Northwood and Pinner Cottage Hospital, Pinner Road, HA6 1DE
Flood Risk Assessment

Rev B – 25th March 2021

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Revision	Purpose	Date	Checked

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1 Introduction

1.1 Site Proposals

Evolve Consulting Engineers Limited has been appointed by NHS Property Services to prepare a Flood Risk Assessment in respect of the proposed development centred at approximate National Grid Reference (510127, 190706). The site currently comprises of the Northwood Health Centre and the former Northwood and Pinner Cottage Hospital.

Refer to Appendix A – Site Location Plan.

The proposed areas for re-development total approximately 7422m² with 1473 m² of Health Care floor space and 5949m². The development area is currently 61% impermeable.

1.2 Planning Policy

The aim of the FRA is to outline the potential for the site to be impacted by flooding, the impacts of the proposed development on flooding in the vicinity of the site, and the proposed measures which could be incorporated into the development to mitigate the identified risk. The report has been prepared in accordance with the guidance detailed in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance (PPG).

Policy SI 12 (Flood Risk Management) of the London Plan states that the current and expected flood risk from all sources across London should be managed in a sustainable and cost-effective way in collaboration with the Environmental Agency.

At a local level, Policy EM6 (Flood Risk Management) of the Local Plan Part 1 states that the Council will require new development to be directed away from Flood Zone 2 and 3 in accordance with the principles of the NPPF. Policy DMEI 9 (Management of Flood Risk) of the Local Plan Part 2 states that development proposals in Flood Zone 2 and 3 will be required to demonstrate that there is no suitable sites available in areas of lower flood risk. Development proposals in these areas will be required to submit a Flood Risk Assessment.

Reference has also been made to the CIRIA SuDS manual (C753) and the West London Strategic Flood Risk Assessment (SFRA) which covers the London Borough of Hillingdon.

The desk study was undertaken by reference to information provided / published by the following bodies:

- Environment Agency
- British Geological Survey (BGS)
- Ordnance Survey (OS)
- Thames Water.
- Defra

2 Background

2.1 Existing Site

The site, of approximately 1 ha, is spilt into two separate areas. Area 1 fronts Pinner Road and consists of the former Northwood and Pinner Cottage Hospital. The hospital is disused apart from a small section of the building which is currently occupied by the London Ambulance Service. The main hospital building is located in the western portion of this area and is a two-storey brick structure with single storey ancillary buildings to the west. Car parking is located to the north and south of the main building, with soft landscaping including a number of mature trees situated to the east.

Area 2 is accessed off Neal Close, and consists of single store brick building currently used as Northwood Health Centre. Car parking is situated to the west and south of the health centre, and soft landscaping to the north and east.

The site is surrounded by residential properties.

2.2 Topography

The topographical site survey carried out by Alan Rhodes Associates in July 2017. The survey indicates ground levels fall in a south-westerly direction and existing levels range from 71m AOD at Pinner Road to 75m AOD in the north-east corner of the site.

EA 'Open data' dataset indicates that external ground levels over the wider area falling north to south.

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3 Hydrological Setting

3.1 Nearby Watercourses

Reference to OS Mapping indicates that there are no watercourses near the site. The closest watercourses are both tributaries of the River Pinn; the Cannon Brook and the Joel Street Farm Ditch. The Cannon Brook is approximately 350m west of the site and flows south-west of Rickmansworth Road, underground, before emerging in Haste Hill Golf Course. The Joel Street Farm Ditch is approximately 500m south-east of the site and flows south from Pinner Road, also underground, before emerging in Haydon Hall Park..

No significant artificial watercourses or features (e.g. canals, reservoirs) have been identified within 1km of the site.

3.2 Existing Flood Protection Measures

The EA defines a Flood Warning Area as "geographical areas where we expect flooding to occur and where we provide a Flood Warning Service. They generally contain properties that are expected to flood from rivers or the sea and in some areas, from groundwater."

