1.5.2 FLOOD RISK ASSESSMENT

Civil/Structural Engineers
Development Consultants
Project Managers

SITE AT 49-51 HOLLOWAY HEAD, BIRMINGHAM
FLOOD RISK ASSESSMENT

FOR

PANTHER SECURITIES

REPORT REF: 1913/FR01

JUNE 2015

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1.0 INTRODUCTION

BJB Consulting has been commissioned by Panther Securities to undertake a flood risk assessment for land located at 49-51 Holloway Head, Birmingham in line with Government Policy with respect to development and flood risk in areas in England, contained within the Department for Communities and Local Government document the National Planning Policy Framework (NPPF), published in March 2012: the National Planning Practice Guidance (NPPG), published in March 2014 and Planning Policy Statement 25 (PPS25) Practice Guidance.

This FRA has been prepared in accordance with the National Planning Practice Guidance (NPPG) and in consultation with the EA. The level of detail for any FRA should be appropriate for the scale and potential impact of the proposed development and this FRA adheres to the EA Standing Advice that lists a number of requirements that any FRA should address.

The comments given in this report and the opinions expressed are subject to BJB Consulting Service Constraints provided in Appendix A.

2.0 LOCATION AND TOPOGRAPHY

2.1 Site Description

The site is located on the corner between Holloway Head and Blucher Street, Birmingham.

The site itself is rectangular and split into two by Brownsea Drive, the southern area is entirely occupied with an existing building which is currently undergoing demolition works whilst the northern area houses a couple of existing building (approx. 40% of the total area) with the remainder as surface parking. The land generally slopes steeply from south to north, with a level difference of approximately 10.0 metres and west to east, with a level difference of approximately 2.7 metres.

The boundaries are defined on all sides by highways with an area of approximately 7000m^2.

2.2 Development Proposals

The development proposals consist of four high rise apartment blocks with car parking at basement levels as shown on the proposed site plan contained in Appendix B.

3.0 POLICY & CONSULTATION

3.1 National Policy & Guidance

3.1.1 National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG)

The National Planning Policy Framework (NPPF) and the accompanying National Planning Practice Guidance (NPPG) sets out the Government's national policy on development and flood risk and seeks to provide clarity on what is required at regional and local levels to ensure flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk. The NPPF outlines a risk based approach to the planning process and requires that the Sequential Test is used to guide the decision making process by steering development to area with the lowest probability of flooding where feasible.

The NPPG also provides details of how all new development must include appropriate consideration of the potential effects of climate change on flooding and the hydrological regime. The NPPG refers to the Environment Agency's Guidance to support the National Planning Policy Framework, accordingly this requires a precautionary increase in fluvial flows of 20% from 2025 to 2115 in rivers, with rainfall intensities gradually increasing by between 5% and 30% from now until 2115.

Although the Planning Policy Statement 25 (PPS25) have been superseded, the PPS25 Development and Flood Risk – Practice Guide (issued in December 2009) can still be used as a reference point. The EA's updated National Standing Advice to Local Planning Authorities for Planning Applications – Development & Flood Risk – England was issued in January 2012. These documents provide further guidance on the scope for site specific FRA's depending on the type of development and probability of flooding.

3.1.2 The Water Framework Directive (2000)

The aim of the Water Framework Directive is to establish 'good ecological and chemical status in all surface water and groundwater'. It also promotes the importance of sustainable water use. During the implementation process, Local Planning Authorities must not act in a way to compromise the WFD's aims. As part of the planning process, powers to control diffuse pollution at the source should be introduced to meet the obligations under the WFD.

3.1.3 Other National Guidance

The latest guidance on the use of SuDS is provided in 'The SuDS Manual' by CIRIA (ref: C697 dated March 2007). This defines SuDS as 'Surface Water drainage systems developed in line with the ideals of sustainable development ….. the philosophy of SuDS is to replicate, as closely as possible, the natural drainage from a site before development". As such, SuDS drainage can be in a variety of forms, including infiltration trenches, swales, permeable surfaces and green roofs.

Sewers for Adoption 7th Edition (2012) provides guidance on the design, construction and maintenance of drains and sewers outside buildings which are to be adopted by a relevant public authority.

BS EN 752:2008 – Drain and Sewer Systems Outside Buildings, provides a framework for the design, construction, rehabilitation, maintenance and operation of drain and sewer systems outside buildings.

The Building Regulations Requirement H3 stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following: listed in order of priority;

a) An adequate soakaway or some other adequate infiltration system, or where that is not reasonably practicable:
b) A watercourse, or where that is not practicable;
c) A sewer

3.2 Local Policy and Guidance

3.2.1 Preliminary Flood Risk Assessment (PFRA)

A Preliminary Flood Risk Assessment (PFRA) was prepared by Birmingham City Council in May 2011 to meet the requirements of the Flood Risk Regulations (2009). Under the regulations Lead Local Flood Authorities are responsible for undertaking a Preliminary Flood Risk Assessment (PFRA) for local sources of flood risk, primarily from surface water, groundwater and ordinary watercourses.

Flood risk data has been collected and mapped of historic flood events from surface water, watercourses, surface water sewers and canals. Based on the evidence collected no historic flood events were recorded in close proximity of the site with the closest being approximately 1km to the north west of the site which was recorded as a 'Canal Breach or Overtopping' as indicated in Figure 4.1 of the PFRA.

Future flood risk data has also been mapped for predicted flooding from surface water, groundwater and ordinary watercourses, this was undertaken using national datasets. Figure 5.1 of the PFRA indicates areas susceptible to surface water flooding, however this is not at a scale/resolution where the subject site can be clearly identified. Figure 5.2 shows that the site is not within an area susceptible to groundwater flooding. Figure 5.3 - Flood Map for Ordinary Watercourses indicates that the site is within flood zone 1.

3.2.2 Strategic Flood Risk Assessment (SFRA) Level 1

A Level 1 Strategic Flood Risk Assessment (SFRA) was produced in January 2010 and revised in January 2012 by Birmingham City Council in partnership with Atkins.

Referring to the Level 1 SFRA, in the appendices flood risk and SUDs suitability has been summarised for a number of sites within Birmingham. The tables below show extracts from these appendices which are relevant to the location of the subject site. These tables highlight that generally the site is not at risk from flooding with the exception of the area of the site known as 49-51 Holloway Head, this portion of the site is noted to be 'part' at risk from surface water flooding between 0.1 and 0.3m for a 1in 200 year event. It is also identified that there has been an historic sewer flooding incident within 500m of the site. The extract of the SUDs suitability table below confirms that the site is not suitable for infiltration techniques.

Level 1 SFRA Appendix K – Flood Risk Tables (extract)

Site Reference	Address	Street Name	Constituency	Major Catchment	Sources of Flooding																Flood risk Management Measures			Over 1ha	FRA Required
					Historic Flooding within 250m or 500m						Predicted Flooding														
											Fluvial				Surface Water										
															1 in 200		1 in 30								
					Watercourse	Surface Water	Sewer	Groundwater	Canal	Other	Flood Zone 3a	Flood Zone 3b	Climate Change	Flood Zone 2	0.1 - 0.3m	>0.3m	0.1 - 0.3m	>0.3m	Groundwater Susceptibility		Flood Warning Zone	Informal/Formal Defences	Maintained Channel		
Extract From Figure K.1 - Residential Sites Flood Risk Table																									
CC36	Land Bounded by	Blucher St / Brownsea Dr / Ellis St / Gough St	Ladywood	River Rea	no	no	500m	no	no	no	no	no	no	no	no	no	no	no	Very Low		no	no	no	no	No
Extract From Figure K.2 - Commercial Sites Flood Risk Table																									
068642000	49 TO 51	HOLLOWAY HEAD	Ladywood	River Rea	no	no	500m	no	no	no	no	no	no	no	part	no	no	no	Very Low		no	no	no	no	Yes
068643700	LAND BOUNDED BY	BLUCHER STREET & BROWNSEA DRIVE & ELLIS ST	Ladywood	River Rea	no	no	500m	no	no	no	no	no	no	no	no	no	no	no	Very Low		no	no	no	no	No

Level 1 SFRA Appendix L – SUDS Suitability Tables (extract)

Site Reference	Address	Street Name	Constituency	Major Catchment	Soil Type	Drainage Ranking	Fertility	Major Aquifer	Minor Aquifer	May be Suitable for Infiltration Techniques
Extract From Figure L.1 - Residential Sites SUDS Suitability Tables										
CC36	Land Bounded by	Blucher St / Brownsea Dr / Ellis St / Gough St	Ladywood	River Rea	Loamy soils with naturally high groundwater	Naturally wet	Low	yes	no	No
Extract From Figure L.2 - Commercial Sites SUDS Suitability Table										
068642000	49 TO 51	HOLLOWAY HEAD	Ladywood	River Rea	Loamy soils with naturally high groundwater	Naturally wet	Low	yes	no	No
068643700	LAND BOUNDED BY	BLUCHER STREET & BROWNSEA DRIVE & ELLIS ST	Ladywood	River Rea	Loamy soils with naturally high groundwater	Naturally wet	Low	yes	no	No

The Level 1 SFRA is accompanied by a number of drawings/maps for different areas within Birmingham, the Ladywood area drawings have been reviewed for this assessment. The Ladywood drawings confirm that the site is within flood zone 1 and is not within the climate change fluvial model outline or within any flood warning zones in line with the flood risk tables extract above. With regards to the 'part' 1 in 200 year surface flooding between 0.1 - 0.3m for the section of the site directly off Holloway Head noted in the table extract above, the drawing for Surface Water Flooding Susceptibility in the Ladywood Constituency (Appendix E) shows this flooding within the footprint of the Holloway Head Roadway only which coincides with the southern boundary of the subject site.

3.2.3 Strategic Flood Risk Assessment (SFRA) Level 2

A Level 2 Strategic Flood Risk Assessment (SFRA) was produced by Birmingham City Council and Atkins dated April 2012 for the City Council. This Level 2 SFRA predominantly focuses on sites where the exception test is required and which are within flood zones 2 and 3, the exception test is not required for this site as discussed in section 4.3 below and is within flood zone 1. There is no information within this Level 2 SFRA that specifically relates to the subject site.

