

LAND WEST OF GLOUCESTER ROAD, GLOUCESTER

Flood Risk and Drainage Statement

AAC5655

2

25 September 2020

REPORT

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
1	Site Promotion	[REDACTED]	[REDACTED]	[REDACTED]	14.08.2020
2	Latest layout added	[REDACTED]	[REDACTED]	[REDACTED]	25.09.2020

Approval for issue

[REDACTED] 25 September 2020

The report has been prepared for the exclusive use and benefit of our client and solely for the purpose for which it is provided. Unless otherwise agreed in writing by RPS Group Plc, any of its subsidiaries, or a related entity (collectively 'RPS') no part of this report should be reproduced, distributed or communicated to any third party. RPS does not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report. The report does not account for any changes relating to the subject matter of the report, or any legislative or regulatory changes that have occurred since the report was produced and that may affect the report.

The report has been prepared using the information provided to RPS by its client, or others on behalf of its client. To the fullest extent permitted by law, RPS shall not be liable for any loss or damage suffered by the client arising from fraud, misrepresentation, withholding of information material relevant to the report or required by RPS, or other default relating to such information, whether on the client's part or that of the other information sources, unless such fraud, misrepresentation, withholding or such other default is evident to RPS without further enquiry. It is expressly stated that no independent verification of any documents or information supplied by the client or others on behalf of the client has been made. The report shall be used for general information only.

Prepared by:

RPS Consulting Services Limited

[REDACTED]
Assistant Hydrologist

Salisbury House, 2a Tettenhall Road
Wolverhampton, West Midlands WV1 4SA

Prepared for:

Tritax Symmetry

[REDACTED]
Development Director

Grange Park Court, Roman Way,
Northampton, NN4 5EA

Contents

1	INTRODUCTION	1
2	SITE DETAILS	2
2.1	Site Overview	2
2.2	Site Description and Surrounding Area	3
2.3	Development Proposals	3
3	SCOPING STUDY	4
3.1	Stroud District Council Strategic Flood Risk Assessment, November 2019.....	4
3.2	Gloucestershire County Council Local Flood Risk Management Strategy, Summer 2014	4
3.3	Gloucestershire Sustainable Drainage Systems (SuDS) Design and Maintenance Guide, November 2015.....	5
3.4	Consultation with Gloucestershire County Council	5
3.5	Consultation with Environment Agency	5
4	FLOOD RISK STATEMENT	7
4.1	Introduction.....	7
4.2	Fluvial.....	7
4.3	Pluvial, Surface Runoff and Ponding	8
4.4	Groundwater.....	9
4.5	Reservoir	9
5	DRAINAGE STATEMENT	11
5.1	Introduction.....	11
5.2	Existing Surface Water Drainage	11
5.3	Existing Foul Water Drainage	11
5.4	Proposed Surface Water Drainage	11
5.5	Proposed Foul Water Drainage.....	12
5.6	Maintenance and Adoption	13
6	CONCLUSIONS AND RECOMMENDATIONS	14
6.1	Review of Flood Risk	14
6.2	Review of Drainage Statement	14

Appendices

Appendix A – Topographic Survey

Appendix B – Masterplan

Appendix C – Correspondence with Gloucestershire County Council

Appendix D – Correspondence with the Environment Agency

Appendix E – Extract from Geo-Environmental Risk Assessment

Appendix F – Severn Trent Water Developer Enquiry and Sewer Records

Appendix G – QBAR Greenfield Runoff Rate

Appendix H – Preliminary MicroDrainage Calculations

1 INTRODUCTION

RPS Consulting Services Limited has been commissioned to undertake a Flood Risk and Drainage Statement on behalf of Tritax Symmetry for a proposed commercial development at Land to the West of Gloucester Road, Haresfield, Gloucester.

The proposal is for a commercial development located adjacent to Junction 12 of the M5, comprising logistics floor space divided across approximately 7 units. The site is being promoted through the Stroud District Local Plan, to assist in meeting Gloucestershire's regional employment needs.