The Environment Agency shows areas of land that benefit from flood defences built to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

The Environment Agency's website indicates that the site is not currently protected by formal flood defences.

3.3 Fluvial Flooding

Fluvial sources include rivers, streams, and ditches. Fluvial flooding occurs when a river cannot cope with the amount of water draining into it from the surrounding land.

The development boundary for the site is identified on the Environment Agency's (EA) flood zone mapping showing areas at risk of flooding from rivers or sea being classified as being in zone 1.

Refer to Appendix B for maps.

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 extents of the current flood zones across the site are tabulated below and can be seen in Appendix B

Flood Zone	1	2	3a	3b	Total
Extent (ha)	1.00	0	0	0	1.00
Coverage (%)	100	0	0	0	

3.4 Coastal/Tidal Flooding

Tidal flooding happens when there are high tides and stormy conditions.

The sites are not located in an area close to a tidal body of water. The Environment Agency flood map shows the sites are not at risk from tidal flooding.

3.5 Groundwater

The West London Strategic Flood Risk Assessment (SFRA) states that "*the majority of the sub-region is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. This geological unit generally has a low hydraulic conductivity which means water does not easily move through it."* It goes on to say *"Other predominant bedrock geology types are Lambeth Group compositions and White Chalk, both of which are predominantly found in the northwest of the sub-region. White Chalk in particular can be prone to groundwater flooding due to its high hydraulic conductivity and low effective porosity, meaning it can become saturated quite quickly due to intense rainfall and recharge the water table"*

As part of the SFRA the Environment Agency's Areas Susceptible to Groundwater Flooding AStGWF is referenced. The data shown in the Sewer, Groundwater and Artificial Flood Risk Web Map indicates that the entirety of the site is at a very low risk of groundwater flooding (within a grid square where less than 25% is at risk of groundwater emergence).

Refer to Appendix B for maps.

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3.6 Surface Water Overland Flow

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

Reference to the Defra Risk of Surface Water Flooding (RoFSW) data contained in tile TQ19

Event AEP	3.33% (1:30)	1% (1:100)	0.1% (1:1000)
Extent (ha)	0.0000	0.0244	0.0698
Coverage (%)	0.0	2.44	6.98

The areas of surface water flooding are spread across a small area of the site based on the information taken from the RoFSW with approx. 7% of the site at risk of surface water flooding from a 0.1% (1 in 1000) AEP event. Flooding is likely to be due to pockets of flooding predicted across the site which may be the result of rainfall filling localised depressions in the hydraulic model used to develop the extents rather a flood flow path.

Although no flooding is shown for the 1:30yr event the Environment Agency shows the site to be Medium Risk from surface water flooding meaning that each year that areas on the site have a chance of flooding between 1 % and 3.3%.

Refer to Appendix B for maps.

3.7 Sewer Flow

Sewer flooding is often caused by excess surface water entering the drainage network. Water companies, in this case Thames Water, are obliged under the Water Industry Act to facilitate drainage of surface water up to a 1 in 30-year return period event.

The data shown in the Sewer, Groundwater and Artificial Flood Risk Web Map contained in the SFRA shows the 2017 data from Thames Water for the number of reported sewer flood incidents within a four-digit postcode area. The site is shown to be in an area having between 21 to 40 instances of sewer flooding.

Refer to Appendix B for maps.

3.8 Reservoir Failure

The Sewer, Groundwater & Artificial Flood Risk Web Map contained in the SFRA shows potential reservoir breach inundation mapping, which displays the largest area that could potentially flood if a reservoir were to fail and release the water it holds. The information displayed by the Web Map is a worst-case scenario, providing data that could be used for emergency planning purposes.

The development site is shown to be outside any area affected by reservoir failure.

Refer to Appendix B for maps.

