

Hydro-GIS Ltd

The Assessment of Flood Risk for Proposed Development Sites at Holyport

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Summary

This report includes the following information to assess the risk of flooding at proposed development sites at Holyport, Berkshire:

- A description of the location of the sites;
- A description of the topography, geology and hydrology of the area;
- Information on historical flooding;
- An assessment of the current flood risk at the sites based on Environment Agency and local authority data

Background

Hydro-GIS Ltd was commissioned by the Holyport Preservation Society to undertake a desk study to assess the flood risk at two proposed development sites close to the village. The sites in question have been put forward by the Royal Borough of Windsor and Maidenhead in an Edge of Settlement Analysis in January 2014. The sites are referred to in this report as area 5c (Maidenhead – triangle of M4, A308(M) and Ascot Road), and area 7a (land west of Holyport – area between Holyport Road and Ascot Road).

Disclaimer

This report discusses the current risk of flooding at the site making use of currently available data. Measurements quoted in the report are taken from Ordnance Survey maps, digital terrain data provided by Infoterra Ltd, information provided by the Environment Agency or other published sources. More detailed flood maps and predicted water level information was requested from the Environment Agency and information on the location of surface water and foul water sewers was requested from Thames Water. No responses were received from either of these requests by the time of submission of this report. The Environment Agency released the statement: *“Please be aware that our staff are currently still dealing with the ongoing major flooding situation. This is having a significant impact on our ability to deal with data requests and other requests for information, not directly linked to the emergency flooding situation. Please be aware that it is likely that it will take longer than 20 working days to deal with this type of request.”* Therefore this report has made the best use of data available from the internet in the absence of more specific information for the sites. An addendum to this report may be submitted should new information be received prior to 31st March 2014.

All measurements are given in metric units. The standard units, cumecs (cubic metres per second), are used for the flow of water.

Location

Figure 1 shows the location of both sites on the Ordnance survey 1:50000 scale map. Site 5c covers an area of 26.8 ha and is centred at OS Grid Reference 489163, 178824. It is an approximately triangular piece of land between the M4 to the south, the A308(M) to the northwest and the A330 to the east. Most of the site is grass-covered, with a small area of hardstanding adjacent to Ascot Road, and stands of trees at the south and the west. Several tracks cross the centre of the site, and the path of an old road is clearly visible east of the motorway junction. Two watercourses (the Cut and the Bourne) enter the site near the western apex and join east of the M4 junction 8/9. The combined channel then flows north-eastward alongside the A308M.

Site 7a is centred at OS Grid Reference 489539, 178213. It is a roughly rectangular piece of land on the western side of Holyport, with an area of 18.3 ha. The north-west and south-eastern edges of the site are formed by the A330 and Holyport Road respectively. The Aysgarth Park housing estate adjoins the site to the north-east. Currently, the site contains five fields used for grass or arable agriculture, and two areas of rural derelict buildings and parkland with trees.