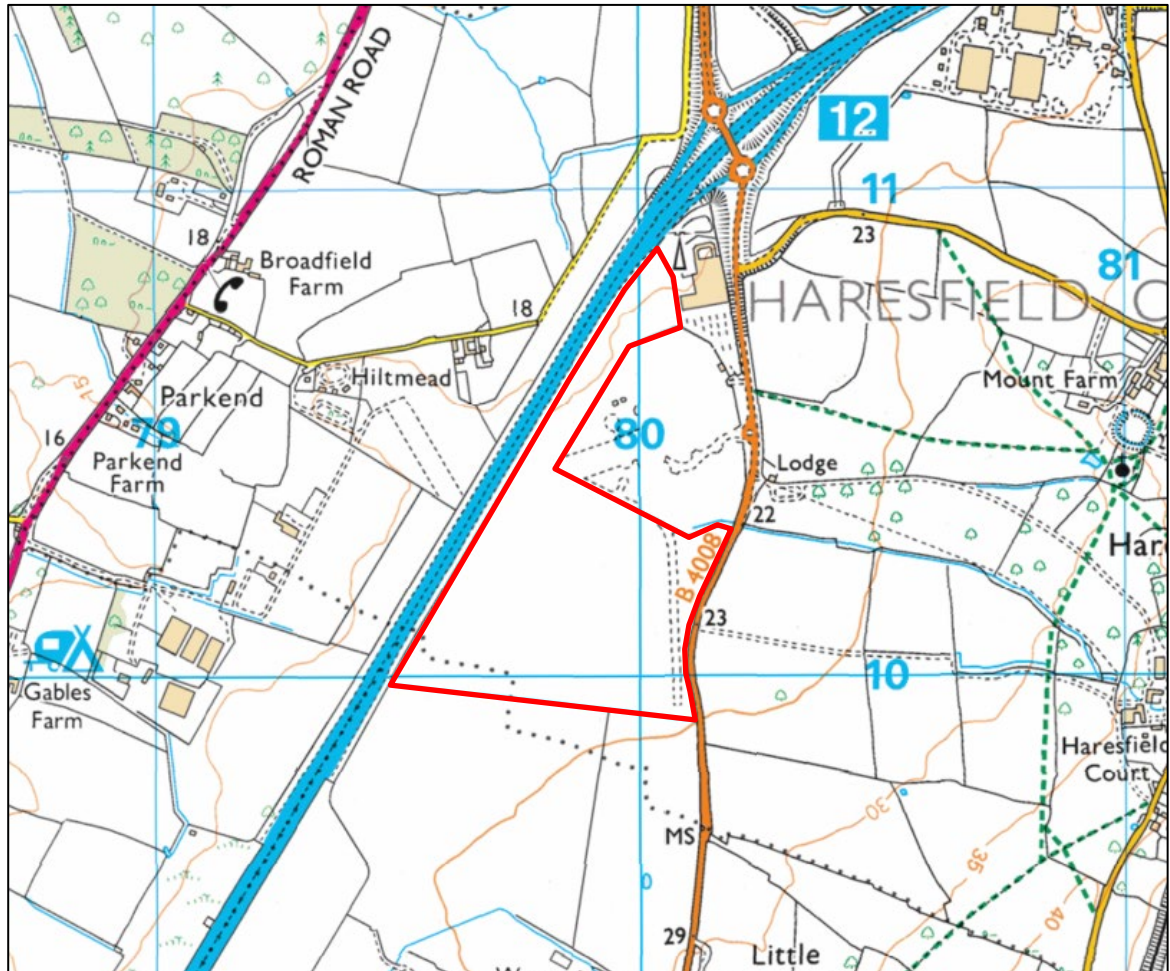
The Flood Map for Planning demonstrates that the vast majority of the site is located within Flood Zone 1. Land in Flood Zone 1 is assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%), the lowest classification of fluvial flood risk. A small area in the northern corner of the site is located within Flood Zone 2, which is land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

The Drainage Statement indicates that the site can sustainably manage surface water arising from the development up to the 1 in 100 year +40% climate change storm event. Suitable SuDS features should be incorporated within the site designs to attenuate surface water prior to discharging from the site at the greenfield runoff rate.

2 SITE DETAILS

2.1 Site Overview

The Application Site is shown in Figure 3.1 below. The site is located to the West of Gloucester Road, Haresfield, Gloucester (National Grid Reference 379834, 210185) and covers an area of approximately 27.14 hectares (ha). The consultees associated with this location are provided in Table 3.1.



Contains OS data © Crown Copyright and database right 2020.

Approximate site boundary indicated in red, for location purposes only.