3.9 Land Drainage

There is no known land drainage on the sites

3.10 Hydraulic Structures

No hydraulic structures are present on-site

4 Hydrogeological Setting

4.1 Groundwater and Water Resources

British Geological Survey (BGS) online mapping (1:50,000 scale) indicates the site to overlie London Clay Formation, which is anticipated to be approximately 12 m in thickness. This formation is further underlain by the Lambeth Group (~15 m in thickness) with the Seaford and Newhaven Chalk Formations at depth (~27 m top of the chalk). Associated with historical development of the site, made ground is likely to overlie these natural deposits.

An intrusive ground investigation undertaken by RSK August 2020 confirms the ground makeup as below:

Stratum	Depth to top of Stratum (mbgl)	Proven Thickness (m)
Made Ground/Reworked Topsoil	GL	0.2 – 1.2
London Clay Formation	0.2 – 1.2	7.3 – 11.6
Lambeth Group	8.5 – 12.0	11m+

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Environment Agency data indicates that as the site is underlain by Chalk it is classified as a Principal Aquifer.

Groundwater provides a third of the drinking water in England and Wales, and also maintains the flow in many of our rivers. In some areas of Southern England, groundwater supplies up to 80% of the drinking water therefore it is crucial that these sources are looked after thus ensuring that the water is completely safe to drink.

The Environment Agency has identified Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The Environment Agency maps show three main zones (inner, outer and total catchment) and a fourth zone of special interest, which is occasionally applied to a groundwater source.

According to Environment agency data, the site is located within Zone II of a SPZ for a public drinking water abstraction borehole located ~1.3 km to the south west. The abstraction is likely to take groundwater from the underlying chalk aquifer.

5 Flood Risk and Mitigation

5.1 Fluvial / Tidal Flooding

- The EA Flood Map for Planning shows the site is located within Flood Zones 1
- The site is additionally not recorded to have been historically impacted by fluvial flooding.
- The PPG details the suitability of different land uses within each flood zone. The proposed land uses are classified as 'less vulnerable' and such uses are generally considered appropriate within Flood Zone 2 subject to passing the Exception Test. See section 6

No mitigation is considered necessary in relation to Fluvial or Tidal flood risk.

5.2 Groundwater Flooding

- This can occur in low-lying areas when groundwater levels rise above surface levels, or within underground structures. EA AStGWF mapping shows the indicates that the entirety of the site is at low risk of flooding from groundwater.
- No basements are planned as part of the development and any new structures within the ground will be designed and constructed considering the local groundwater levels.

No mitigation is considered necessary in relation to groundwater flood risk.

5.3 Surface Water Flooding

- This can occur during intense rainfall events, when water cannot soak into the ground or enter drainage systems. The Environment Agency shows the site to be Medium Risk from surface water flooding meaning that each year that areas on the site have a chance of flooding of between 1% and 3.3%.
- Flooding is likely to be due to pockets of flooding predicted across the site which may be the result of rainfall filling localised depressions in the hydraulic model used to develop the extents rather than distinct flow paths for storms.
- The site is not located within a Critical Drainage Area, it is not within surface water Flood Zone 3a

Mitigation required. The residual flood risk associated with excess surface water runoff in an extreme rainfall event would be mitigated by ensuring ground floor levels set a suitable freeboard above surrounding ground (minimum 150mm). Similarly, exterior ground levels across the site should also be appropriately contoured to direct surface water away from the building in such a scenario.

Priority will be given to use of SuDS. Runoff from the site (post development) will not exceed greenfield runoff rates, where feasible. The SuDS design will take into account the groundwater and geological conditions.

5.4 Flooding from Sewers

- The site is shown to be in an area having between 21 to 40 instances of sewer flooding.
- The discharge rate to the existing sewer will be agreed with Thames Water to ensure that there is capacity to receive discharge from the site without significantly increasing flood risk.

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Mitigation required. All floor levels must be a minimum of 300mm above the 1% (1 in 100) AEP river flood level, including climate change and land around the building is graded so as to direct water away from the entrances.

Priority will be given to use of SuDS. Runoff from the site (post development) will not exceed greenfield runoff rates, where feasible. The SuDS design will take into account the groundwater and geological conditions.