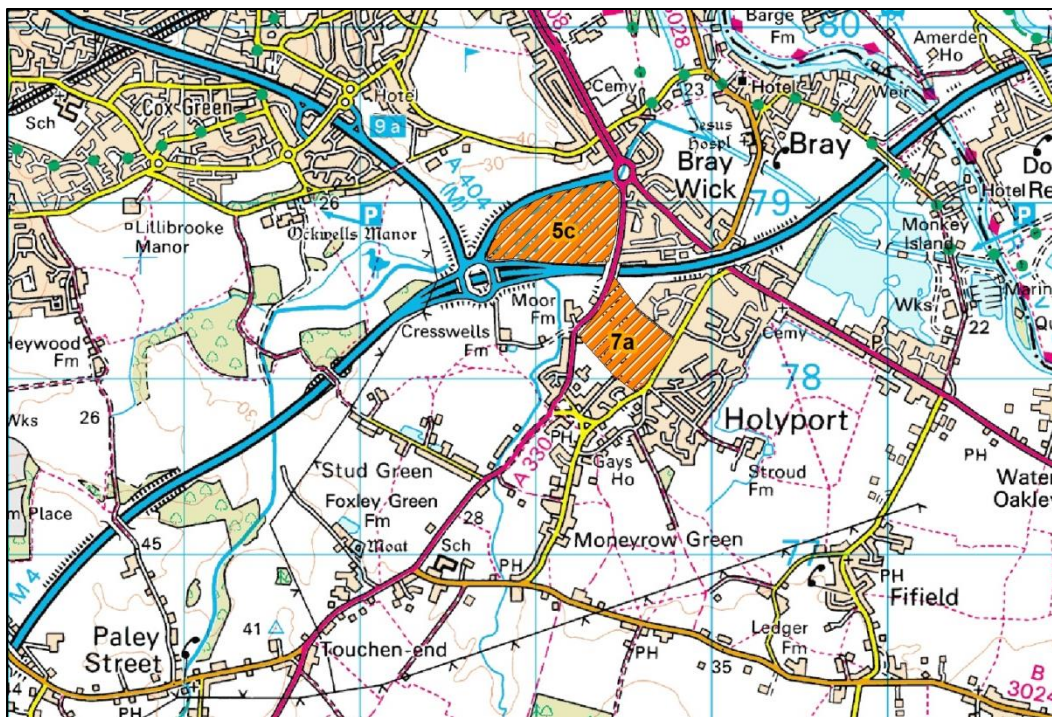


Figure 1. The location of the development sites (Background map OS 1:50000 sheet 175)

Topography

Both sites are at low altitudes with gently sloping to rolling topography. Site 5c is highest in the south-east corner, up to 28m AOD, with the ground sloping towards the north-west. The majority of the site is below 25m AOD, with the lowest areas along the northern boundary where land falls below 23m AOD.

For site 7a there is not such a range of levels with the southern and eastern parts of the site slightly higher above 27m AOD with the land sloping north-west towards the A330 where it falls below 24m

AOD. What is notable however is that the existing residential area of Aysgarth Park along the north-eastern boundary of the site is also lower with the ground below 24m AOD in places.

A digital terrain model (DTM) generated using geographical information systems (GIS) software for the sites and surrounding area using the Geoperspectives data set (provided by Infoterra Ltd) which has spot heights at every 5m taken from an airborne survey and is accurate to +/- 0.3m. This is represented as colour-ramp shading in Figure 2. Further analysis in GIS was able to define the flow directions water would take based on the topography. This shows that surface water drainage from site 7a will flow in a westerly direction towards the A330 following the direction of the small stream, but also in a northerly direction towards the Aysgarth Park residential area. The drainage from site 5c will flow towards the north-western boundary which follows the path taken by the Cut.

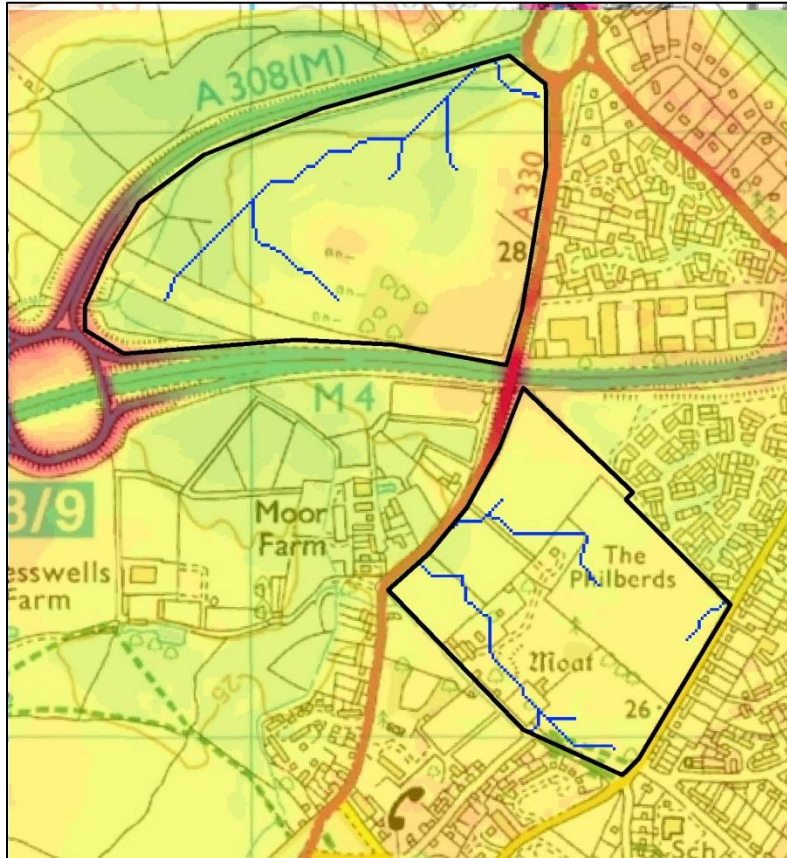


Figure 2. DTM and flow pathways (blue lines) for the sites. The DTM ground levels range from 21m AOD (dark green) to 33m AOD (red).