Figure 2.1: Site Location Plan

Table 2.1: Site Specific Data and Consultees

OS NGR	SO79831018
Local Planning Authority	Stroud District Council (SDC)
Lead Local Flood Authority	Gloucestershire County Council (GCC)
Sewer Utility Company	Severn Trent Water (STW)

2.2 Site Description and Surrounding Area

The site is located approximately 8.5km south of Gloucester's city centre, comprising a parcel of land of irregular shape. The site covers an area of approximately 27.14 ha. The land generally falls towards the north west, from a level of approximately 24.7m Above Ordnance Datum (AOD), to approximately 18.7m AOD. The topographical survey is included within Appendix A for reference.

The site is currently greenfield land, primarily used for agricultural purposes. A portion of the site is presently being used for the construction taking place on the adjacent land.

The western boundary of the site is delineated by the M5 and Gloucester Road makes up the eastern boundary. Further agricultural land is located to the south of the site, whilst an energy-from-waste facility and a garden centre are located beyond the northern boundary.

2.3 Development Proposals

The proposal is for a commercial development located adjacent to Junction 12 of the M5, comprising logistics floor space divided across approximately 7 units. The site is being promoted through the Stroud District Local Plan, to assist in meeting Gloucestershire's regional employment needs.

The site masterplan is provided in Appendix B for reference.

3 SCOPING STUDY

3.1 Stroud District Council Strategic Flood Risk Assessment, November 2019

This Strategic Flood Risk Assessment (SFRA) undertakes a Level 2 assessment of the site options identified for potential allocation with the emerging Stroud Local Plan. The SFRA considers all sources of flooding within the study area including fluvial, surface water, groundwater, sewers, canals and reservoirs. It provides an update to the policy and flood risk information provided in the existing Stroud Level 1 SFRA (2008) and builds upon the Level 2 SFRA for Stroud originally published in March 2012.

Stroud has experienced several notable flood events, including the January 1939, March 1947, July 1968, December 1981, January 1990, December 2000 and summer 2007 events. The fluvial flood risk within the Stroud District is high, due to the presence of numerous watercourses, many with steep catchments which respond rapidly to rainfall. The highest surface water flood risk in Stroud District is associated with the steep river catchments of The Cam and River Frome.

The areas of highest groundwater flood risk within the district broadly correspond with the locations of permeable superficial geology deposits, and surface aquifers. Groundwater flooding has been recorded across the Stroud District by GCC. There are records of groundwater flooding in Little Haresford (December 2017) and Standish (March 2018), located approximately 0.8km and 1.6km southeast of the proposed development site, respectively. The Risk of Flooding from Groundwater Map illustrates that the whole site is located within an area with less than 25% chance of groundwater emergence, however land immediately south of the site is within an area with 50-75% chance of groundwater emergence.

Sustainable Drainage Systems (SuDS) can be integrated into the design of all new development within Stroud District. The effectiveness of SuDS within a site is defined by site characteristics including (but not limited to) topography, geology, soil permeability, water table, existing water flows across the site, land ownership and extent of site coverage necessary to effectively manage surface water runoff and drainage.

3.2 Gloucestershire County Council Local Flood Risk Management Strategy, Summer 2014

The Local Flood Risk Management Strategy (LFRMS) was prepared by GCC. It sets out the vision and framework for managing flood risk, identifies the most vulnerable communities across Gloucestershire, and identifies the range of measures that will be taken in partnership with others to manage flood risk. The LFRMS is an important tool to help individuals, communities, businesses and authorities understand and manage flood risk within the county.

Gloucestershire has a long history of flooding. In the summer 2007 Gloucestershire experienced one of the most significant flood incidents seen in the UK, which resulted in 5000 homes and businesses flooded. Significant flooding also occurred in both November and December 2012, where an estimated 125-150 properties suffered from flooding.

The LFRMS sets out strategic objectives to help manage local flood risk across Gloucestershire:

- Improve our understanding of flood risk.
- Put in place plans to manage these risks.
- Avoid inappropriate development and ensure that new development does not increase flooding elsewhere.
- Increase public awareness of flooding and encourage communities to take action.
- Ensure close partnership working and coordination with other Risk Management Authorities and local communities.
- Support response to, and recovery from, flooding incidents.

3.3 Gloucestershire Sustainable Drainage Systems (SuDS) Design and Maintenance Guide, November 2015

This document was prepared by GCC to provide guidance to developers, designers, engineers and other professionals on the council's requirements for the design of SuDS in Gloucestershire. It sets out the planning, design and maintenance requirements for the delivery of attractive and high quality SuDS schemes that would offer multiple benefits to the environment and communities and will ensure a smooth and satisfactory SuDS approval process.