6 Conclusion

- It is recommended that ground floor levels are elevated 150mm above external levels, where appropriate, and that the ground levels around entrances are graded so as to direct water away from the building.

- Attenuation and flow rate restriction should be considered for the proposed surface water drainage to achieve a significant reduction on the existing runoff rates. Refer to Evolve Drainage Strategy document for details .

Overall, it has been demonstrated that the development would be safe, without increasing flood risk elsewhere, and that a positive reduction in flood risk would be achieved through the inclusion of surface water attenuation.

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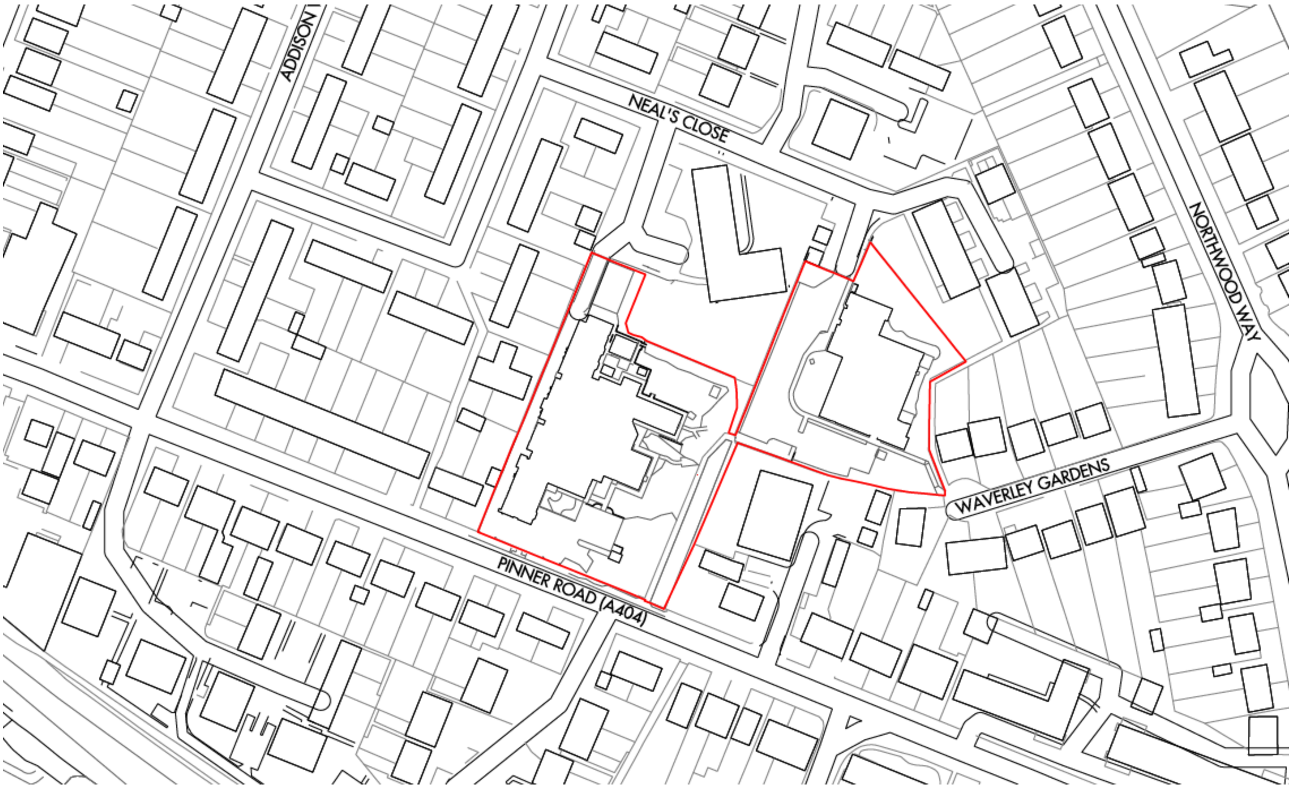
Appendix A Site Location