Geology

Information provided online by the British Geological Survey and Cranfield University was accessed to describe the geology and soils at the sites. Both sites are underlain by the Lambeth Group including areas of clay, silt and sand, and also have superficial deposits of Kempton Park gravels. The gravels and areas of sand and silt within the Lambeth Beds can provide groundwater for potable uses and are classified as both major and minor aquifers (Figure 3), and often referred to as the Thames gravels. The area just to the south of site 7a is underlain by impermeable London clay. Boreholes alongside the A308M show about 50cm of topsoil then clay to a depth of 8m. There are no borehole records available for site 7a, but boreholes in the clayey areas along the western edges of site 5c struck water at depths from 4.5m to 9m and below.

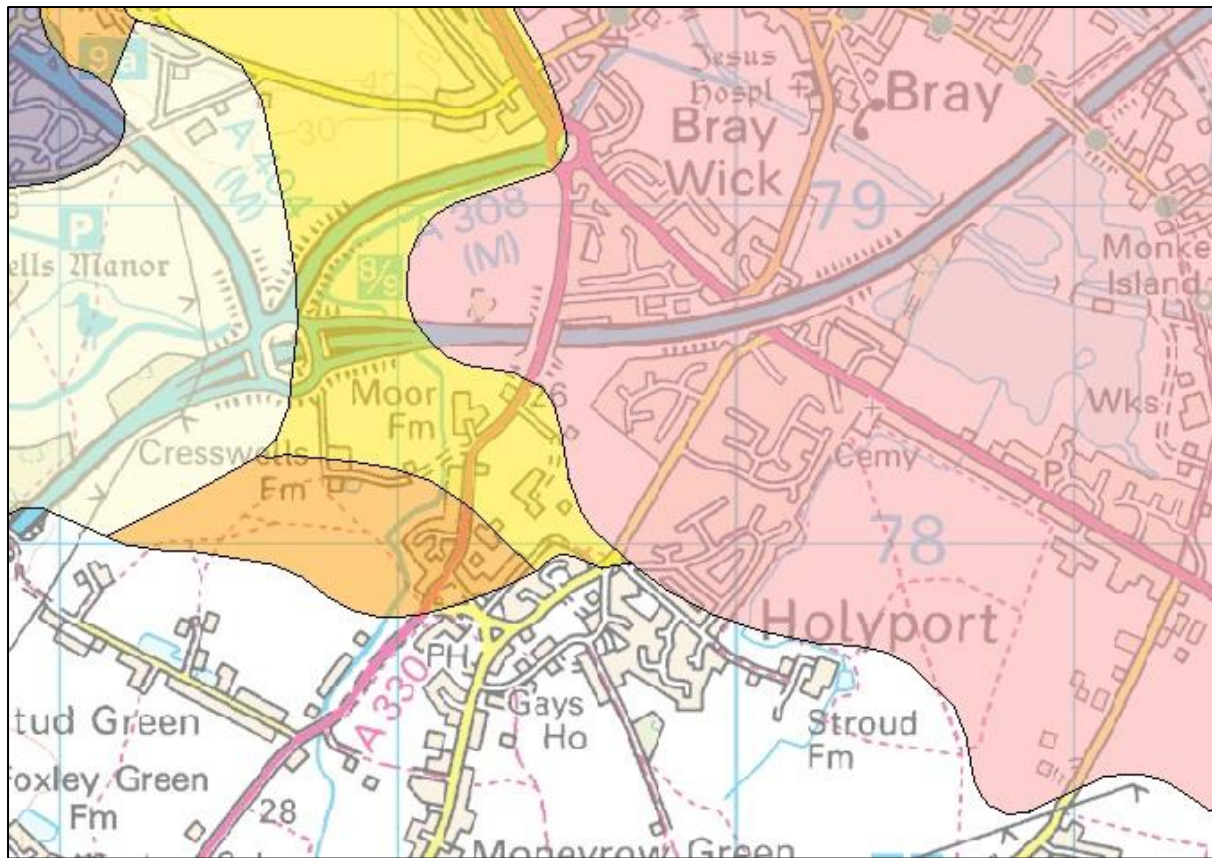


Figure 3. EA groundwater vulnerability map for Holyport. Major aquifer high vulnerability: purple, intermediate vulnerability: pink. Minor aquifer high vulnerability: orange, intermediate vulnerability yellow.

