood Management Plan

CFMPs help us to understand the scale and extent of flooding now and in the future and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

- The Environment Agency, who will use the plan to guide decisions on investment in further plans, projects, or actions.
- Regional planning bodies and local authorities who can use the plan to inform spatial planning activities and emergency planning.
- IDBs, water companies and other utilities to help plan their activities in the wider context of the catchment.
- Landowners, farmers, and land managers that manage and operate land for agriculture, conservation, and amenity.
- The public and businesses to enhance their understanding of flood risk and how it will be managed.

3.0 Relevant Policy, Legislation and Guidance

3.1 Site Location and Description

The site is currently vacant and the proposal for the site is 4No. Residential homes with associated hard and soft landscaping. Site access is achieved via Woodhead Road, which runs adjacent to the northern boundary of the site. The proposed plots will have individual accesses connecting the developments to Woodhead Road. The site is surrounded by agricultural farmland or other residential developments. The River Holme is located to the south of the site.

3.2 Topography

A topographical survey has been completed for the site. Following a review of the topographical survey; the site shows levels are relatively flat with some small fall in level across the site. There is a slight fall to the east of the site which appears to be a low point. There is a level difference of approximately 10m from the site to the river to the south of the site. Please refer to Appendix A for more information.

3.3 Hydrology

The Ordnance Survey and EA maps show that the site is situated within the catchment of the River Holme which is located approximately 20m to the south of the site. Dobb Dike is located adjacent to the River Holme approximately 50m from the site.

3.4 Drainage

A combined sewer (150mm) serves the residential properties within Woodhead Road. This runs adjacent to the proposed site. Refer to Appendix B for more information.

3.5 Water Mains

YW supply mains serve the properties within Woodhead Road. There are 4 mains pipes within the road.

3.6 Flood Defence

There are no flood defences within 1km of the site.

3.7 Reservoir

Following a review of Ordnance Survey maps, Brownhill Reservoir sits around 950m to the southwest of the site.

3.8 Geology and Hydrology

A site investigation has not been completed for the site; the following sources have therefore been reviewed to provide the anticipated ground conditions:

- BGS 1:50,000 scale map
- BGS GeoIndex

Summary of Anticipated Geology Features/Sources	Description/Remarks
Bedrock Geology	Medium strong to extremely strong medium to widely jointed thinly to thickly bedded fine to coarse-grained SANDSTONE may contain slate or mudstone and siltstone beds. Weathers to a loose to very dense sand, gravel, or silty/clayey sand. Low to high permeability flow is through matrix and discontinuities. Includes GREYWACKES.
Superficial (drift) Geology	Very soft to very stiff sometimes sandy CLAY or SILT. Desiccation of top few metres may result in firm to stiff material overlying soft to very soft deposits at depth. Generally, very low to moderate permeability flow dominantly through fissures. Includes lacustrine deposits, glaciolacustrine deposits, fine marine deposits, estuarine alluvium, and lowland river alluvium (any of which may contain peat beds or lenses) and loess/loessic soils.

Table 3.8 Anticipated Geology

4.0 Current Site Flood Classification

4.1 Flood Risk and Probability

The risk framework outlined in the SFRA defines the flood risk using the categories in Table 4.1. The EA flood map defines the geographical extent of fluvial flooding for Flood Zones 1, 2, 3a and 3b.

Flood Zone	Definition	Probability
Flood Zone 1	At risk from flood event greater than the 1 in 1000-year event (greater than 0.1% annual probability).	Low Probability
Flood Zone 2	At risk from flood event between the 1 in 100 and 1 in 1000-year event (between 1% and 0.1% annual probability)	Medium Probability
Flood Zone 3a	At risk from a flood event less than or equal to the 1 in 100-year event.	High Probability
Flood Zone 3b	Land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood or otherwise defined by the Local Planning Authority. This zone also comprises land where water has to flow or be stored in times of a flood.	Functional Floodplain

Table 4.1a Fluvial Flood Zone Definition

Flooding is a natural process that can present a range of different risks depending on its form. Flood practitioners and professionals define the risks presented by flooding according to an Annual Exceedance Probability (AEP), or as having a 'return period.'

Flood Risk includes the statistical probability of an event occurring and the scale of the potential consequences. Flood risk is estimated from historical data and expressed in terms of the expected frequency of a flood of a given magnitude. The 10-year, 50 year and the 100-year floods have a 10%, 2%, and 1% chance of occurring in any given year, respectively. However, over a longer period the probability of flooding is considerably greater.

For example, for the 100-year return period flood:

- There is a 1% chance of the 100-year flood occurring or being exceeded in any single year.
- A 26% chance of it occurring or being exceeded in a 30-year period; and
- A 51% chance of it occurring or being exceeded in a 70-year period.

Table 4.2 below provides a summary of the relevant AEP and corresponding return period events of a particular severity.

AEP	Definition
100%	1 in 1 Year
10%	1 in 10 Years
2%	1 in 50 Years
1%	1 in 100 Years
0.5%	1 in 200 Years
0.1%	1 in 1000 Years

Table 4.1b Definition of AEP and Return Period Flood Events

4.2 Flood Risk Vulnerability and Flood Zone Compatibility

In terms of flood risk vulnerability, the proposed redevelopment is classified as “More Vulnerable” in the NPPF and SFRA which includes residential dwellings.