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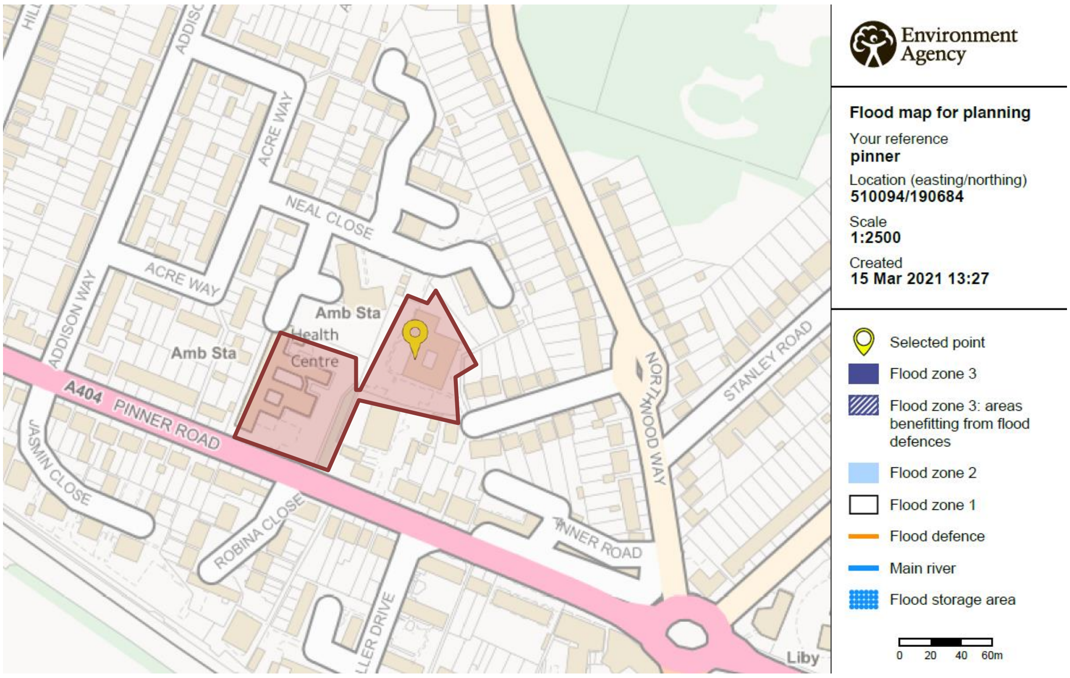
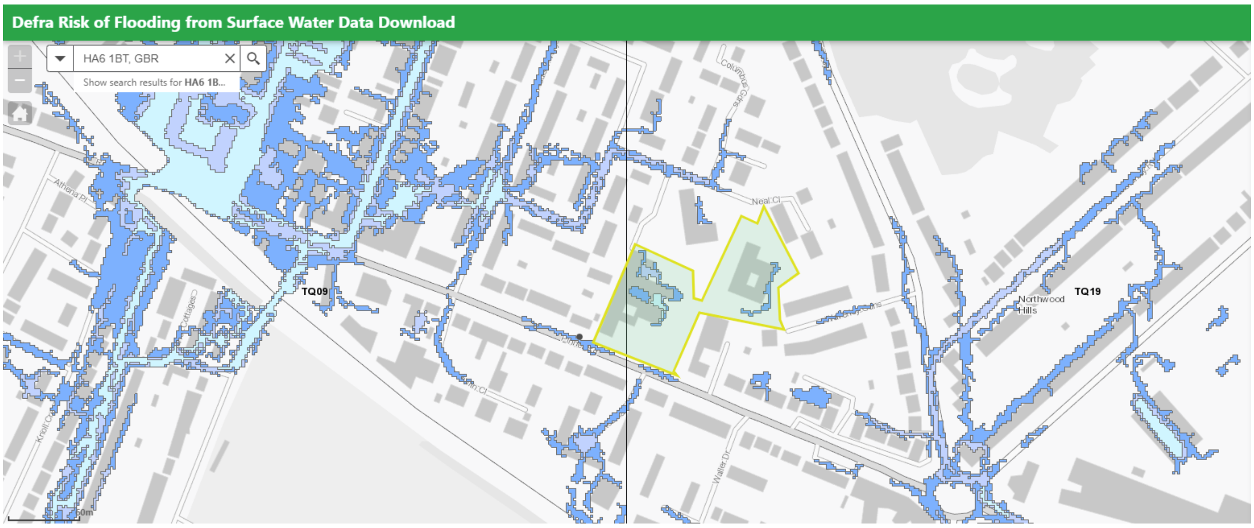
Appendix B Flood Maps