The soils are characterised by an area of freely draining loamy soil to the east with slowly permeable seasonally wet clay soils to the west. Approximately half of site 5c is covered by the clay soils but these only extend to the western edge of site 7a near the A330.

Hydrology

Both sites lie within the catchment of the Cut, as shown in Figure 4. This is a small river which has its source just to the north of Bracknell and joins the Thames approximately 2km east of site 5c at Bray lock. The river gets its name from the fact that the original course was diverted further east away from its original route into the River Loddon. The main tributary of the Cut, the Bourne, flows in a northerly direction through the village of Holyport, some 100m to the west of site 7a over the other side of the A330 and joins the Cut in site 5c, as described in the site location.

The Cut catchment drains an area of approximately 90 km², and has a standard annual average rainfall of 676mm which is relatively low compared to the UK as a whole. The catchment is predominantly underlain by the impermeable London clay and has a high proportion of urban areas (including most of Bracknell) making it respond rapidly to rainfall with significant flows. The Cut is gauged at Binfield and has flow records going back to 1957. The median annual flood is listed by the Environment Agency (2014) as 7.88 cumecs, and the highest flow on record of 18.75 was recorded on 20th July 2007.

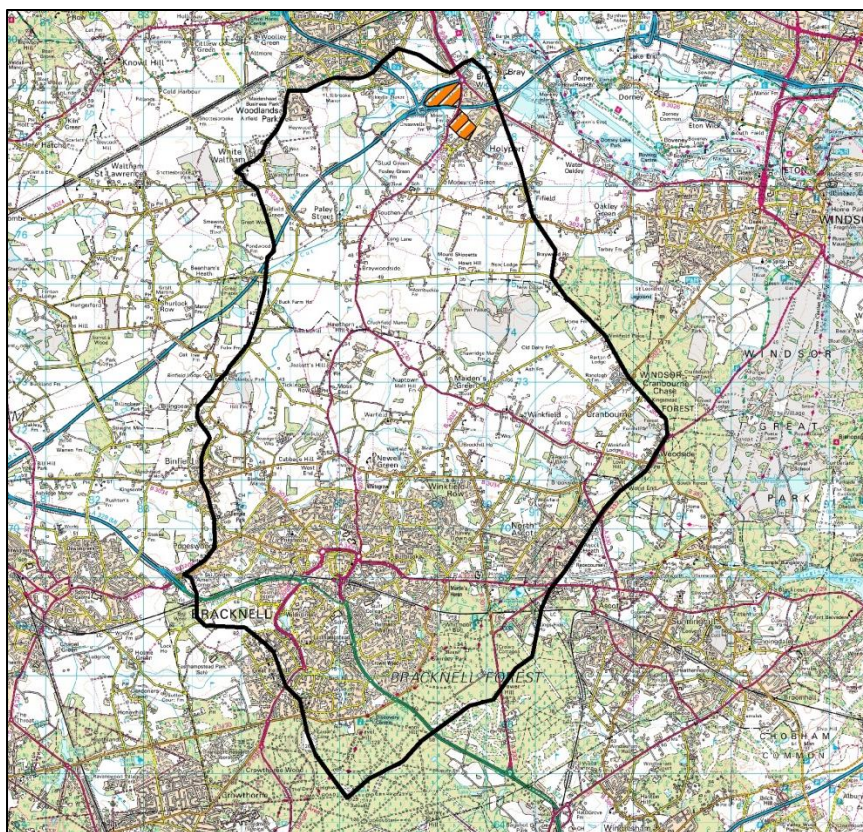


Figure 4. The Cut catchment area outlined in black in relation to the development sites.