3.2.4 Birmingham City Council SuDS Guidance

A Sustainable Drainage Guide to Design, Adoption and Maintenance dated April 2015 has been produced by Birmingham City Council.

The SUDs guidance states that 'SuDS are expected to be put in place for the management of runoff on all major developments. It is the responsibility and duty of the developer to ensure that SuDS are provided in all developments, where appropriate.'

Zoning maps have been provided for the different areas within Birmingham with the Ladywood Zoning Map provided in Appendix F, this zoning map shows the site is within an area which has 'very significant constraints' to SUDs development. This corresponds with the Level 1 SFRA which identifies the site as not being suitable for infiltration techniques.

A number of primary design considerations have been identified in relation to SuDS within the guidance and for each zone the top three primary design considerations have been identified, for the Ladywood area as a whole the following primary design considerations have been identified:

- Surface Water Flood Risk
  Whilst SuDS may not remove the risk of flooding, surface water control measures must be integral to the design of the proposed SuDS features to not increase, and should seek to reduce, this risk.
  SuDS features should prioritise surface water quantity control measures.

- Fluvial Flood Risk
  Whilst SuDS will not remove the risk of fluvial flooding, the design of the proposed SuDS features must not increase, and should seek to reduce, this risk.
  SuDS features should prioritise surface water quantity control measures.

- Groundwater Flood Risk
  Whilst SuDS will not remove the risk of groundwater flooding, quantity control measures and attenuation should be integral to the design of the proposed SuDS features to mitigate this risk.
  SuDS features should prioritise surface water quantity control measures and water quality.

3.3 Stakeholder Consultation

Local stakeholders were consulted to obtain information on flood risk and to confirm design criteria and principles, and to agree the methodology for the technical assessment of the management of surface water.

Stakeholders consulted include:

- The Environment Agency (EA)
- Birmingham City Council
- Severn Trent Water

Copies of all correspondence from the above stakeholders are included in the Appendices.

3.3.1 Environment Agency

The Environment Agency (EA) has available on their web site indicative flood plain maps for much of England and Wales. A site specific search on the EA flood maps is contained in Appendix C and has confirmed that the site at Holloway Head is within Flood Zone 1. From these maps it is clear that the site is outside the extent of extreme flooding and the chance from flooding each year from rivers or any adjacent water body is less than 1:1000.

3.3.2 Birmingham City Council

The council's information relating to their SFRA and associated mapping have been reviewed in the context of the subject site as discussed in section 3.2 above.

3.3.3 Severn Trent Water

Severn Trent Water sewer records have been obtained in the vicinity of the site as included in Appendix G. These show the presence of below ground combined foul and surface water sewers, with the final discharge from the site made into the existing adopted sewer in Brownsea Drive and Ellis Street as indicated on Severn Trent Water sewer records.

As part of the development proposals there will be the need for connecting into the existing combined system subject to Severn Trent Water's confirmation of available capacity to accommodate the proposed development.

4.0 FLOOD RISK

4.1 Sources of Flooding

The NPPF and associated NPPG state that all potential sources of flooding should be considered. Data provided from the consultation and review of other information is discussed below.

4.1.1 Potential Sources of Fluvial Flooding

The closest water course to the site is approximately 200m to the west of the site. This water course is a section of the Birmingham Canal Old Line.

This water course does not pose any risk of flooding to the development site according to the information reviewed.

The nearest river, River Rea (River Tame) is 940m from the site at approximately 105.0m AOD. The subject site lowest AOD level is approximately 126.4m rising up to 138.9m.

The approximate maximum flood level of this river determined from the EA Flood Data Map this is at approximately 105.0 AOD metres which is therefore approximately 21.4 metres below the existing lowest site ground level. The effects of global warming have been predicted to include 20% increase in peak flows. The site levels are approximately 21.4 metres higher than the inferred 1 in 100 year flood level. Hence it is considered that the increased flood flows would not create an envelope that extends onto the site.

4.1.2 Tidal/Coastal Flooding

The development site is not a coastal location, and the EA's mapping confirm that the risk of tidal/coastal flooding does not affect the subject site.

4.1.3 Groundwater

The EA online maps identify that the northern half of the site is within an area designated as a Ground Water Source Protection Zone 'Total catchment (Zone 3)'. This is defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75. There is still the need to define individual source protection areas to assist operators in catchment management.

The whole site is also within Groundwater Vulnerability Zone designated as Major Aquifer High.

4.1.4 Surface Water Flooding

EA map searches have identified that the site is in an area designated as very low risk of surface water flooding generally, however it is noted that along the southern boundary of the site, Holloway Head roadway is at a high risk of surface water flooding.

The site is not shown to be affected by pluvial flooding generally as indicated on the RMS 75, 100 & 1000 year Return Flood Data Maps contained in Appendix H. The RMS mapping was acquired from the Envirocheck carried out for the original Flood Risk Assessment carried out for this site in 2009 by BJB.

4.2 Historic Flooding

The Birmingham City Council PFRA and SFRA Mapping identifies no historic flood events recorded in close proximity of the site with the closest being approximately 1km to the north west of the site which was recorded as a 'Canal Breach or Overtopping'. The Level 1 SFRA flood risk tables also identified an historic sewer flooding incident within 500m of the site, however the location of this incident is not apparent on the mapping reviewed.

The overall conclusion is that the risk of flooding from the local river system is negligible but due to the risk of surface water flooding on Holloway Head roadway, the surface water management to be developed for the site should take this into consideration as appropriate.

4.3 Planning Policy Compliance

According to the EA Flood Maps the site is located within Flood Zone 1 (Low Probability of Flooding). All uses of land are appropriate in this zone.

The development proposal is for new residential apartments and car parking these are classified as 'more vulnerable' to flooding, as a worst case for the residential units, according to Table 2 of the NPPG Flood Zone and Flood Risk Tables.

According to Table 3 of the NPPG Flood Zone and Flood Risk Tables, which is reproduced in Figure 1, the proposed development is appropriate and the Exception Test is not required.

Flood risk vulnerability classification (see NPPG table 2)		Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	√	√	√	√	√
	Zone 2	√	√	Exception Test required	√	√
	Zone 3a	Exception Test required	√	x	Exception Test required	√
	Zone 3b functional floodplain	Exception Test required	√	x	x	x

Key: √ - Development is appropriate
X - Development should not be permitted

Figure 1 – Extract of Table 3 from the of the NPPG Flood Zone and Flood Risk Tables

5.0 SURFACE WATER MANAGEMENT

5.1 Existing Surface Water Drainage Infrastructure

The existing site is almost entirely developed with buildings and hard surfacing, as such approximately 100% of the entire site is impermeable to rainfall. The surface water currently discharges into the combined public sewers in the adjacent roadways via below ground gravity drainage.

5.2 Existing Surface Water Runoff Regime

The site is brownfield in nature and generally impermeable and therefore existing run-off rates should be assessed accordingly. In respect of Brownfield sites, the Interim Code of Practice for Sustainable Drainage Systems (July 2004) states that 'drainage proposals will be measured against the existing performance of the site'. The design of any future drainage system should therefore be based upon an assessment of the existing rate of runoff, taking account of the existing extent of impermeable surfaces and the capacity of the existing system serving the impermeable catchment and drainage to the receiving system. The existing rate would then be taken forward and used as the basis for defining the 'limiting flow' for the purposes of designing any future storm water drainage and balancing system.

5.2.1 Assessment of Discharge Rates

The current site discharge rate is based on Q=2.78 x 50 Aimp (ha) and has been calculated for the site as follows:

Area (impermeable) = 0.7ha,
Therefore Q = 2.78 x 50 x 0.7= 97.3 l/s (existing)

As the site is brownfield the Environment Agency and sewer authorities would expect to see a reduction of 30% in peak discharge from the proposed development area giving an allowable discharge of 68 l/s. The reduction in the peak discharge rate can be provided for the site utilising appropriate SUDS techniques as discussed in section 5.4.

5.3 Proposed Surface Water Drainage Strategy

The proposed development will not be affected by the flood plain since it is proposed that there will not be any reduction in ground levels below the 1 in 100 year flood level. The nature of the proposed development will not increase the impermeable area of the site from 100% as existing.

The existing site is extensively developed with impermeable areas from buildings and external works draining into below ground combined foul and surface water sewers, with the final discharge made into the existing adopted sewer in Brownsea Drive and Ellis Street roads as indicated on Severn Trent Water sewer records.

The proposed new development will maintain this current arrangement but will have separate new foul and surface sewers and ultimately utilizing the existing adopted connection in the above mentioned roads.

All utilities will be outside the flood plain within the subject site.

5.4 Consideration of SUDS Suitability

Both the Environment Agency and Birmingham City Council require Sustainable Drainage (SUDS) techniques to be incorporated within new developments were possible, however since the site is less than 1 hectare in area and is currently 100% impermeable the required reduction of surface water run-off of 30% off the existing discharge is not strictly required unless it can be practically achieved as part of the proposed development.

Consideration should therefore be given to the use of the Sustainable Urban Drainage Systems. The following table gives commentary in relation to the suitability of sustainable Urban Drainage techniques for the proposed development. It should be noted that infiltration techniques are also generally viewed as not suitable for this site location as identified within Birmingham City Council's Level 1 SFRA as discussed above.

SUDS Technique	Commentary	Suitability
Infiltration by Soakaway	Due to site restrictions and underground parking levels there is no external landscaping areas where it would be appropriate to implement infiltration drainage systems to dispose of surface water.	No
Green roofs	The option of incorporating green roofs into the development is potentially viable subject to planning and client requirements.	Potential
Permeable paving	Due to site restrictions and underground parking levels there is no external landscaping areas where it would be appropriate to permeable paving to dispose of surface water.	No
Rainwater harvesting	The proposed residential units are in a form of individual apartments which would each require their own system and therefore it is not practical in this case.	No
Retention	There are no external works areas in which underground storage tanks could be located, except for the provision of oversized pipework constructed below the basement car park slabs which could potentially be viable subject to invert levels of existing connections.	Potential
Swales	Due to site restrictions and underground parking levels there is no external landscaping areas where it would be appropriate to implement swales.	No
Detention basins	Detention basins are not feasible as there are no suitable areas within the site.	No
Ponds	Due to site restrictions and underground parking levels there is no external landscaping areas where it would be appropriate to implement a pond.	No
Wetlands	Wetlands are not feasible as there are no suitable areas within the site.	No

The table above identifies that green roofs and retention are potentially suitable for the site to manage the surface water storage and discharge of the site.