EA Flood Map



Defra Risk of Flooding from Surface Water

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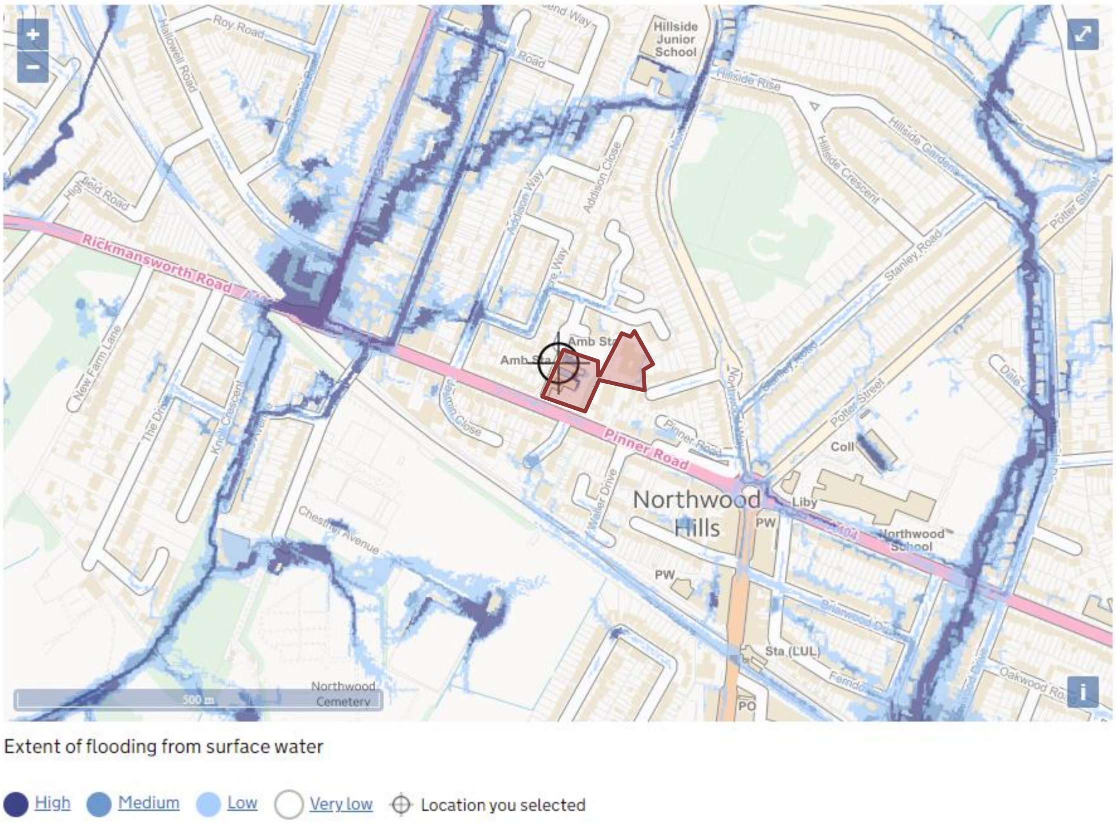
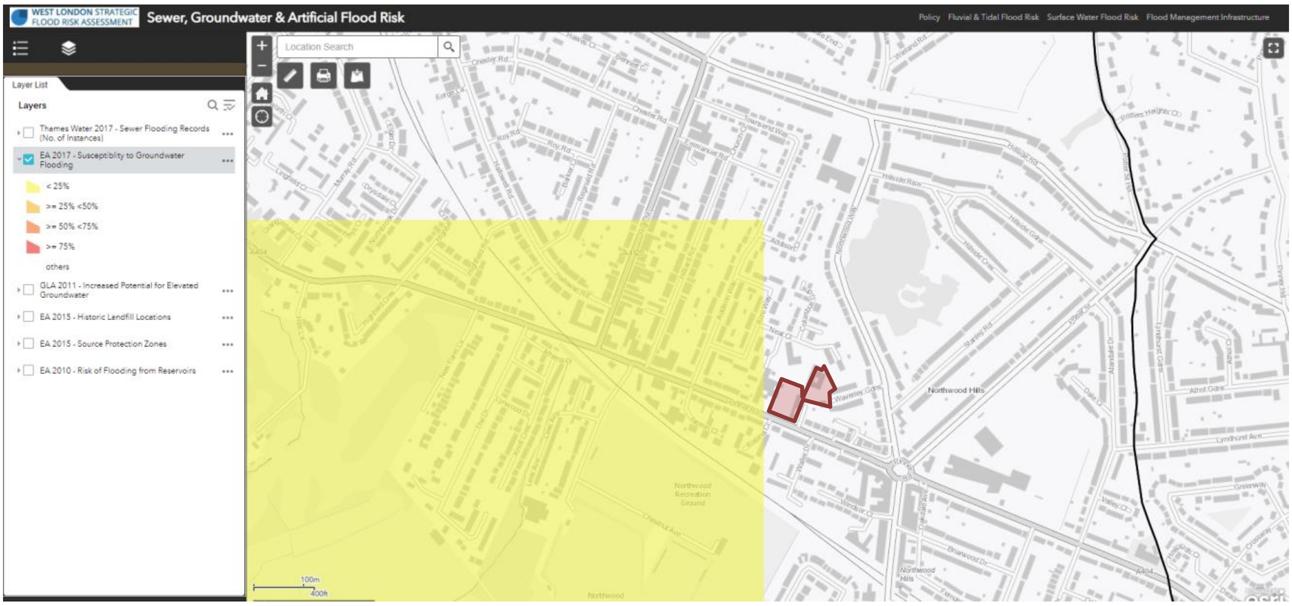