Historical Flooding

The flooding in July 2007 was the result of an intense slow moving depression falling on saturated soils after a very wet period throughout May, June and early July. A fall of 55.4mm was officially recorded in 24 hours by the EA at Caversham lock in Reading on 20th July but more locally a fall of 99mm was recorded over the period of 07:00 - 20:35 at Waltham St Lawrence, just 4km to the west of the site. The second highest peak flow recorded on The Cut of 18.10 cumecs was also from a summer event in June 1981. The magnitude of the gauged flow in the river demonstrates the fact that is responsive to rainfall events and despite the relatively low annual average rainfall, heavy falls of rain, particularly resulting from intense convective cells (i.e. thunderstorms) in the summer months are not uncommon in the area. Other extreme rainfalls have been observed within the area in the past as shown in Table 1.

Table 1. Extreme 24 hour rainfalls in the vicinity of Holyport (Source: British Rainfall Digital Archive)

Date	Location	Rainfall depth (mm)
17/07/1890	Maidenhead	86
12/07/1901	Maidenhead	108
17/08/1909	Maidenhead	68
23/07/1920	Maidenhead	63
15/09/1968	Bray	52

An account of the weather for 12th July 1901 from *British Rainfall* (Sowerby-Wallis, 1902) also refers to damage from flooding following the event:

“A severe TS [thunderstorm] on the borders of Berkshire, Buckingham and Herts brought an exceedingly heavy fall to a few stations, and the M [maximum] to about 25. Maidenhead appears to have been in the centre of intensity, and at one station more than one-sixth of the whole years R [rain] fell in six hours. The heavy fall commenced about 7 p.m. and appears in most places to have ceased before midnight. A considerable amount of damage was done by lightning and by flooding.”

Site 7a has also been waterlogged following the heavy rain experienced during the recent extremely wet weather from December 2013 – February 2014 as shown in Figure 5. This is a frequent occurrence and happens most years following heavy rainfall, as indicated by the soil classification listing the area prone to seasonal waterlogging, although in 2014 a considerable area became inundated. There were also areas of flooding in the land between site 7a and Aysgarth Park (Figure 6 where water from site 7a at higher levels drained towards areas of the estate.



Figure 5. Standing water on site 7a in February 2014, near the A330.



Figure 6. Flooding of land adjoining site 7a and Aysgarth Park

Current Flood Risk

The most accurate information on the current flood risk is provided by the EA in the form of maps and predicted flood levels based on the results of detailed flood modelling studies. Such studies to predict the extent of fluvial (river) flooding have been undertaken on the River Bourne. This information forms the basis of the EA Flood Zone maps which can be accessed on the internet. An extract of the Flood Zone maps for the area around Holyport is shown in Figure 7. The dark blue lines indicating the Cut and River Bourne are classified as main rivers. The predicted extent of flooding is shown in terms of the 1 in 100 year outline (zone 1 – high risk) and the 1 in 1000 year or extreme flood outline (zone 2 – medium risk). The map shows that the majority of site 5c is within zones 2 and 3, and about half of site 7a within flood zone 2.