Calculations will need to be carried out for the required storage volumes based on the allowable discharge rate of 68l/s (including 30% reduction) to provide the minimum volumes required for a 1 in 100 year storm event.

6.0 FOUL DRAINAGE STATEMENT

The discharge loads for the proposed new residential development is based on the occupancy and use of the development as set out in the British Water Code of Practice: Flows and Loads 4 (BW COP: 18.11/13):

SOURCE OF WASTE				Flow litre / DAY		
Description	No of apartments	Occupancy	No	Per Head	TOTAL	
Residential units (1 bed)	276	1.5	414	150	62100	
Residential units (2 bed)	234	2.5	585	150	87750	
Total load(s)					149850	litres/day
					1.8	l/s

Note: Occupancy figures are 3 people for 1 bed apartments and 4 people for 2 bed apartments as set out in BW COP: 18.11/13, however the document applies the occupancy level to a limit of 50 population therefore more realistic occupancy levels are taken a 1.5 for 1 bed and 2.5 for 2 bed apartments.

Existing combined sewers are present in the roads surrounding the site and in view of the past uses and connections to these sewers the proposed foul discharge will utilise the existing connections to be identified prior to commencement of the construction works.

7.0 SUMMARY AND CONCLUSIONS

BJB Consulting has prepared this Flood Risk Assessment in accordance with the guidance set out in the National Planning Policy Framework and following consultation with the Environment Agency, Birmingham City Council and Severn Trent Water. The report can be summarised as follows:

- The site falls within an area designated by the Environment Agency as Flood Zone 1 - land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
- The main flood risk relates to surface water flooding, however the risk is only to the southern boundary of the site where the Holloway Head roadway is at risk from surface water flooding to a depth of 0.1m – 0.3m for a 1 in 200 year event.
- The proposed development will not increase the current impermeable area of 100% however an attenuation/SUDS measure could potentially be accommodated within the development proposals to help ease the demand on the existing public surface water sewer.
- As discussed in section 4.3 – Planning Policy Compliance – the proposed development comes under 'more vulnerable' category (for the residential use areas) and therefore in accordance with the National Planning Practice Guidance, Table 3, the proposed development is appropriate for the Zone 1 site and an Exception Test is not required.

PREPARED BY	CHECKED BY	DATE	REVISION
Grace Randall **MEng (Hons)** **Project Engineer**	**Basil Basray** **BEng (Hons), CEng, MIStructE** **Managing Partner**	**June 2015**	**-**

APPENDIX A
BJB SERVICE CONSTRAINTS

SERVICE CONSTRAINTS

This report (together the "Services") were compiled and carried out by BJB Consulting (BJB) for Panther Securities (the "client") in accordance with their instruction. The Services were performed by BJB with the reasonable skill and care ordinarily exercised by a reasonable Civil Engineer at the time the Services were performed. Further, and in particular, the Services were performed by BJB taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between BJB and the client.

Other than that expressly contained in paragraph 1 above, BJB provides no other representation or warranty whether express or implied in relation to the Services.

Unless otherwise agreed the Services were performed by BJB exclusively for the purposes of the client. BJB is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing BJB does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such parties relies thereon that party does so wholly at its own and sole risk and BJB disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.

It is BJB's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without BJB's review and advice shall be at the client's sole and own risk. Should BJB be requested to review the report after the date hereof, BJB shall be entitled to additional payment at the then existing rates or such other terms as agreed by BJB and the client.

The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. This information and conclusions contained in this report should not be relied upon in the future without the written advice of BJB. In the absence of such written advice of BJB, reliance on the report in the future shall be at the client's own and sole risk. Should BJB be requested to review the report in the future, BJB shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between BJB and the client.

The observations and conclusions described in this report are based solely upon the Services, which were provided pursuant to the agreement between the client and BJB. BJB has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and BJB. BJB is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, BJB did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.

The services are based upon BJB's observations of Environment Agency Flood Maps of the Site together with BJB's interpretation of information including documentation, obtained from third parties and from the client on flooding and drainage issues relating to the Site. The Services clearly

are limited by the accuracy of the information, including documentation. Further BJB was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. BJB is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to BJB and including the doing of any independent investigation of the information provided to BJB save as otherwise provided in the terms of the contract between the client and BJB.

Any site drawings provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding the site.

APPENDIX B
PROPOSED SITE PLAN

NOTES:

BLOCK A - 84
Roof Level - 72.15

BLOCK B1 - 61
Roof Level - 75.60

BLOCK B2 - 110
Roof Level - 75.60

BLOCK C - 131
Roof Level - 82.90

BLOCK D - 124
Roof Level - 82.90

TOTAL UNITS - 510

REV	DATE	NOTES

Client

PANTHER SECURITIES

Project

HOLLOWAY HEAD

Drawing Title

PROPOSED SITE PLAN
PHASE 2

Drawn	Checked	Paper Size	Scale	Date
TM	ML	A1	1:250	MAY 2014

Project No.	Drawing No.	Revision
14135	102	X

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APPENDIX C
ENVIROMENT AGENCY MAPPING

Environment Agency

Enter a postcode or place name: B1 1HN Go

Other topics for this area... Flood Map for Planning (Rivers and Sea)

Flood Map for Planning (Rivers and Sea)

Map legend

Click on the map to see what Flood Zone (National Planning Policy Guidance definitions) the proposed development is in.

- Flood Map for Planning (Rivers and Sea)
  - Flood Zone 3
  - Flood Zone 2
  - Flood defences (Not all may be shown*)
  - Areas benefiting from flood defences (Not all may be shown*)
- Main Rivers
  - River line

B1 1HN at scale 1:10,000 Other maps Data search Text only version

More about flooding:

Understanding the Flood Map for Planning (Rivers and Sea)

A more detailed explanation to help you understand the flood map shown above.

Current flood warnings

We provide flood warnings online 24 hours a day. Find out the current flood warning status in your local area.

*** Legend Information:** Flood defences and the areas benefiting from them are gradually being added through updates. Please contact your local environment agency office for further details.

creating a better place

Follow us: YouTube Twitter Flickr Facebook

Author: The Environment Agency | wiybysupport@environment-agency.gov.uk
Last updated: 28th May 2015

Environment Agency

Enter a postcode or place name: Other topics for this area...

Go | Risk of Flooding from Rivers and Sea | View other Interactive Maps

Risk of Flooding from Rivers and Sea

River flooding happens when a river cannot cope with the amount of water draining into it from the surrounding land. Sea flooding happens when there are high tides and stormy conditions.

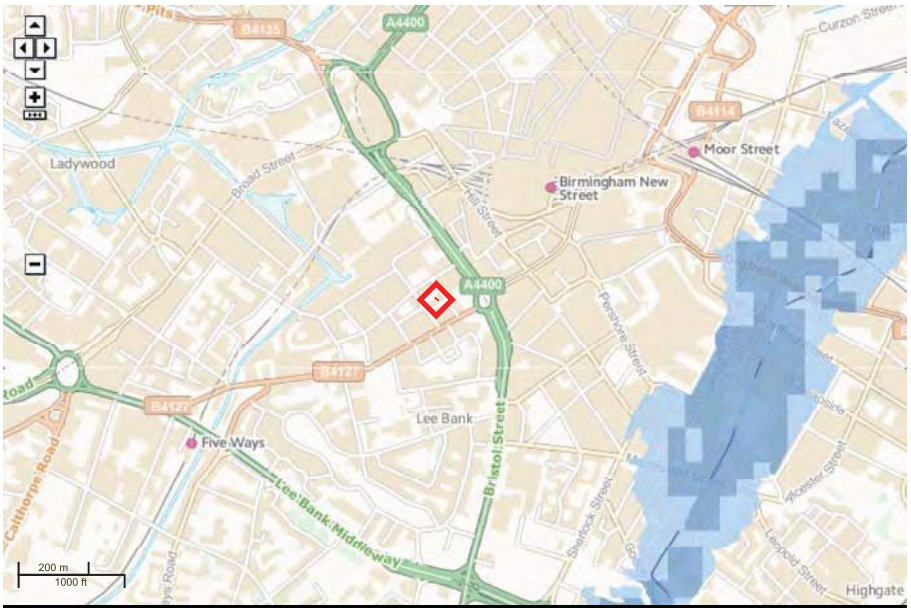
The shading on the map shows the risk of flooding from rivers and the sea in this particular area.

Click on the map for a more detailed explanation.

Map of X: 406,771; Y: 286,309 at scale 1:10,000 Data search

Map legend

- Risk of Flooding from Rivers and Sea
  - High
  - Medium
  - Low
  - Very Low



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Author: The Environment Agency | enquiries@environment-agency.gov.uk
Last updated: 09 June 2015

Environment Agency

Enter a postcode or place name:

Go

Other topics for this area...

Risk of Flooding from Surface Water

View other Interactive Maps

Risk of Flooding from Surface Water

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.

The shading on the map shows the risk of flooding from surface water in this particular area.

Click on the map for a more detailed explanation.