The SFRA states that the suitability of all sites in flood risk terms will be subject to ratification by the EA, a detailed site-specific FRA being prepared to support any planning application and demonstration that surface water runoff from the development will pose no detrimental impact to off-site areas.

The proposed site is considered as More Vulnerable Infrastructure and as such is suitable for Flood Zones 1 and 2 with an exception test required for developments in Flood Zone 3. The EA mapping service has been used to confirm that the site is located within Flood Zone 3.

Flood Zone 3 is split into two categories; 3a is a high flood risk with a chance of flooding between once every 30 and 100 years (1 – 3.3%), 3b is a functional floodplain where water must flow or be stored in times of flood. The southern boundary of the site is considered to be in Flood Zone 3. However, the proposed dwellings are located within Flood Zone 1.

An exception test is usually required for developments within Flood Zone 3 to demonstrate the management of sources of flooding and that there are no reasonable alternative sites, that the development is safe, and it will not increase flood risk elsewhere. As the dwellings themselves are located outside the Flood Zone 3 it is considered that the requirements of the exception test have been met.

4.3 Flood Assessment

Potential sources of flooding and associated mechanisms for review are as follows:

- Tidal Sources - Potential flooding resulting from tidal sources.
- River (Fluvial and Tidal) Sources - Potential flooding resulting from watercourses near to the site or from the sea.
- Groundwater Flooding- Potential flooding because of rising groundwater levels.
- Overland/Surface water (Pluvial) Flooding - Potential flooding because of surface water flows from adjacent land.
- Sewers and Drains - Potential flooding resulting from sewers or drains.
- Canals and Artificial Waterways - Potential flooding resulting from failure or overtopping canal networks.
- Reservoir/Lake Flooding - Potential flooding resulting from overtopping or bursting of reservoirs or lakes.
- Infrastructure - Potential flooding because of failed or burst water mains; and
- Climate Change – Potential rise in sea levels and estimated peak flows of watercourse.

4.4 Tidal Flooding

Coastal flooding occurs when sea levels rise above the normal tidal range. This can happen anywhere around the coast, including the estuaries. Tidal flooding is a result of one or a combination of high tides, storm or tidal surges, wave action and high sea levels combining with high river flows.

The site is located inland and does not lie within an area at risk of tidal flooding. Tidal flooding is therefore not a flood risk associated with this proposed development and requires no further consideration.

4.5 River (Fluvial) Flooding

The proposed site is considered as More Vulnerable Infrastructure and as such is suitable for development within Flood Zones 1 and 2, with an exception test required for Flood Zone 3a. The EA mapping service which is used to confirm the extent of a flood zone within the vicinity of a site indicates that the Site is located across Flood Zones 1, 2 and 3.

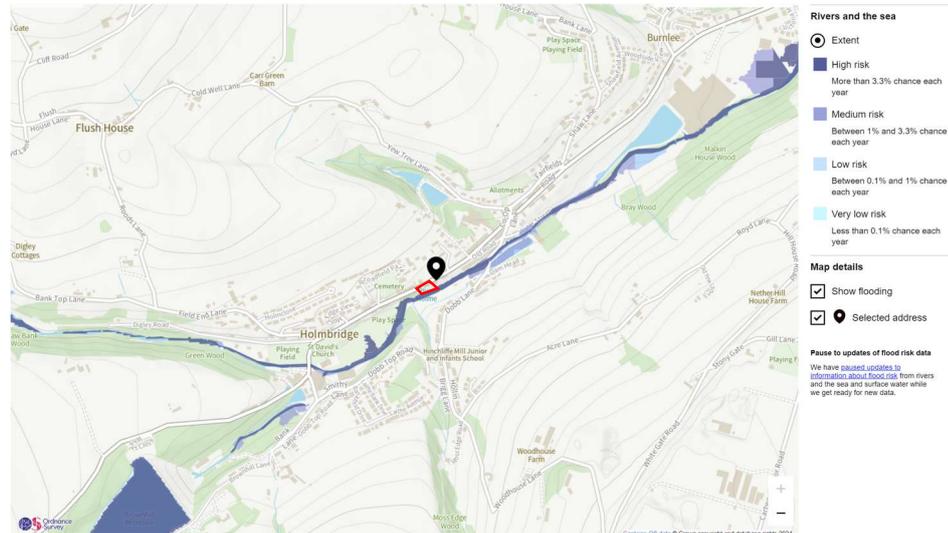


Figure 4.6 Environment Agency – Fluvial Flood Map

Fluvial flooding occurs when water courses receive an increased volume of surface water run-off. This can be exacerbated by new developments introducing increased areas of impermeable surfaces to the catchment and reducing the time of entry of flows to the water course.

The Flood Maps are based upon the approximate extent of floods with a Flood Zone 3 having a risk greater than 0.5% annual probability for flooding from the sea and tidal waters, and more than a 1% annual probability boundary for flooding from rivers under present expectations, or where this is greater, the extent of the highest known flood. It should be noted that the flood map area assumes no defences and does not consider the likelihood that flood risk will be increased by climatic change. It is important to recognise that a 1% flood has a 26% probability of being equalled or exceeded at least once in 30 years (the duration of a typical mortgage) and a 49% probability of being equalled or exceeded at least once in 70 years (a typical human lifetime).

A review of the available information indicates that the scale of the flood mapping in relation to the development does not give an accurate reflection of the extent of the flood zones. The following method is therefore proposed; overlay the scaled flood map to best fit the site topographical survey, interpolate a line of best fit to the extent of Flood Zone 3, identify the extent of the contour from the topographical survey which best reflects the flood zone outline.