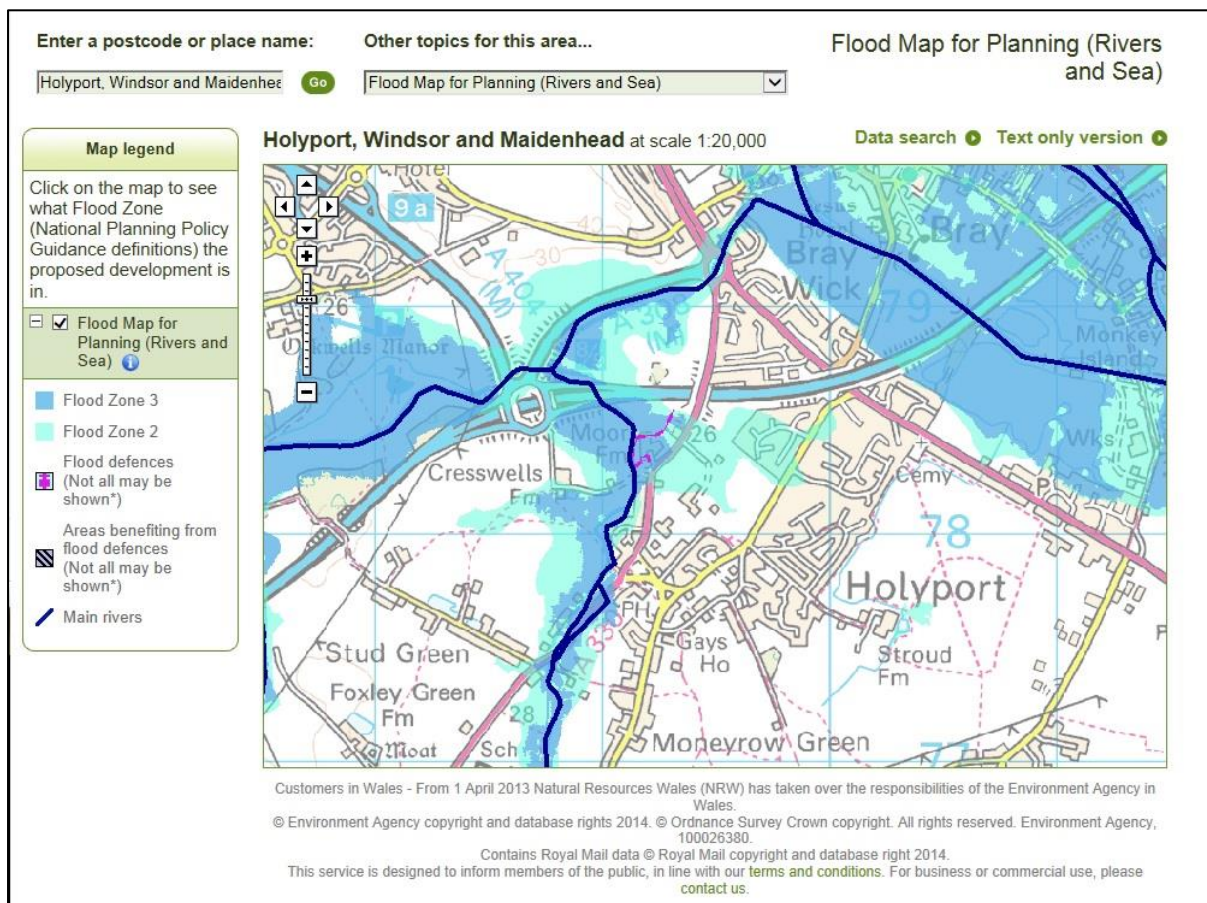


Figure 7. EA flood zone map for Holyport.

In addition the EA have recently released maps of surface water flood risk on the internet based on the areas where rainfall will flow and pond following an extreme event. The areas at risk around Holyport are shown in Figure 8. The risk at site 7e is limited since the roads form a barrier to the flow of surface water into the site from elsewhere, however the maps do show some areas at high risk of surface water flooding towards the western edge of the site. The risk of surface water flooding at site 7a is more extensive with a low to medium risk across large areas of the site. The medium risk area is shown on the western edge bordering the A330. From the evidence of flooding in 2014 and the observations that standing water is present most winters, the risk at the western part of the site should perhaps be classified as high. Some small areas of medium risk are also shown in the east of the site bordering Aysgarth Park.