Map of X: 406,771; Y: 286,309 at scale 1:10,000

Data search

Map legend

- Risk of Flooding from Surface Water
  - High
  - Medium
  - Low
  - Very Low

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Author: The Environment Agency | enquiries@environment-agency.gov.uk
Last updated: 09 June 2015

Environment Agency

Enter a postcode or place name: Go

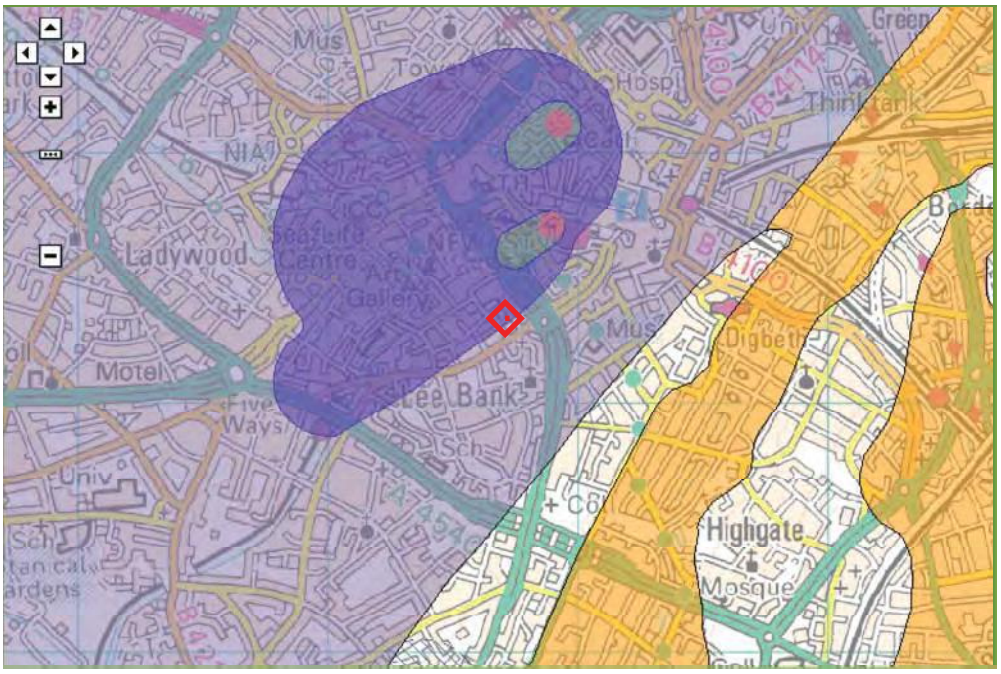
Other topics for this area... Groundwater

Groundwater

Map legend

- Groundwater source protection zones
  - Inner zone (Zone 1)
  - Inner zone - subsurface activity only (Zone 1c)
  - Outer zone (Zone 2)
  - Outer zone - subsurface activity only (Zone 2c)
  - Total catchment (Zone 3)
  - Total catchment - subsurface activity only (Zone 3c)
  - Special interest (Zone 4)
- Aquifer Maps - Superficial Deposits Designation
- Aquifer Maps - Bedrock Designation
- Groundwater Vulnerability Zones
  - Major Aquifer High
  - Major Aquifer Intermediate
  - Major Aquifer Low
  - Minor Aquifer High
  - Minor Aquifer Intermediate
  - Minor Aquifer Low
- Other national environmental organisations

Map of X: 406,692; Y: 286,255 at scale 1:20,000 Other maps Data search Text only version



More about Groundwater

Groundwater Source Protection Zones:

Groundwater provides a third of our drinking water. We ensure that your water is safe to drink defining Source Protection Zones. These zones help to monitor the risk of contamination from any activities that might cause pollution in the area.

The Source Protection Zones are not displayed at scales greater than 1:20,000 (Ordnance Survey 1:50,000 scale) as the data was only modelled to this level and is not accurate pass this. They should not be compared against field boundaries.

Understanding Groundwater Source Protection Zones maps

British Geological Survey Aquifer Maps:

From 1st April 2010 new aquifer designations replace the old system of classifying aquifers as Major, Minor and Non-Aquifer. This new system is in line with our Groundwater Protection Policy (GP3) and the Water Framework Directive (WFD) and is based on British Geological Survey mapping.

The Aquifer Extents are not displayed at scales greater than 1:75,000 (Ordnance Survey 1:250,000 scale) as the data was only modelled to this level and is not accurate pass this.

Understanding Groundwater Source Protection Zones maps

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Author: The Environment Agency | wiybysupport@environment-agency.gov.uk
Last updated: 28th May 2015

Environment Agency

Enter a postcode or place name:

Go

Other topics for this area...

Nitrate Vulnerable Zones

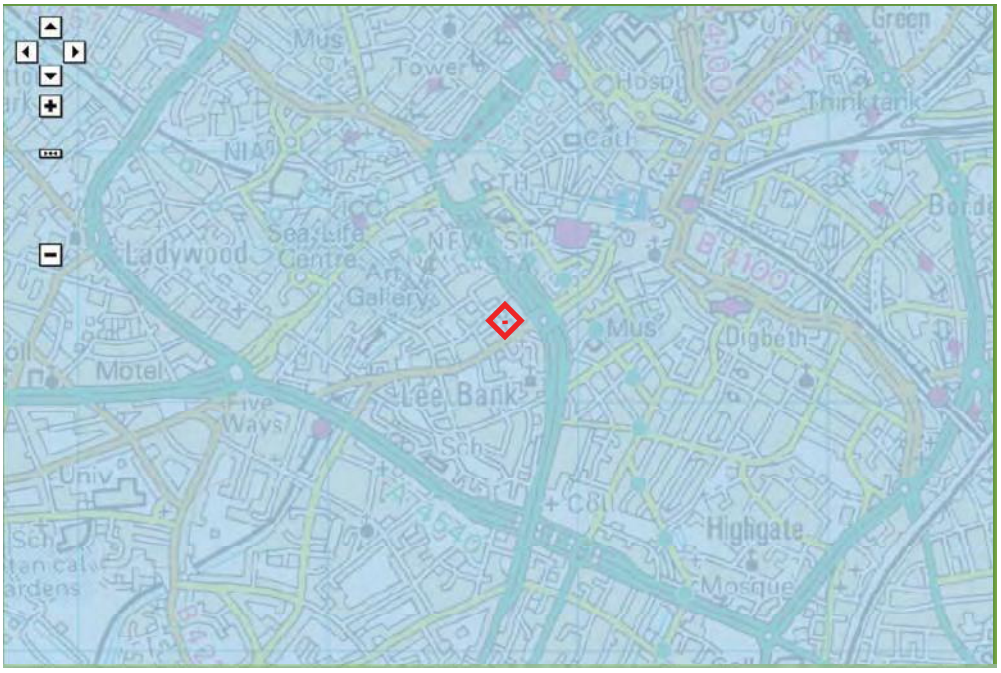
Nitrate Vulnerable Zones

Map legend

- Nitrate Vulnerable Zones
- Surface Water NVZ Area
- Groundwater NVZ Area
- Eutrophic NVZ Area
- Other national environmental organisations
- Natural Resources Wales Area of responsibility
- Scottish Environment Protection Agency Area of responsibility

Map of X: 406,692; Y: 286,255 at scale 1:20,000

Other maps | Data search | Text only version



Nitrate Vulnerable Zones

These maps show the areas of England and Wales that are designated as Nitrate Vulnerable Zones from November 2013. The areas shown reflect the versions deposited for England at the offices of the Secretary of State for Environment, Food and Rural Affairs and for Wales deposited at the offices of the Welsh Government. For further information and advice for farmers visit our Nitrate Vulnerable Zone pages.

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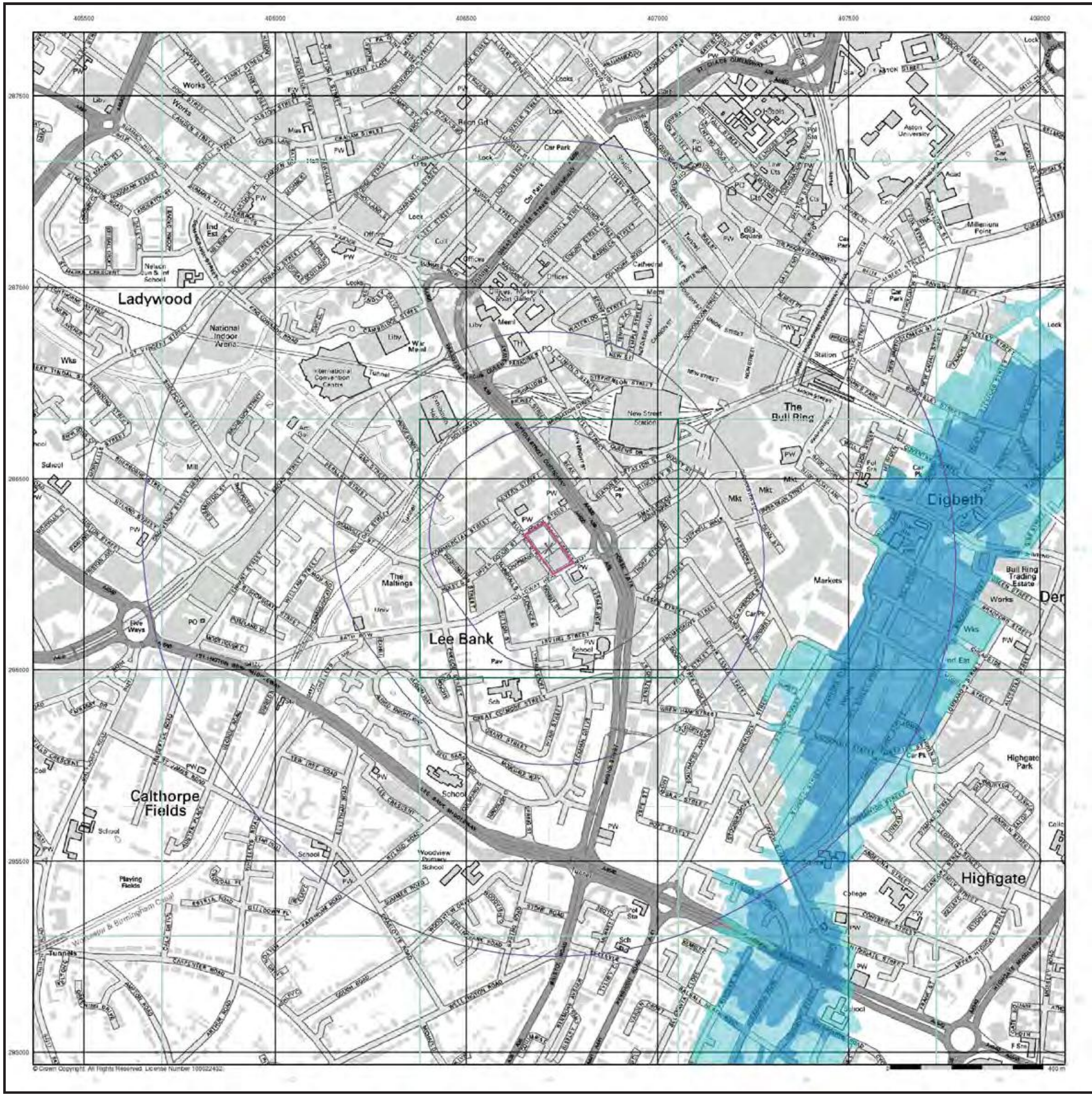
Author: The Environment Agency | wiybysupport@environment-agency.gov.uk
Last updated: 28th May 2015