The main requirements outlined in this SuDS guide are summarised below:

- To minimise the impact of the development on the environment, surface water discharges from the site should not exceed the current runoff rate from the pre-developed site.
- The assessment must make due allowance to the effects of climate change over the lifetime of the development.
- Evidence that the hierarchal approach has been applied to the discharge of surface water must be provided.
- Developers must demonstrate they have considered the possibility that their drainage design might fail even if the system is designed for 100 year storms with allowance for climate change.

3.4 Consultation with Gloucestershire County Council

GCC were consulted on 26th June 2020 regarding the proposed development, and the response is provided in Appendix C for reference. The information provided by GCC is summarised below:

- The LLFA has a report of highway flooding on Stonehouse to the northeast of the site in 2007 and a report of property flooding in 2012 from surface water to the east. There is also a report of the M5 Junction 12 southbound slip road and carriageway flooding in 2007.
- The drainage strategy should comply with the principles of SuDS hierarchy for surface water.
- Where necessary, infiltration tests should be completed to BRE Digest 365 standard and the results provided.
- There should be no surface water flooding on site for rainfall events up to and including the 1 in 30 year event and no internal flooding to properties up to the 1 in 100 year +40% Climate Change event.
- Discharging into an ordinary watercourse may require Land Drainage Consent from Stroud District Council.
- When developing next to a watercourse, it is recommended a 5-8m strip of land be kept free for maintenance purposes.
- Any attenuation features should be shown including calculations for stored volumes and discharge rates.
- For greenfield developments, the peak discharge rate up to the 1 in 100 year rainfall event +40% Climate Change should never exceed the peak greenfield runoff rate for the same event.
- The drainage strategy should not result in any deterioration in water quality and the use of SuDS should improve water quality wherever possible.

3.5 Consultation with Environment Agency

The EA were consulted regarding the proposed development on 20th July 2020, their response is provided within Appendix D for reference.

A full Product 4 response could not be provided because there is no detailed modelled information available for this site and the EA do not have any records of flooding in this area. Although there are no records of historical flooding in the area, the absence of coverage does not mean that the area has never flooded, only that the EA do not currently have records of flooding in this area.

4 FLOOD RISK STATEMENT

4.1 Introduction

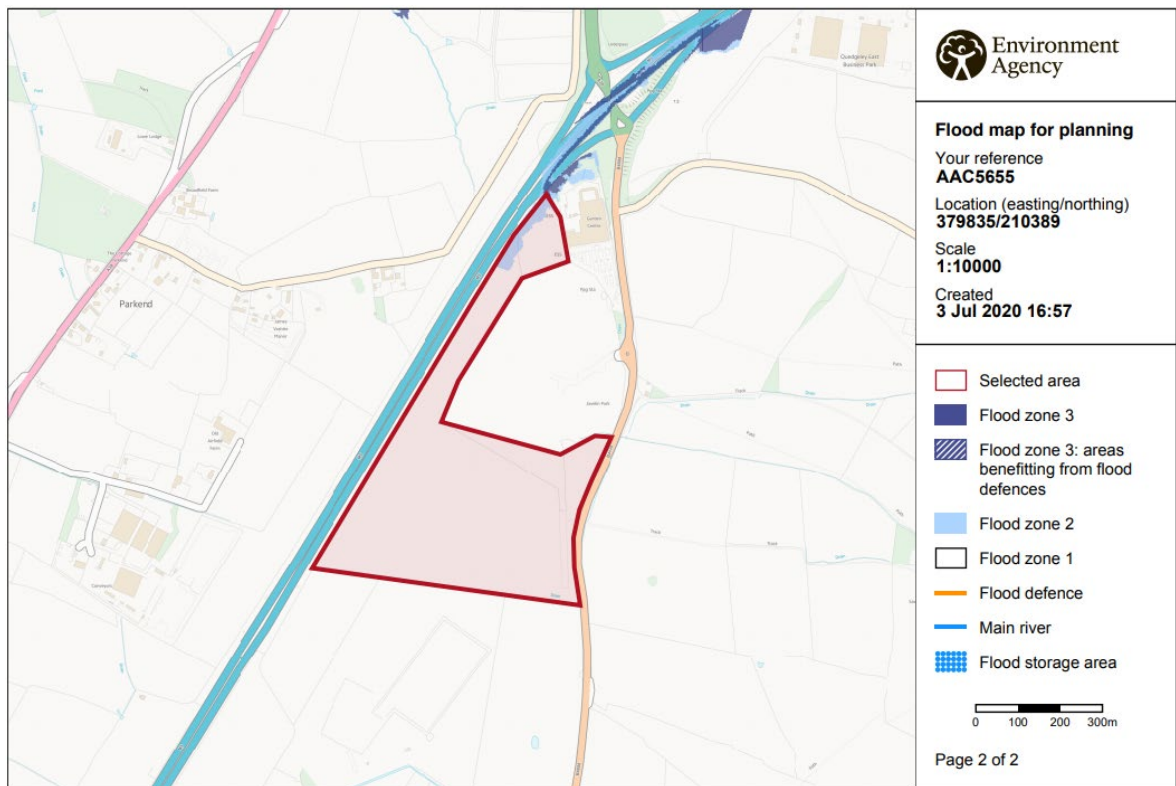
Following the scoping exercise, the potential flood risks to the proposed development site have been assessed in greater detail.