The above method has been followed and estimated extent of the flood zone has been compared against the topographical survey, please refer to appendix D.

Based on the extent of the estimated boundary of flood zone 3, it generally appears to be in the vicinity of the 170.500m AOD contour.

In accordance with government flood resilience and resistance guidance, 600mm freeboard is required to protect the property from potential flooding. Due to the uncertainty in the calculation of the flood level an additional 300mm is suggested to be added. This would require a minimum FFL of 171.400m AOD, the minimum proposed FFLs have been set at a minimum of 182.200m AOD circa 10.8m above the anticipated flooding level.

The DEFRA Paper 'Flood and Coastal Defence Project Appraisal Guidance (1999)' gives indicative standards of protection for existing development against river flooding of 1.0 – 4.0% annual probability of failure for typically less intensively developed urban areas i.e. they defend against a flood with that probability of occurring.

Based on the guidance within the NPPF the site is suitably located with respect to fluvial flooding.

4.6 Groundwater Flooding

Groundwater flooding generally occurs during intense, long-duration rainfall events, when infiltration of rainwater into the ground raises the level of the water table until it exceeds ground levels. Groundwater flooding may take weeks or months to dissipate as groundwater flow is much slower than surface water flow and water levels thus take much longer to fall. Groundwater flooding is sporadic in time and location, but when it does occur, it usually lasts longer than surface water flooding and interferes with property and infrastructure (such as roads). Groundwater levels may also rise because of reactivating springs.

Based on the geological information available it is unlikely that the geological strata would be highly responsive to rainfall events and therefore the changes in groundwater level over time are unlikely to be significant resulting in groundwater flooding issues.

The information available suggests that the site is not at risk from groundwater flooding.

4.7 Overland/Surface Water (Pluvial) Flooding

Pluvial and overland flow results from rainfall that fails to infiltrate the surface and travels over the ground surface. This is exacerbated by low permeable urban development or low permeability soils and geology (such as clayey soils). Overland flow is likely to occur at the base of an escarpment and low points in terrain. Local topography and built form can have a strong influence on the direction and depth of flow. The design of development down to a micro-level can influence or exacerbate this. Overland flow paths should be considered in spatial planning for urban developments. In addition, surface water flooding can be exacerbated if development increases the percentage of impervious area.

The EA flood map as shown in Figure 4.8 has identified that the existing site is classed as very low risk (less than 0.1% annually) of surface water flooding.

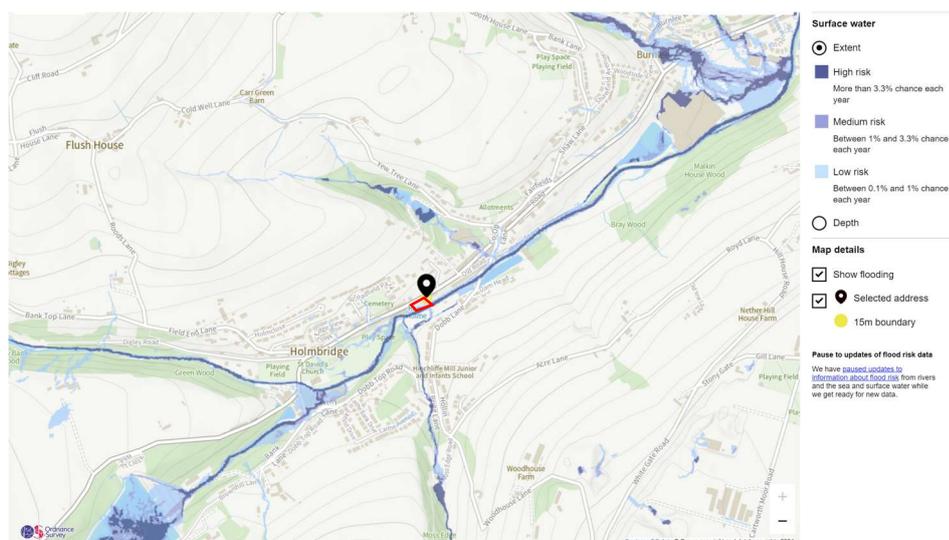


Figure 4.8 Environment Agency Pluvial Flood Map

Surface water flooding can be exacerbated if development increases the percentage of impervious area which has the potential to change the surface water flow regime for the site and the surrounding area. It is important to ensure that any surface water flows generated by the change to impermeable area are collected on site and do not pass into neighbouring land. The surface water regime for the site will be changed and will introduce positive drainage to the hardstanding area.

There is no change to the flood risk of the surrounding areas and flow routes from the proposed development, the risk of flooding elsewhere has not been increased and the performance of the flood route has been maintained.

The location of the proposed access to the site will not affect the existing overland flow path. On this basis, the proposals for the development will not increase the risk of flooding in the area.

With the design of the surface water management of the site in line with the above principles no further consideration of this flooding mechanism is required.

4.8 Sewer Flooding

Flooding can occur when the sewerage infrastructure becomes overwhelmed by heavy rainfall (due to inadequate capacity) or blockages in drain systems (such as silt or debris accumulation). Works above or adjacent to existing sewer networks may also damage buried pipeline to the extent that it leads to flooding through damage during excavations or through damage causing blockages below ground.