APPENDIX D

ENVIROCHECK FLOOD MAP AND RIVER NETWORK



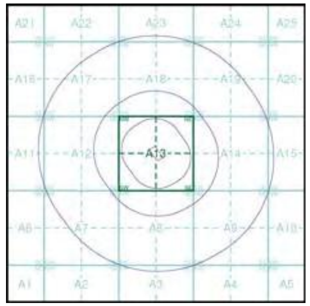
General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



N

Order Details

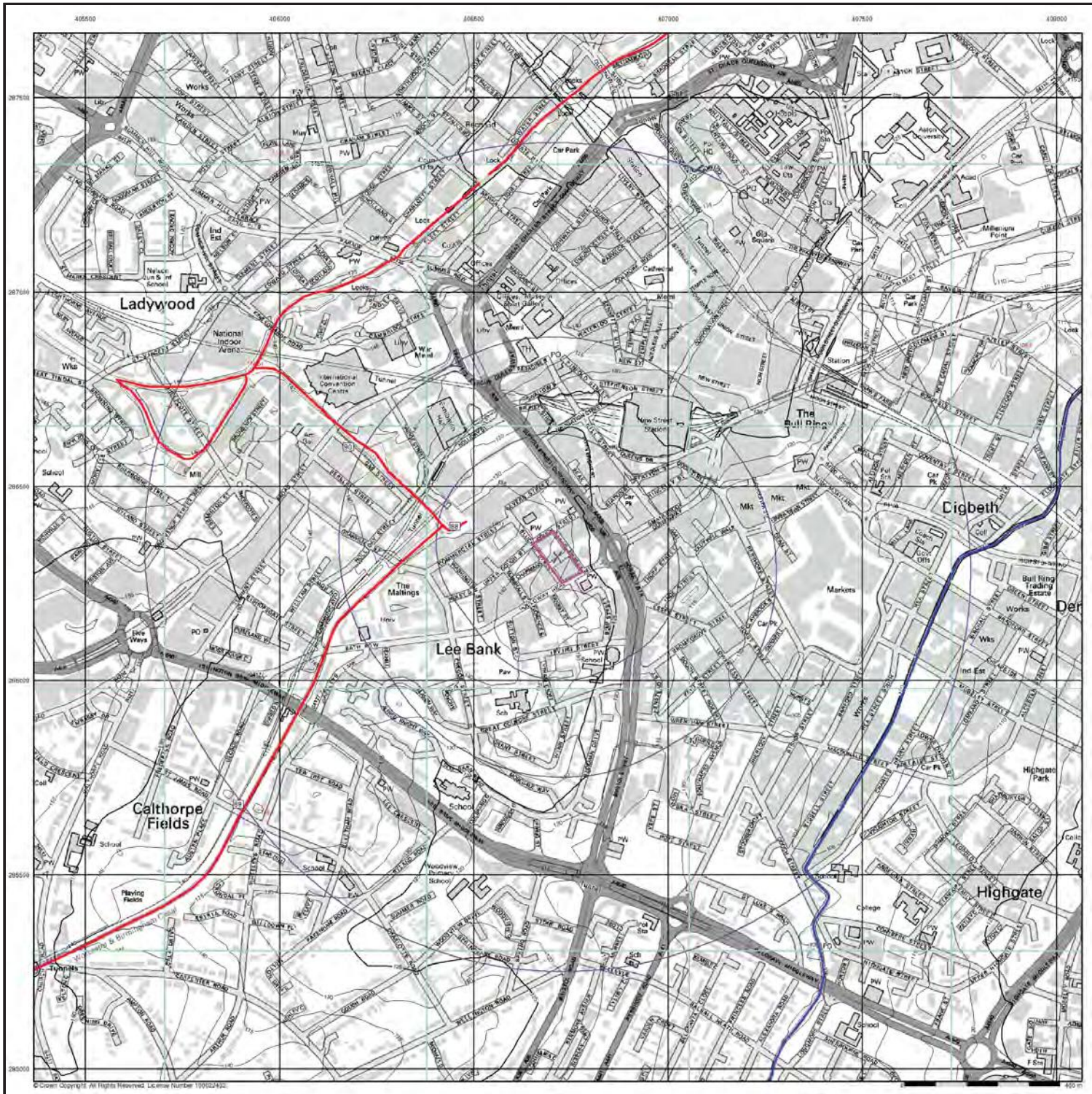
Order Number: 68011741_1_1
Customer Ref: 1913
National Grid Reference: 406720, 286320
Slice: A
Site Area (Ha): 0.76
Search Buffer (m): 1000

Site Details

Site at 406720, 286320

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID

Detailed River Network Data

- Primary River
- Secondary River
- Tertiary River
- Canal
- Canal Tunnel
- Undefined River
- Lake/Reservoir
- Offline Drainage Feature
- Extended Culvert (greater than 50m)
- Underground River (inferred)
- Underground River (local knowledge)
- Downstream of High Water Mark
- Downstream of Seaward Extension
- Not assigned River feature

Contours (height in metres)

Standard Contour — 105

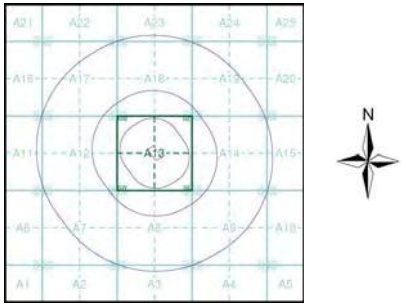
Master Contour — 100 — 95

Spot Height — 167.3

MLW — Mean Low Water

MHW — Mean High Water

EA/NRW Detailed River Network Map - Slice A



Order Details

Order Number:	68011741_1_1
Customer Ref:	1913
National Grid Reference:	406720, 286320
Slice:	A
Site Area (Ha):	0.76
Search Buffer (m):	1000

Site Details

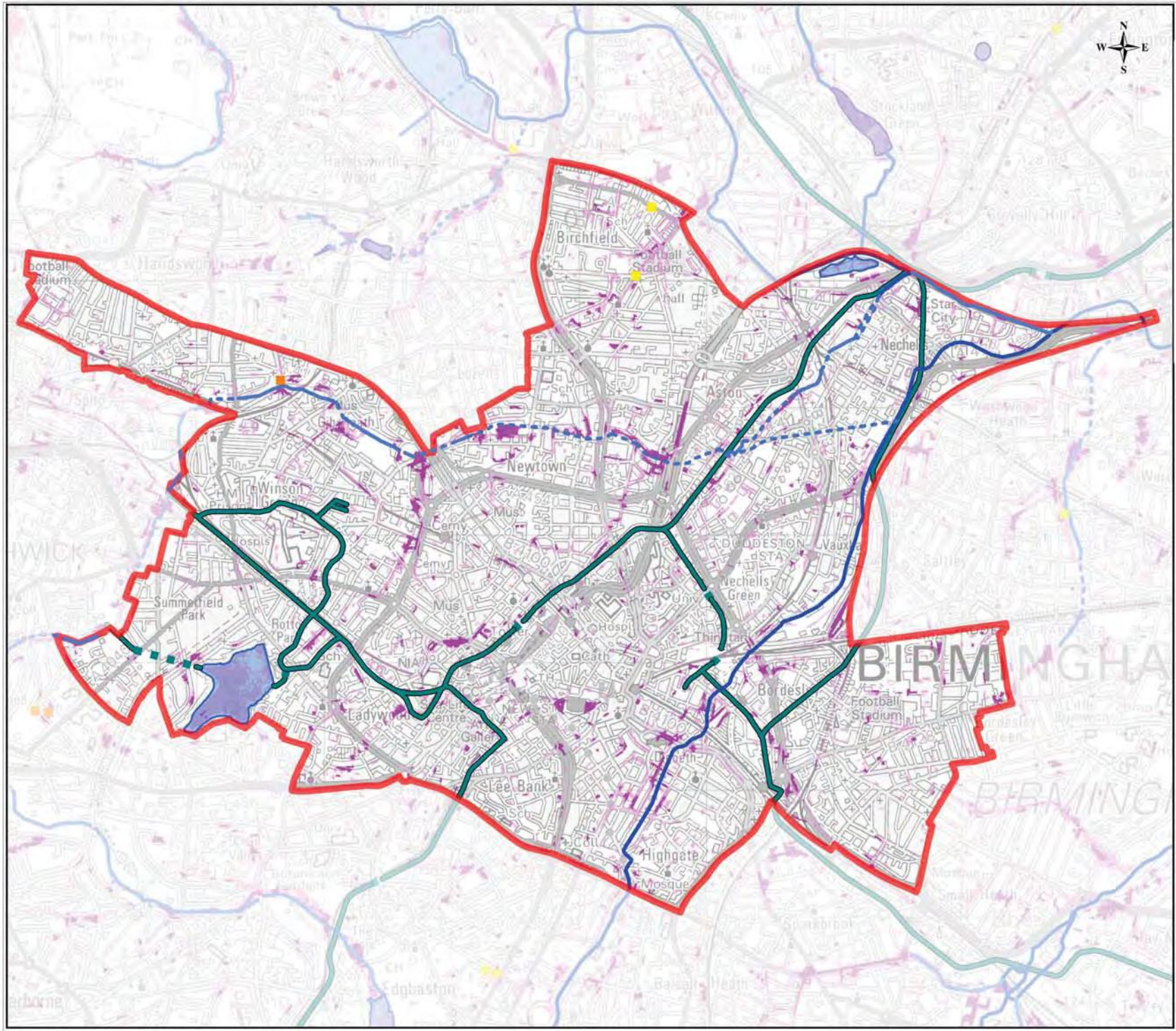
Site at 406720, 286320

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

APPENDIX E

SURFACE WATER FLOODING SUSCEPTIBILITY IN THE LADYWOOD CONSTITUENCY



PROJECT:
Strategic Flood Risk Assessment
Level 1

DRAWING TITLE:
Surface Water Flooding Susceptibility
Ladywood Constituency

Birmingham City Council

Map produced by GIS Team
Planning Strategy
1 Lancaster Circus, Queensway
Birmingham. B4 7DJ
0121 675 9266