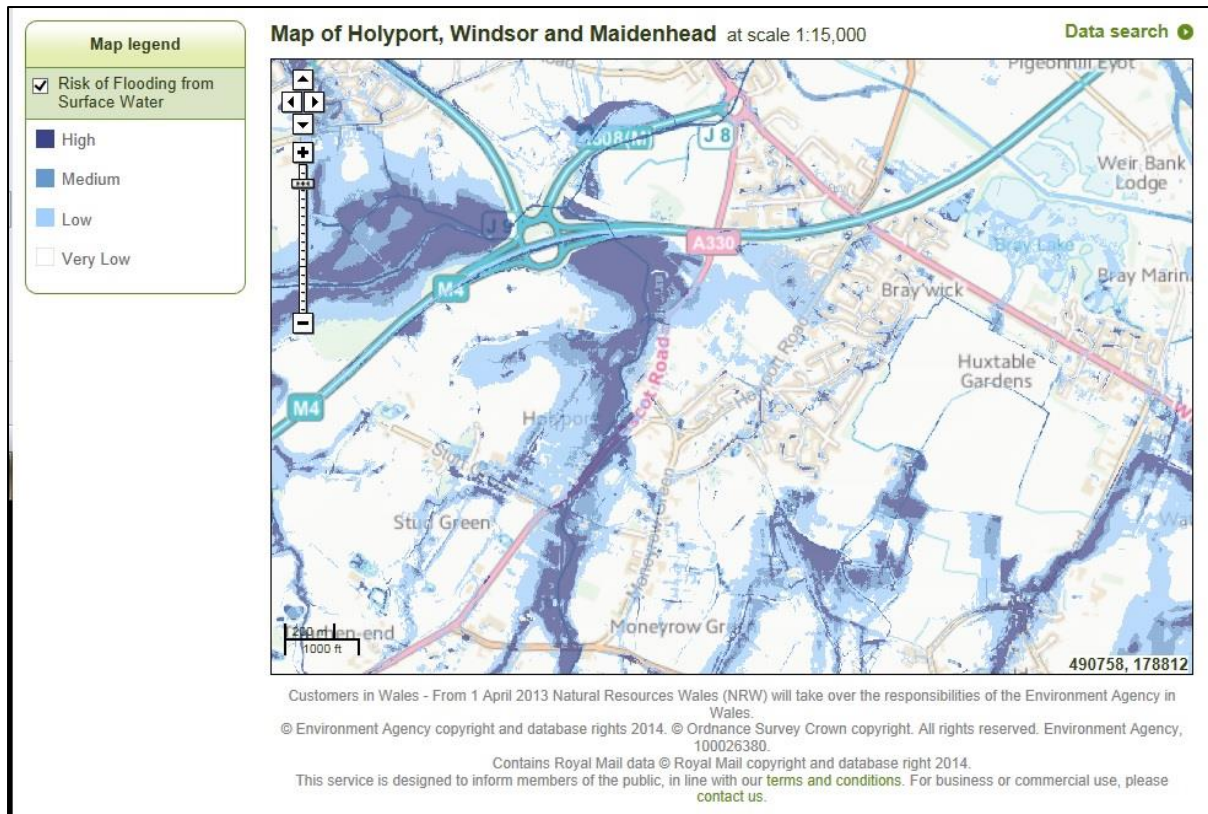


Figure 8. EA surface water flood risk map for the area around Holyport

Further information on the current risk of flooding at Holyport is provided by the Windsor and Maidenhead Strategic Flood Risk Assessment (WMSFRA) release in November 2013. This report basically summarises the EA information for the geographical extent of the Royal Borough of Windsor and Maidenhead and includes some additional information from local authorities such as incidents of sewer and road flooding. The maps which accompanied the report did show incidences of sewer flooding in both site 5c and 7a, although the area in 7a was the same as shown in Figure 5. Observations suggested this to have been from surface water but perhaps the blockage or backing up of a surface water sewer under the A330 had contributed. Locations of foul and surface water sewers were requested from Thames Water but at the time of writing this information had not been received. A very small area of sewer flooding was also shown towards the east of site 7a. The risk for both sites is considered as medium as only small areas of flooding are shown.

The WMSFRA did include a separate section on Holyport where it stated that “experience has shown a relatively high susceptibility to flooding due to elevated groundwater levels”. Separate maps showing the risk of groundwater flooding gave the risk as 75% or greater, which is the highest risk category. The fact that the soil maps classify the higher eastern parts of the sites as free draining and the lower western areas as poorly drained also has an effect on the risk of flooding from groundwater. Rain falling on the freely draining areas will slowly percolate into the groundwater. During winter when there is no uptake of water by vegetation the water table may rise and as subsurface flow will make its way towards the lower surrounding areas. This will contribute to the surface water ponding from the rainfall leading to the large areas of standing water as shown in Figures 5 and 6. The gentle gradient at site 7a and the raised ground of the A330 means that the standing surface water can remain for many weeks.

Conclusions

This study has investigated the background conditions at the proposed development sites near to Holyport and made an assessment of the risk of flooding at the sites based on published information. The risk of flooding from a range of sources for each site is summarised in Table 2. Overall the risk of flooding at both sites is considered as high and therefore the sites should be rejected as potential development areas.

Table 2. A summary of flood risk from different sources at the two sites

Type of Flooding	Flood risk	
	Site 5c	Site 7a
Fluvial	High	Medium
Surface Water	High	High
Groundwater	High	High
Sewer	Medium	Medium

References

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