There is no recorded flooding incidents caused by incapacity within the sewerage network affecting the site and as such no further consideration of this flooding type is required.

4.9 Canals and Artificial Waterways

There are no canals or artificial waterways within 1km of the site boundary, as such flood risk is considered low as such no further consideration of this flooding type is required.

4.10 Reservoirs and Lakes

When reservoirs and lakes flood, there can be implications beyond the immediate area of the water body. The EA flood map shown in Figure 4.10, shows that in the very unlikely event of a failure of a body of water upstream, the site would be at risk of flooding only when there is also flooding from rivers.

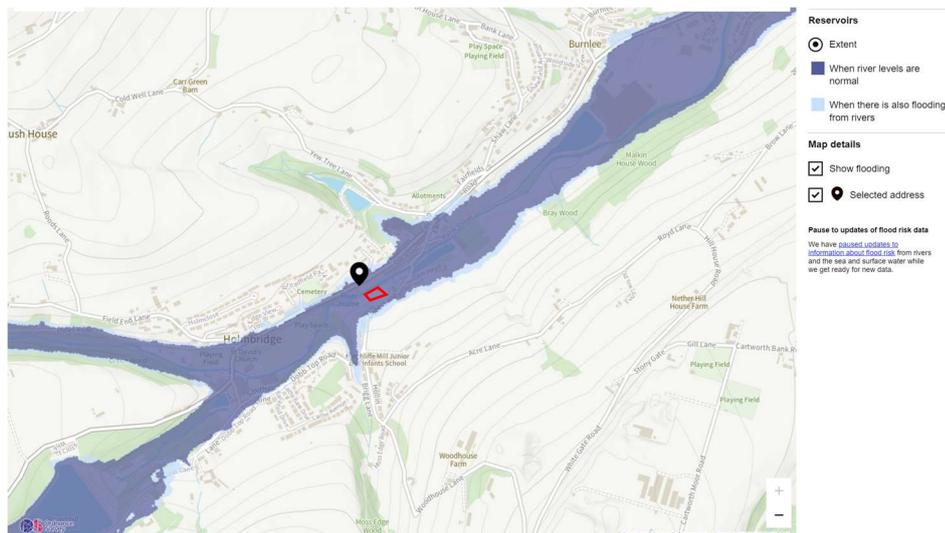


Figure 4.10 Environment Agency Reservoir Flood Map

The likelihood of reservoir flooding is much lower than other forms of flooding. Current reservoir regulation, which has been further enhanced by the Flood and Water Management Act, aims to make sure that all reservoirs are properly maintained and monitored to detect and repair any problem. Due to the flood management and protection regulations, the likelihood of reservoir failure is very low, therefore reservoir flood risk is ultimately very low. As such, the site is suitably located regarding reservoir flooding.

It is recommended that residents sign up to the EA flood warning system, where given the distance from the reservoirs there would be sufficient time to evacuate to a suitable location.

4.11 Water Mains

Based on the site topography and water main locations, the risk to the development is considered low and as such no further consideration of this flooding type is required.

4.12 Climate Change

Climate change will be the major cause of increased flood risk in the future. The CFMP suggests that for climate change the EA tested the following changes up to 2110:

- Further to review of paragraphs 30 to 32 of the Flood Risk and Coastal Change section of the planning guidance, it is understood that to adequately take climate change into account for the site, it should be within the upper end allowance category for Table 1 peak river flow allowances by river basin district (use 1961 to 1990 baseline). As such a 45% allowance for climate change should be allowed.
- A total sea level rise of 1050 mm by the year 2110. This will increase the probability of tidal flooding and increase the length of time that watercourses will not be able to flow freely to the sea at high tide (tide-locked).
- Therefore, climate change was shown to have a significant impact on flood risk.

The Analysis of UK Climate Projections 2018 (UKCP18) found that:

- There has been an increase in annual average rainfall over the UK, especially over Scotland where the most recent decade (2008–2017) has been on average 11% wetter than 1961–1990 and 4% wetter than 1981–2010.

- In recent decades there has been an increase in annual average rainfall over the UK, the most recent decade (2008–2017) has been on average 11% wetter than 1961–1990 and 4% wetter than 1981–2010.

It has been predicted that the UK's coastal flood risk will increase under all the emission scenarios used in UKCP18, because of mean sea level rise. This will result in an increase in the frequency and magnitude of extreme water levels around the UK coastline. This increase in coastal flood risk combined with an increase in precipitation in winter is likely to result in more frequent flooding in various parts of the UK.

The impact of climate change will likely increase the risk of flooding from several of the mechanisms considered, therefore it is recommended that the resident of the property sign up to the EA flood warning service and consider appropriate protection measures. It is not anticipated that an evacuation plan for the site is required as the normal access locations will be available.

Technical Guidance to the NPPF and the PPG include for an increase in the peak rainfall intensity of up to 30%, as well as increase in peak flows in watercourses of up to 20% within 100 years. This will significantly affect smaller urban catchments, leading to rapid runoff into and subsequent increased flows within watercourses, surface water flooding, surcharging of gullies, drains and sewer flooding.

CFMPs have also considered flood risk for the next 50-100 years and have considered the flood risk drivers of climate change, urban development, and changes in land use.

Catchment models and the Modelling and Decision Support Framework (MDSF) software were used in the CFMP to test sensitivity to the flood risk drivers across the catchments in the study area.