Scale 1:29,000 @ A3

Date:December 2011

DRAWING NUMBER: 5045289/06/06A

APPENDIX F

BIRMINGHAM CITY COUNCIL
SUDS GUIDANCE ZONING MAP FOR LADYWOOD

Ladywood

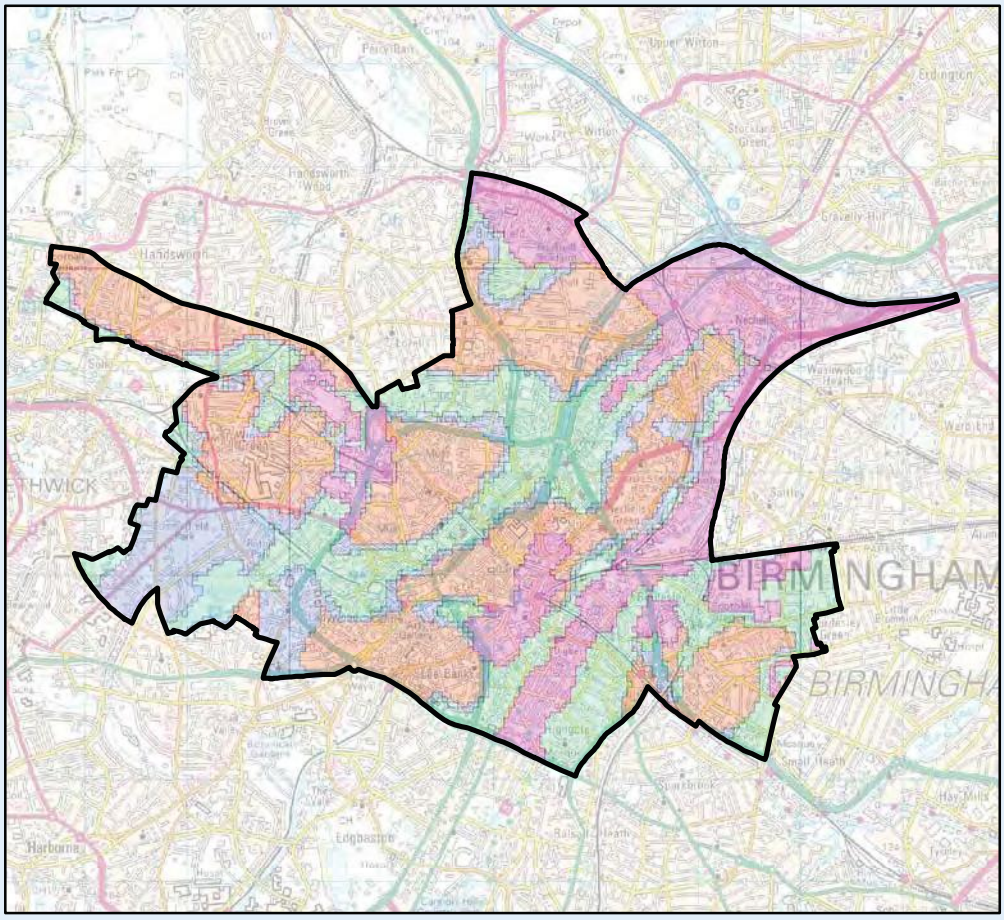
SuDS development within this area should give primary consideration to:

Surface Water Flood Risk

Fluvial Flood Risk

Groundwater Flood Risk

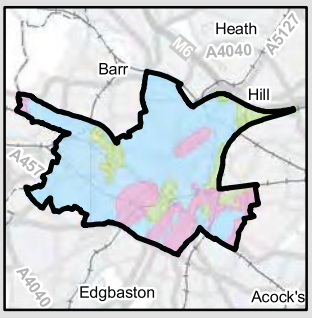
DRAINAGE SUMMARY



Legend

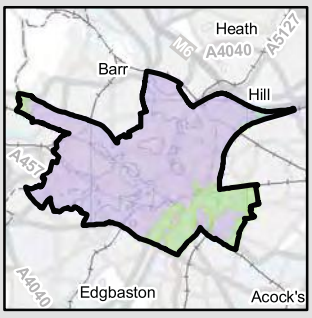
- Highly compatible for infiltration SuDS
- Opportunities for bespoke infiltration SuDS
- Probably compatible for infiltration SuDS
- Very significant constraints are indicated

Groundwater Contamination



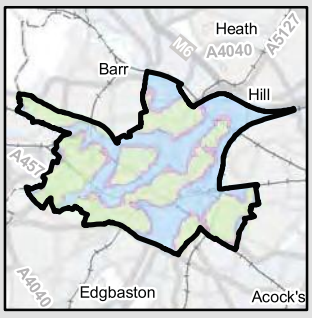
- Considerable susceptibility
- Low susceptibility
- Moderate susceptibility
- Very significant constraints are indicated

Predominant Flow Type



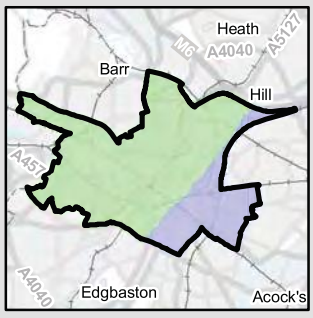
- Fracture flow
- Intergranular or mixed flow

Depth to Water Table



- 3-5 m below ground surface
- < 3 m below ground surface
- > 5 m below ground surface

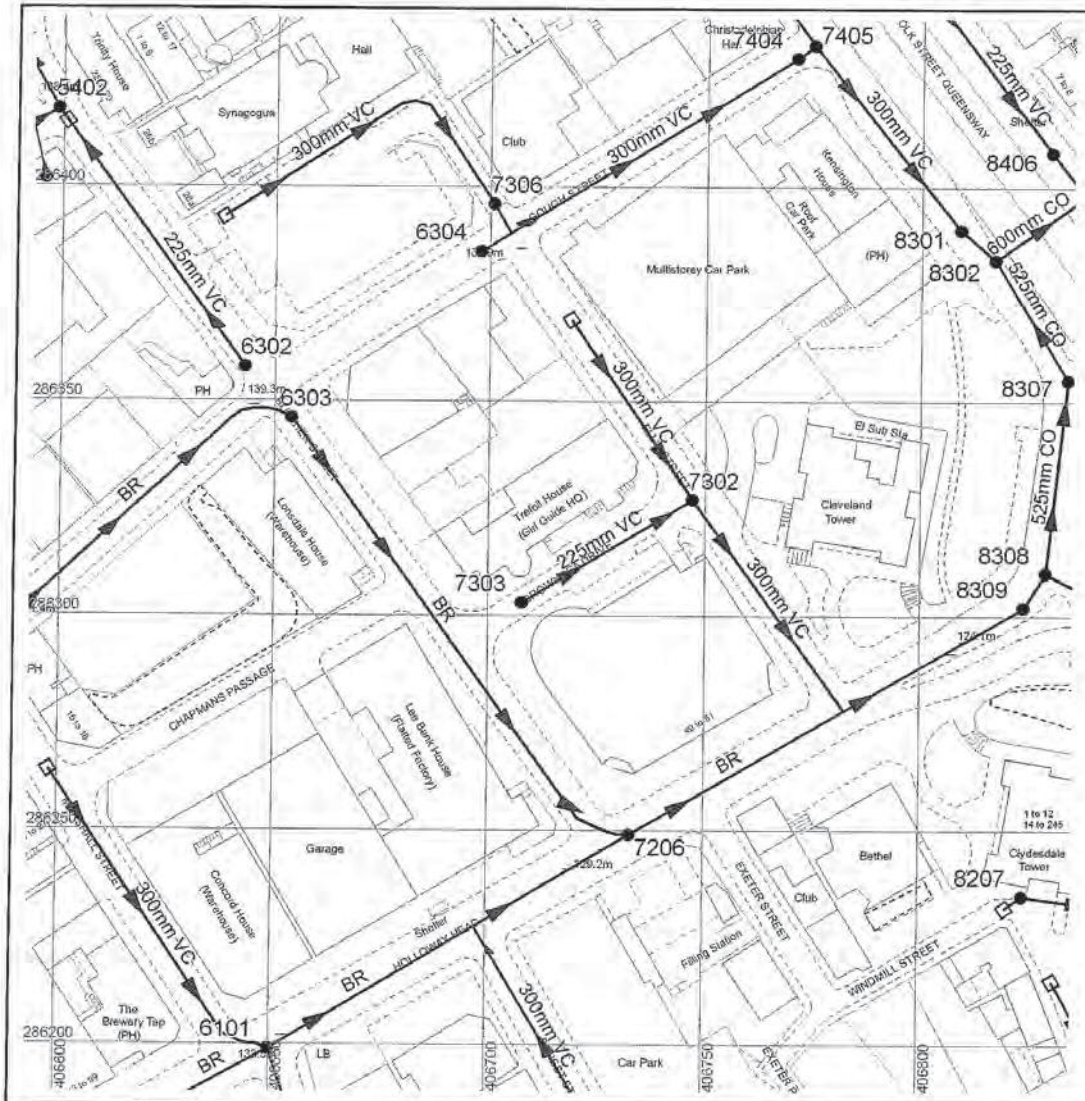
Permeability



- Free draining
- Highly variable permeability
- Poorly draining

APPENDIX G

SEVERN TRENT SEWER RECORDS



Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SP06865404	nil	nil	nil	C	VC	C	300	nil	0.00	2006
SP06865402	138.50	135.36	133.66	C	VC	C	525	nil	13.09	nill
SP06866101	133.62	130.00	124.83	C	BR	E	680	570	18.78	nill
SP06866302	139.68	137.29	136.35	C	VC	C	225	nil	75.32	nill
SP06866303	136.98	135.00	124.64	C	BR	E	550	700	12.54	nill
SP06866304	136.32	133.10	122.77	C	VC	C	300	nil	8.30	1979
SP06867206	128.45	124.83	119.63	C	BR	E	720	540	20.21	nill
SP06867303	132.45	130.45	126.48	C	VC	C	225	nil	11.53	nill
SP06867306	136.26	133.02	nil	C	VC	C	300	nil	0.00	nill
SP06867302	129.59	126.38	nil	C	VC	C	300	nil	0.00	nill
SP06867404	125.90	122.77	121.69	C	VC	C	300	nil	4.63	nill
SP06867405	125.39	121.59	nil	C	VC	C	300	nil	0.00	nill
SP06868207	nil	nil	nil	C	VC	C	150	nil	0.00	nill
SP06868301	123.62	nil	115.97	C	VC	C	300	nil	0.00	nill
SP06868302	123.30	115.84	115.32	C	CO	C	600	nil	49.63	nill
SP06868309	123.53	119.63	nil	C	CO	C	450	nil	0.00	nill
SP06868306	123.14	118.13	nil	C	CO	C	525	nil	0.00	nill
SP06868307	122.44	nil	115.67	C	CO	C	525	nil	0.00	nill
SP06868406	123.12	119.38	115.44	C	VC	C	225	nil	3.25	nill