4.2 Fluvial

The Environment Agency (EA) is responsible for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea and provides an online information service through the Flood Map for Planning hosted on the 'GOV.UK' website (<https://flood-map-for-planning.service.gov.uk/>). This data is not intended to provide detailed flood information for individual properties, but the information can be used as part of a flood risk assessment to inform a planning application. An extract of the Flood Map for Planning obtained from the 'GOV.UK' website is provided below in Figure 4.1.

The map demonstrates that the vast majority of the site is located within Flood Zone 1. Land in Flood Zone 1 is assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%), the lowest classification of fluvial flood risk. A small area in the northern corner of the site is located within Flood Zone 2, which is land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Flood zones associated with a tributary of the Beaurepair Brook encroach into the northern tip of the site. Although development is proposed within this area of the site, commercial development is appropriate within Flood Zone 2, as it is classed as 'less vulnerable'. Risk can be further reduced through informed layout and design of the development. There are drainage ditches located along the southern boundary and to the east of the site, these watercourses are not considered to pose a fluvial flood risk to the proposed development.



© Environment Agency copyright and / or database rights 2018. All rights reserved. © Crown Copyright and database right 2018. Ordnance Survey licence number 100024198.

Approximate site boundary indicated in red, for location purposes only.

Figure 4.1: EA Flood Map for Planning (accessed 03.07.2020)