The location of future urban developments and flood defences within a catchment can heavily influence flood risk in the area and has the potential to further increase flood risk at areas downstream of such developments. Impacts include the lowering of the SoP offered by flood defences and the carrying capacity of culverts, drains, sewers and watercourse channels. This potentially leads to areas being at risk of flooding that were previously not at risk and highlights the increasing conflicts and pressures that are emerging between climate change scenarios and future development aspirations.

The NPPF sets out important objectives to tackle climate change, sea level rise and avoid flood risk. The purpose of design policies should be to ensure that developments are sustainable, durable, and adaptable to natural hazards such as flooding. Following this guidance, it should be possible to mitigate against increased flood risk through incorporating 'flood proofing' measures such as raised finished floor levels into the development design, and/or development of compensatory storage and flood storage basins. The Adaptation Strategies for Climate Change in the Urban Environment (ASCCUE) project is a study undertaken collaboratively by the University of Manchester, The University of Cardiff, University of Southampton, and Oxford Brookes University. One of the aspects examined was surface water runoff during extreme rainfall events. With an increase in development, there comes an increase in the number of impermeable areas thus leading to increased runoff during storm events.

5.0 Conclusion and Recommendations

5.1 Conclusions

This Level 1 FRA concludes that:

- Tidal Flooding – The Environment Agency mapping shows that the site is at low risk of flooding therefore no further assessment is required with respect to Tidal flooding.
- River Flooding (Fluvial) – The Environment Agency mapping shows that although the site is in Flood Zone 3 meaning it is at risk from a flood event less than or equal to the 1 in 1000-year event. Finished floor levels are to be set at a minimum of 182.200mAOD.
- Groundwater Flooding - there is a low risk of groundwater flooding occurring at the site, therefore no further assessment is required with respect to groundwater flooding.
- Surface Water (Pluvial) Flooding - the Environment Agency mapping shows that the site is at very low risk of flooding. The proposed development will change the surface water flow regime for the site and proposals will need to be developed in line with local and national guidelines.
- Sewer Flooding - There are no known previous flooding incidents from the sewers located surrounding the site and as such there is low risk of sewer flooding affecting the site.
- Canals and Artificial Waterways Flooding – The location of canals and artificial waterways are sufficiently far from the site and therefore unlikely to result in flood risk and as such will not require further assessment.
- Reservoirs and Lakes – The Environment Agency mapping shows that the site is at risk of flooding and as such suitable consideration is required for an extreme event.
- Water Mains – the location of water mains suggest that any flooding would be directed away from the site and does not require further assessment.
- Climate Change - the potential impacts of climate change will increase the risk of flooding and suitable protection measures should be considered.

5.2 Recommendations

The Level 1 FRA shows that the site is at risk from fluvial flooding but with mitigation measures can be overcome. A drainage strategy will be prepared to demonstrate the proposals to manage surface water flow within the site. The proposed development is suitably located based on the proposed land use and flood zone classification.

Appendix A – Topographical Survey

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Project Name	777 Woodhead Road, Richmond, VA
Client	Nicola Drive
Site Address	777 Woodhead Road, Richmond, VA 23134
Project Description	Residential Development
Phase	Planning
Date	May 2015
Drawn By	Checked
Existing Site Plan	Scale & A1
Revision	1/2015



Client: Nicola Drive
 Site Address: 777 Woodhead Road, Richmond, VA 23134

Project Description: Residential Development
 Phase: Planning

Date: May 2015
 Drawn By: [Blank]
 Checked: [Blank]

Drawing No.	Scale & A1
Existing Site Plan	1/2015
Revision	

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 THE DIVISION, AMANDA BRODE
 HANOVERFIELD, VIRGINIA 23170
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Appendix B – Environment Agency Flood Map for Planning