- Abandoned Gravity Sewer
- Private Combined Gravity Sewer
- Private Foul Gravity Sewer
- Private Surface Water Gravity Sewer
- Public Combined Gravity Sewer
- Public Foul Gravity Sewer
- Public Surface Water Gravity Sewer
- Trunk Combined Gravity Sewer
- Trunk Foul Use Gravity Sewer
- Trunk Surface Water Gravity Sewer
- Combined Use Pressurised Sewer
- Foul Use Pressurised Sewer
- Surface Water Pressurised Sewer
- Highway Drain
- Combined Lateral Drain (SS)
- Foul Lateral Drain (SS)
- Surface Water Lateral Drain (SS)

All Private Sewers are shown in magenta
All section 104 sewers are shown in green
All Non-Sewer Standard (NSS) Lateral Drains are shown in orange

- Culverted Watercourse
- Cable, Earthing
- Cable Junction
- Cable, Optical Fibre/Instrumentation
- Cable, Low Voltage
- Cable, High Voltage
- Cable, Other
- Housing, Building
- Housing, Kiosk
- Disposal Site
- Sewage Treatment Works
- Housing, Other
- Pipe Support Structure
- Sewage Pumping Facility
- Sewer Facility Connection Inlet / Outlet

- Blind Shaft
- Combined Use Manhole
- Flushing Chamber
- Foul Use Manhole
- Grease Trap
- Head Node
- Hydrobrake
- Lamphole
- Outfall
- Overflow
- Penstock
- Petrol Interceptor
- Sewer Blockage
- Sewer Collapse

- Sewer Chemical Injection Point
- Sewer Junction
- Sewerage Air Valve
- Sewerage Hatch Box Point
- Sewerage Isolation Valve
- Soakaway
- Surface Water Manhole
- Vent Column
- Waste Water Storage
- SSSI Area
- Access Right
- Pre-1937 Properties

TABULAR KEY

A. Sewer pipe data refers to downstream sewer pipe.
B. Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.
C. Gradient is stated a 1 in..

MATERIALS

- - NONE
- AC - ASBESTOS CEMENT
- BR - BRICK
- CC - CONCRETE BOX CULVERT
- CI - CAST IRON
- CO - CONCRETE
- CSB - CONCRETE SEGMENTS (BOLTED)
- CSU - CONCRETE SEGMENTS (UNBOLTED)
- DI - DUCTILE IRON
- GRC - GLASS REINFORCED CONCRETE
- GRP - GLASS REINFORCED PLASTIC
- MAS - MASONRY IN REGULAR COURSES
- MAR - MASONRY RANDOMLY COURSED
- PE - POLYETHYLENE
- PF - PITCH
- PP - POLYPROPYLENE
- PSC - PLASTIC STEEL COMPOSITE
- PVC - POLYVINYL CHLORIDE
- RPM - REINFORCED PLASTIC MATRIX
- SI - SPUN (GREY) IRON
- ST - STEEL
- U - UNKNOWN
- VC - VITRIFIED CLAY
- XXX - OTHER

SHAPE

- C - CIRCULAR
- E - EGG SHAPED
- O - OTHER
- R - RECTANGLE
- S - SQUARE
- T - TRAPEZOIDAL
- U - UNKNOWN

PURPOSE

- C - COMBINED
- E - FINAL EFFLUENT
- F - FOUL
- L - SLUDGE
- S - SURFACE WATER

CATEGORIES

- W - WEIR
- C - CASCADE
- DB - DAMBOARD
- SE - SIDE ENTRY
- FV - FLAP VALVE
- BD - BACK DROP
- S - SIPHON
- HD - HIGHWAY DRAIN
- S104 - SECTION 104

N W E

RECEIVED 10 JUN 2009

Severn Trent Water

Severn Trent Water Limited
Waterworks Road
Edgbaston
Birmingham
B16 9DD
Telephone: 0845 601 6616

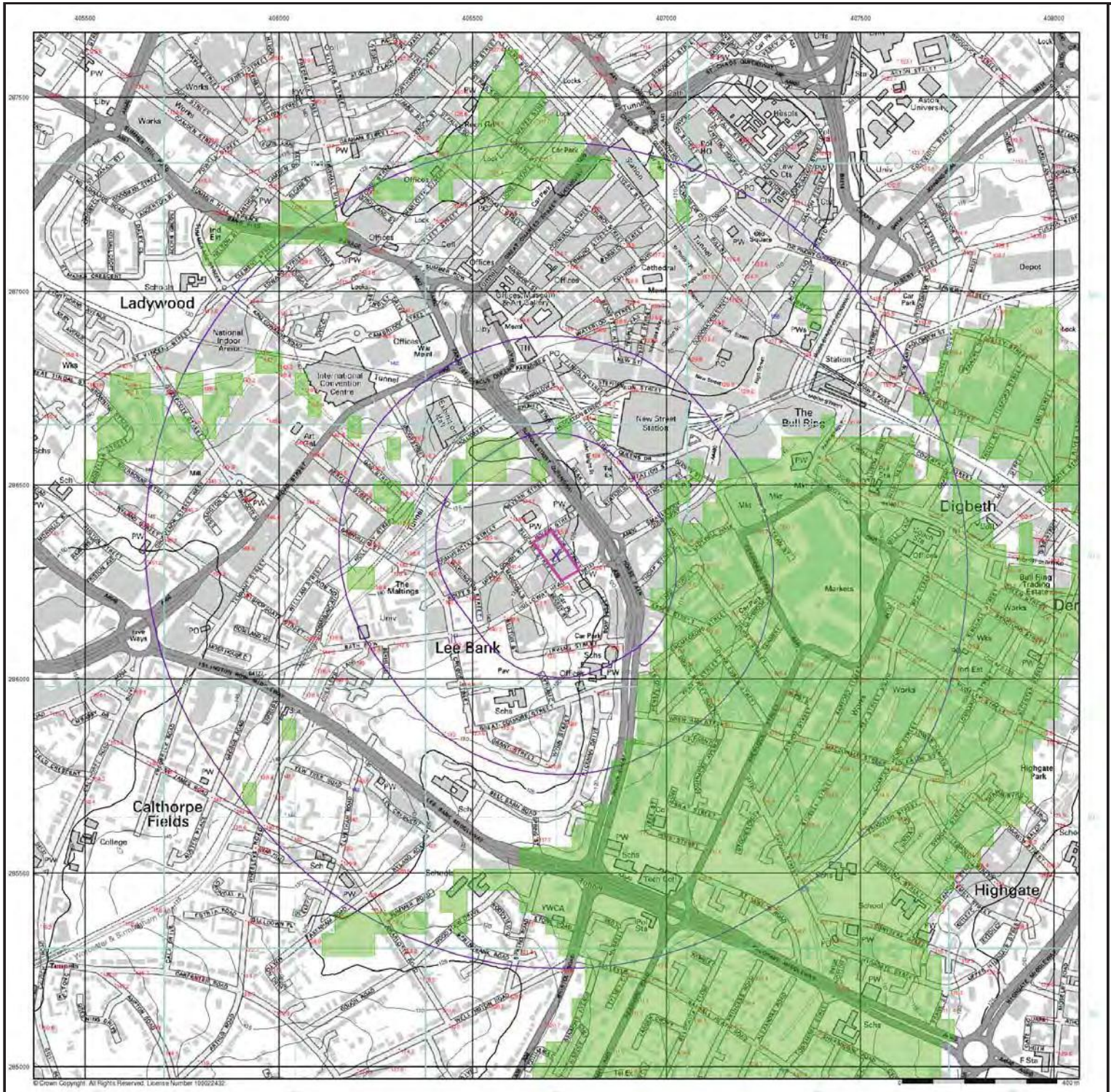
SEWER RECORD (Tabular)

O/S Map scale: 1:250
Date of issue: 12.06.09
Sheet No. 1 of 1

This map is centred upon:
O / S Grid reference:
x : 406714
y : 286314

Do not scale off drawing.