EA Risk of Surface Water Flooding and Extent



EA Susceptibility to Groundwater Flooding

EA Water Depth of Surface Water High Risk Scenario

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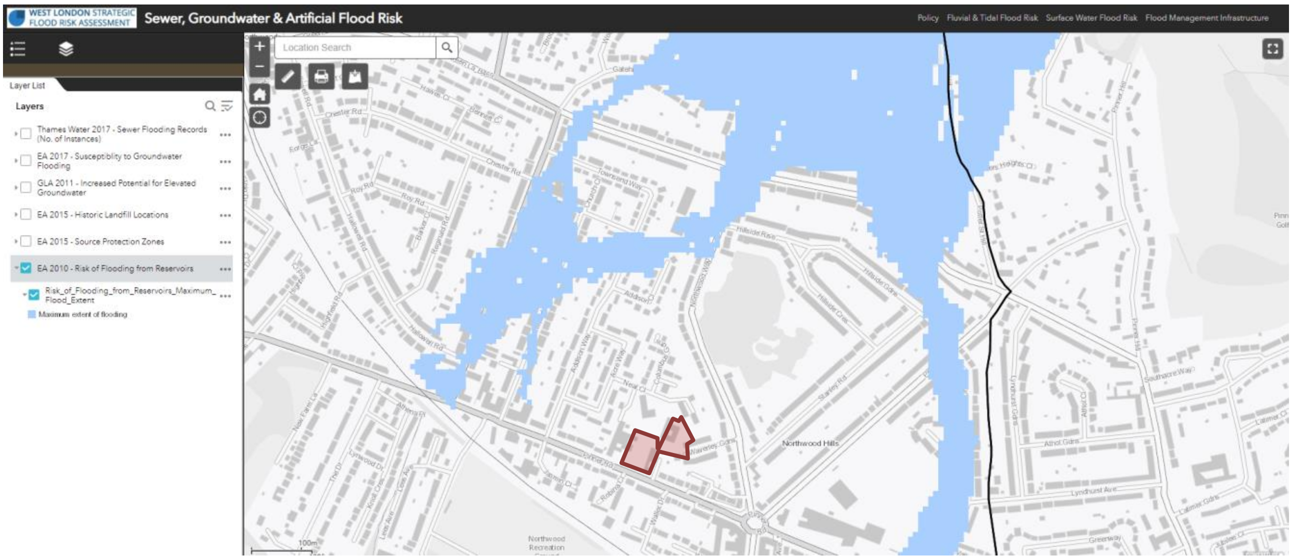
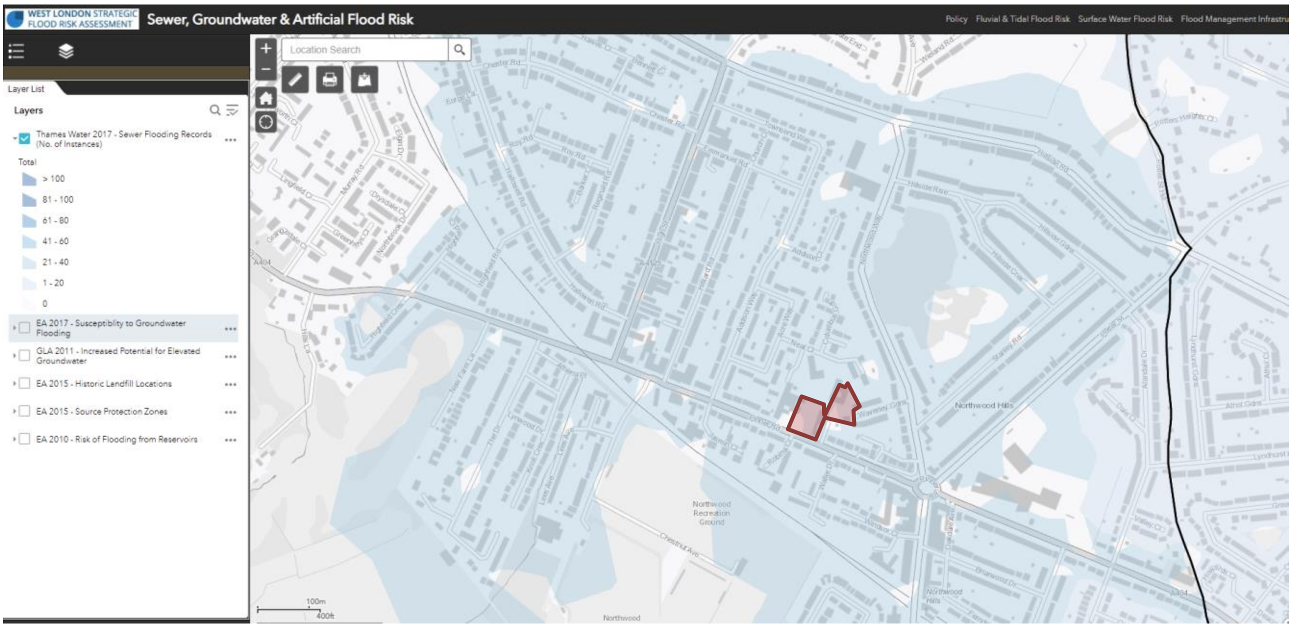


EA Risk of Flooding from Reservoir Failure



Thames Water Sewer Flooding Records