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
412396/406942

Created
23 Jul 2024 8:32

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>

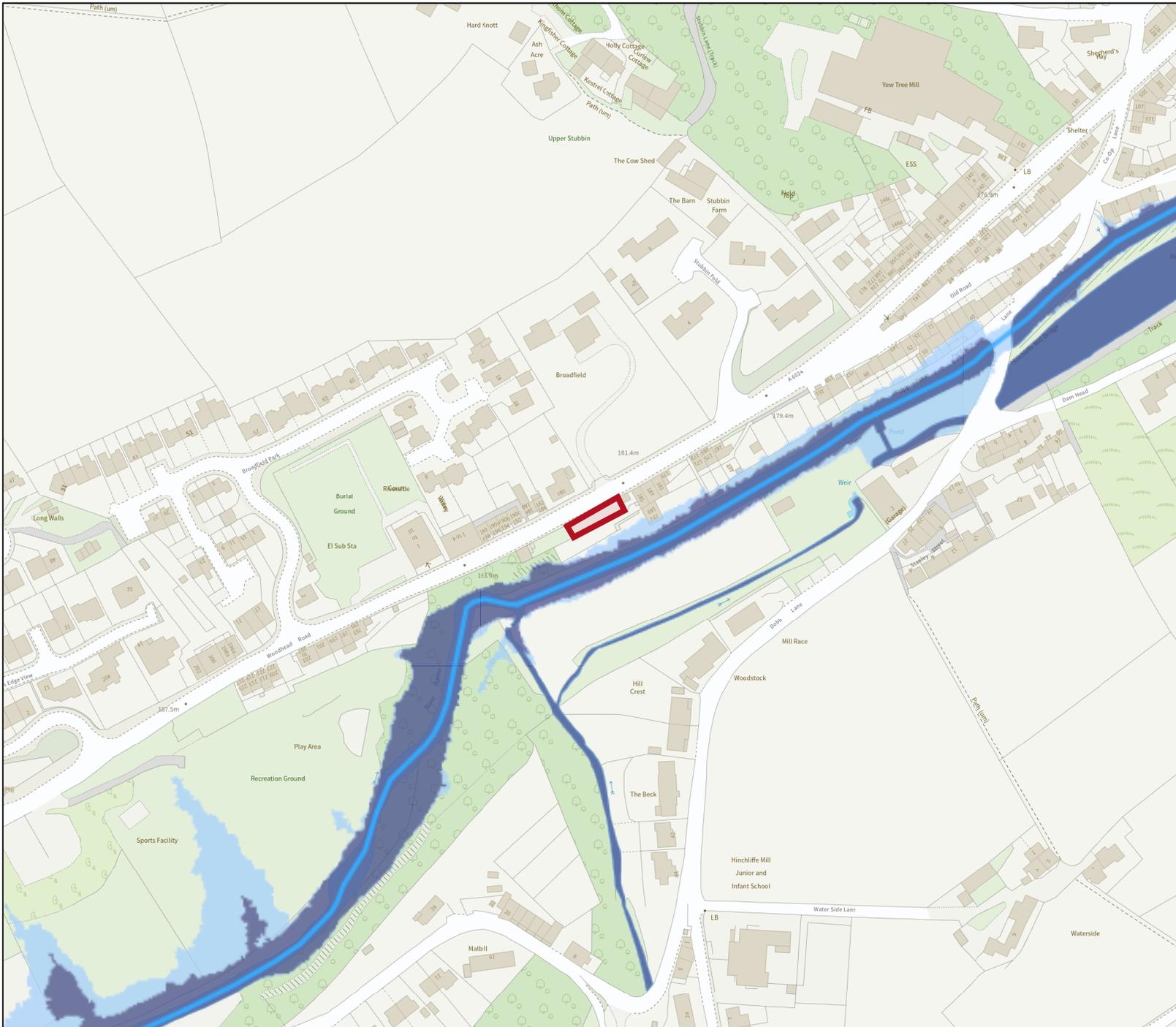
Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
412396/406942