APPENDIX H
RMS FLOOD RETURN DATA



Envirocheck® Flood
A Landmark service

RMS 75 year Return Flood Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

RMS 75 year Return Flood Data

Flood Depth (mm)	Flood Type: Defended Flood	Flood Type: Undefended Flood	Pluvial Flood (flood depth n/a)
0 - 200			
201 - 500			
501 - 2000			
2001 +			

Contours (height in metres)

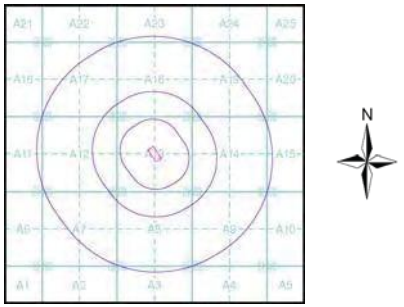
Standard Contour — 105 — 100 — 95

Index Contour

+167.3 Spot Height

+45.8 Air Height

RMS 75 year Return Flood Map - Slice A



Order Details

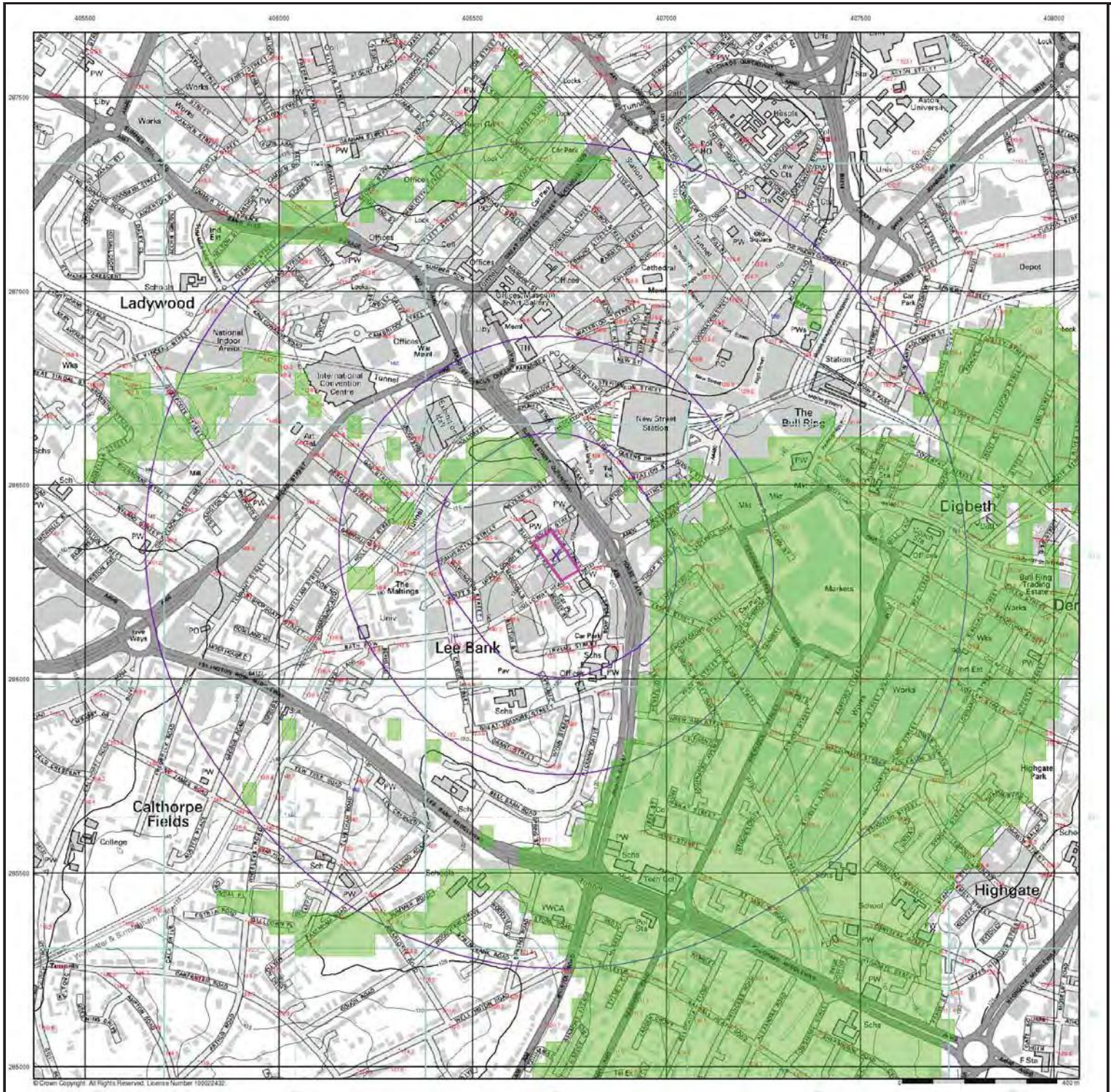
Order Number:	27750464_1_1
Customer Ref:	1913
National Grid Reference:	406720, 286320
Slice:	A
Site Area (Ha):	0.7
Search Buffer (m):	1000

Site Details

49-51 Holloway Head, BIRMINGHAM, B1 1QP

LANDMARK Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Envirocheck® Flood
A Landmark service

RMS 100 year Return Flood Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

RMS 100 year Return Flood Data

Flood Depth (mm)	Flood Type: Defended Flood	Flood Type: Undefended Flood	Pluvial Flood (flood depth n/a)
0 - 200			
201 - 500			
501 - 2000			
2001 +			

Contours (height in metres)

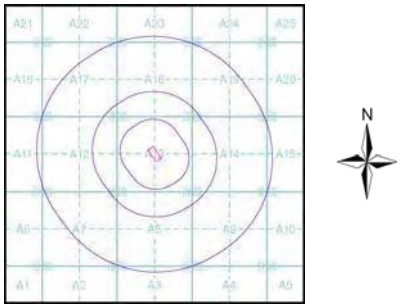
Standard Contour — 105 — 100 — 95

Index Contour

167.3 Spot Height

45.8 Air Height

RMS 100 year Return Flood Map - Slice A



Order Details

Order Number:	27750464_1_1
Customer Ref:	1913
National Grid Reference:	406720, 286320
Slice:	A
Site Area (Ha):	0.7
Search Buffer (m):	1000

Site Details

49-51 Holloway Head, BIRMINGHAM, B1 1QP

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Tel: 0844 844 9952
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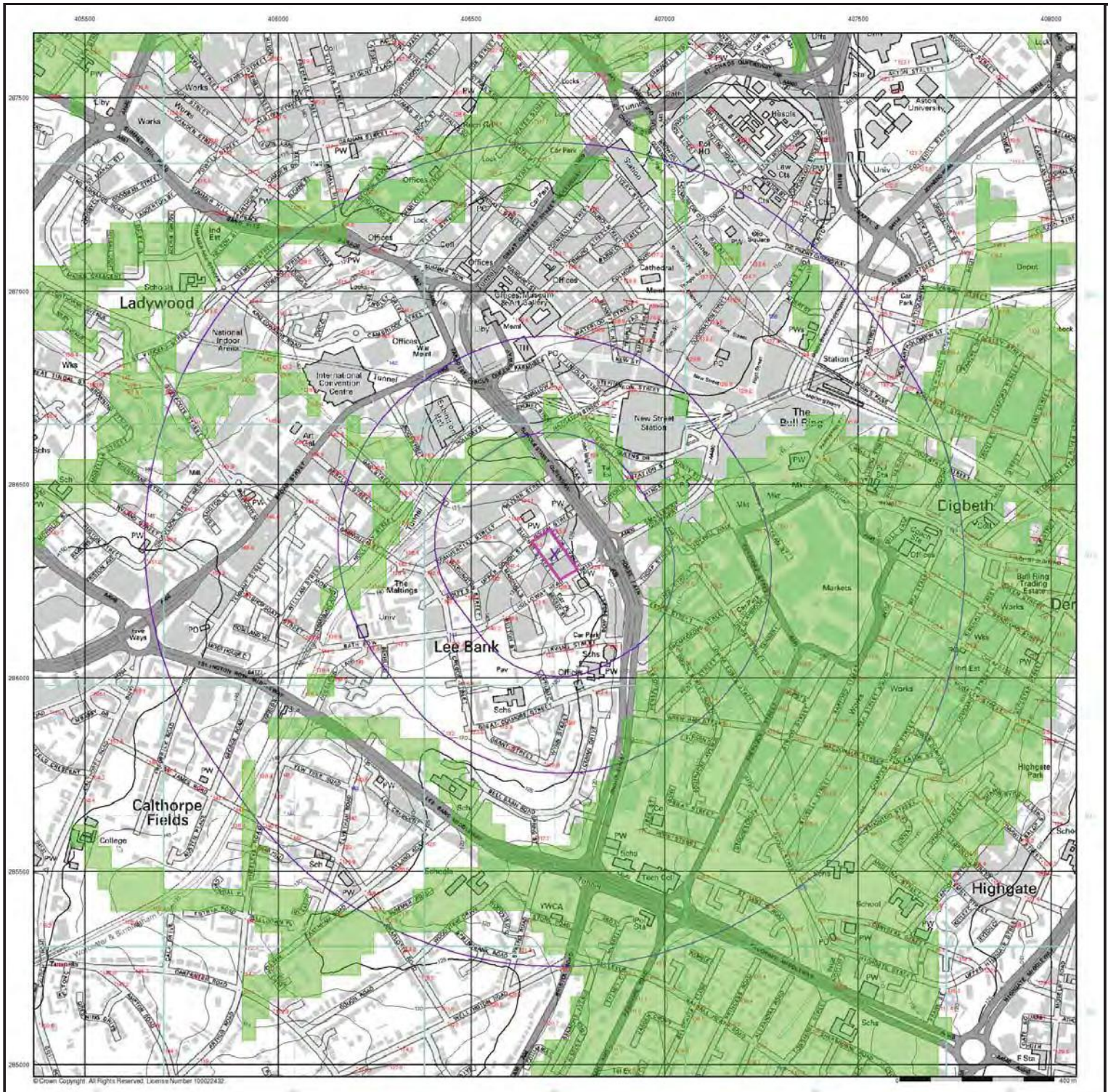


Envirocheck® Flood

A Landmark service

RMS 1000 year Return Flood Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

RMS 1000 year Return Flood Data

Flood Depth (mm)	Flood Type: Defended Flood	Flood Type: Undefended Flood	Pluvial Flood (flood depth n/a)
0 - 200			
201 - 500			
501 - 2000			
2001 +			

Contours (height in metres)

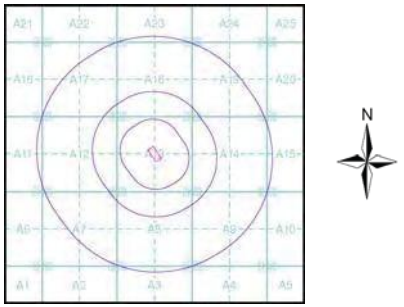
Standard Contour — 105 — 100 — 95

Index Contour

*167.3 Spot Height

*45.8 Air Height

RMS 1000 year Return Flood Map - Slice A



Order Details

Order Number:	27750464_1_1
Customer Ref:	1913
National Grid Reference:	406720, 286320
Slice:	A
Site Area (Ha):	0.7
Search Buffer (m):	1000

Site Details

49-51 Holloway Head, BIRMINGHAM, B1 1QP

LANDMARK Information Group

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Fax: 0844 844 9951
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