Scale
1:2500

Created
23 Jul 2024 8:32



-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area



Appendix C – Yorkshire Water Asset Plan

Property Identifier



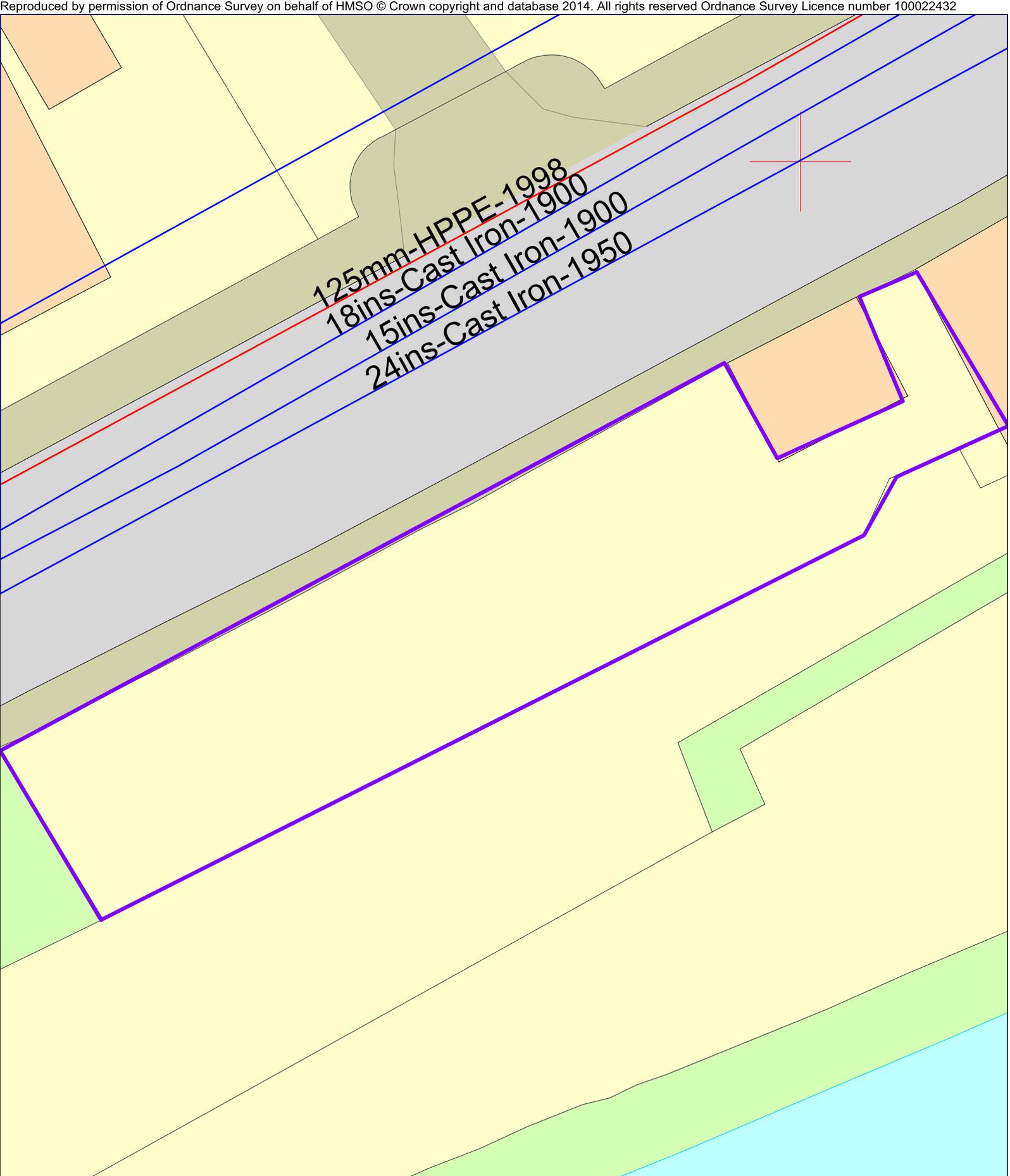
Sewer Legend

	Combined Sewer		S24 Combined Sewer
	Surface Water Sewer		S24 Surface Water Sewer
	Foul Sewer		S24 Foul Sewer
	Section 104 Sewer		Rising Main
	Overflow Sewer		Abandoned Sewer
	Syphone Sewer & Vacuum Sewer		
	Pumping Station		Public Sewer Treatment Works

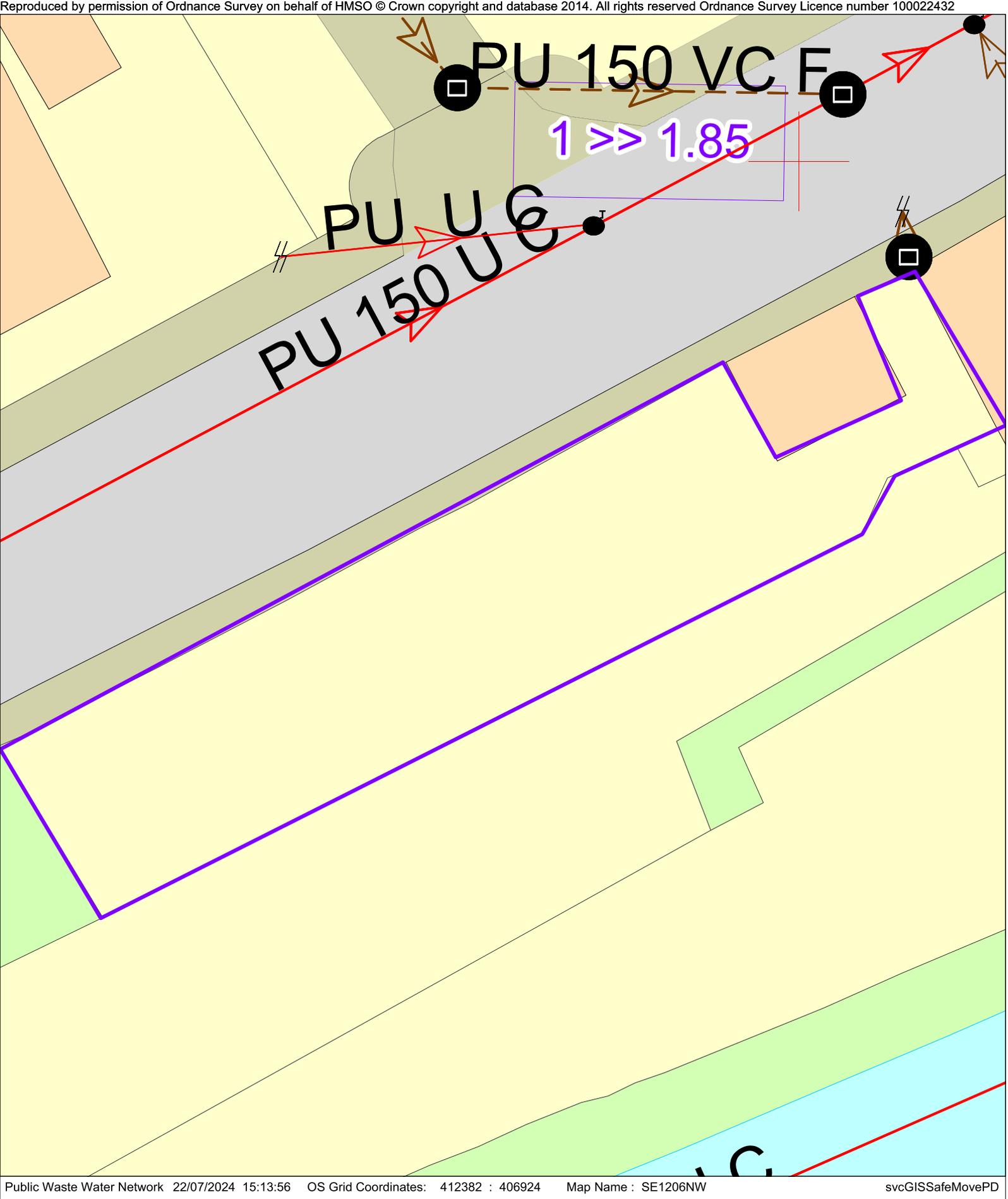
Please note that the direction of flow arrows may not always appear depending on the scale of the map.

Water Legend

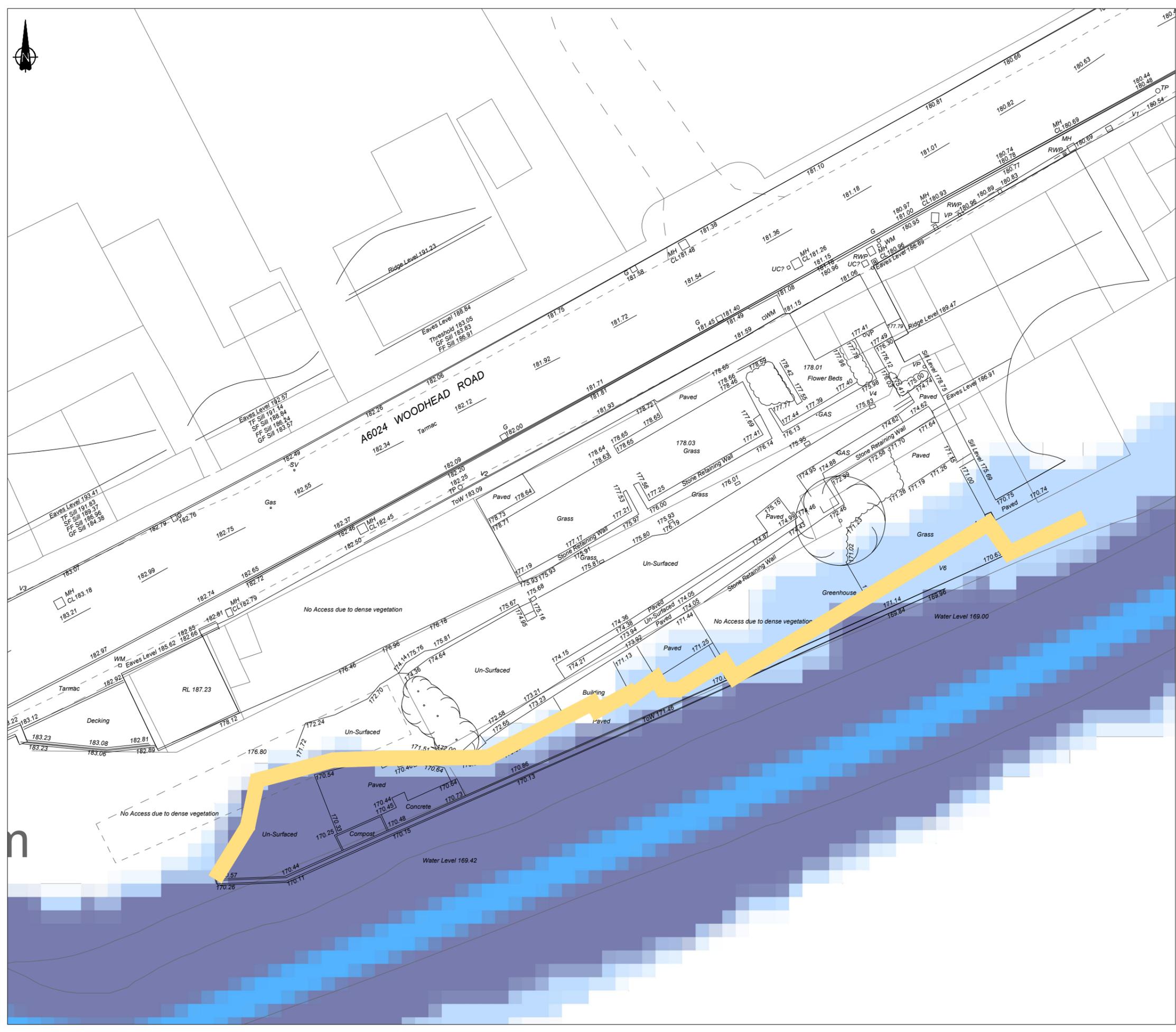
	Water Main 4" and below
	Water Main 4" and above
	Raw Water Main
	Private Water Main
	Fire Hydrant
	Pumping Station
	The assets in this area are the responsibility of another Water Undertaker



Public Clean Water Network 22/07/2024 15:13:55 OS Grid Coordinates: 412382 : 406924 Map Name : SE1206NW svcGISSafeMovePD



Appendix D – Flood Zone Estimation Plan



Do not scale from drawings unless by agreement with Architect/Engineer. Work to figured dimensions only. Check all dimensions on site prior to commencing the works. Drawings to be read in conjunction with other relevant consultant information. Where any discrepancy is found to exist it should be reported to the Architect/Engineer immediately.



LEGEND

- ASSUMED EXTENT OF FLOOD ZONE 3
- EXTENT OF 170.500m AOD CONTOUR

Revision	Date	Drawn	Description
P1	07/08/24	CA	Issued for Information.

Client & Project
Nicola Orme
 Woodhead Road

Address
Woodhead Road
 Holmbridge,
 HD9 2NW

Drawing Title
Flood Zone Extents

Status / Stage	Sheet	Scale @ A3	Drawn	Checked
S2	1 of 1	1:250	CA	AW

Drawing Number
 S4655-BDN-XX-XX-DR-C-0001

Revision
 P1

0mm	2.0m	4.0m	8.0m	12.0m
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Established 1983.

T: 01915356189 E: durham@bdnlttd.com
 W: www.bdnlttd.com

North East (Head Office)
 The Old School, Simpson Street,
 Sunderland, SR4 6DR

North West
 Room 110, Ulverston Business Centre,
 Ulverston, LA12 7LQ

BuildingDesignNorthern