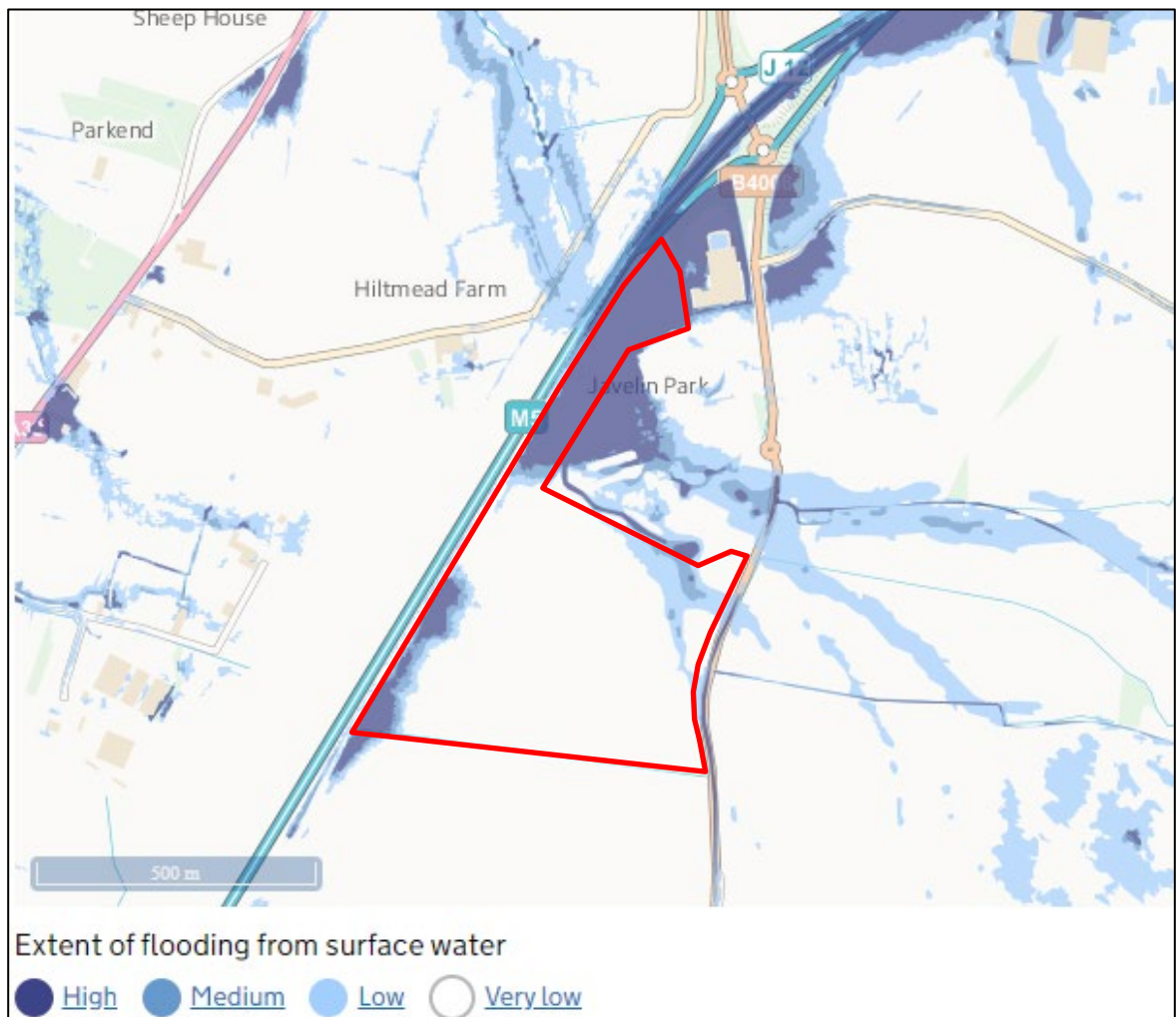
4.3 Pluvial, Surface Runoff and Ponding

Pluvial flooding is defined as flooding which results from rainfall-generated overland flow, before the runoff enters any watercourse or sewer. It is usually associated with high intensity rainfall events (typically >30mm/h) but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen, developed or otherwise has low permeability resulting in overland flow and ponding in depressions in the topography. Urban pluvial flooding arises from high intensity ‘extreme’ rainfall events. In such situations underground sewerage and drainage systems and surface watercourses may be completely overwhelmed.

Surface water flood risk is defined by the EA as:

- ‘Very low’ risk of surface water flooding; land assessed as having less than 1 in 1,000 (0.1%) chance of flooding in any given year.
- ‘Low’ risk of surface water flooding; land assessed as having between 1 in 100 (1%) and 1 in 1,000 (0.1%) chance of flooding in any given year.
- ‘Medium’ risk of surface water flooding; land assessed as having between 1 in 30 (3.3%) and 1 in 100 (1%) chance of flooding in any given year.
- ‘High’ risk of surface water flooding; land assessed as having greater than 1 in 30 (3.3%) chance of flooding in any given year.

As illustrated within Figure 4.2 below, most of the application site is assessed as being at ‘very low’ risk of surface water flooding.



Approximate site boundary indicated in red, for location purposes only.

Figure 4.2: EA Flood Map for Surface Water (accessed 08.07.2020)

There is an area at potential 'high' risk of surface water flooding in the narrow northern section of the site. This would appear to be associated with the existing drainage network passing beneath the M5 motorway (SO 7992 1071) before continuing west to join the Gloucester and Sharpness Canal.

It is accepted that the EA Flood Map for Surface Water is unlikely to be reliable at a very local scale because it is imprecise due to national assumptions made about rainfall, surface water run-off, topography and the stormwater drainage network.

Some features, such as smaller hydraulic structures or flow paths may not be represented in the modelling. In addition, some flow paths under bridges and roads are not always captured within the modelling because the top of the feature is represented rather than the opening through it. This can cause the resulting flood extent to show a different pattern of flooding than would be expected.

A smaller area of 'low' to 'high' risk was identified along the western boundary near the south west corner. The majority of this flooding (up to the 1% chance of flooding) is below 300mm. It would appear to be the result of surface water collecting against the raised embankment of the motorway.

As stated within the SFRA, these areas tend to be isolated pockets of surface water flooding and the depth of flooding is typically shallow (<0.3m). Within these areas, it should be possible to mitigate the risk of surface water flooding through the use of appropriate SUDS techniques. Where there is potential for surface water flooding to be deeper it is recommended that areas are retained as open space along with identified surface water flow routes.

The introduction of a positive drainage system once the site is developed will ensure that surface water is intercepted and fully managed such that it will not pose a flood risk to existing or proposed development.

4.4 Groundwater

Groundwater flooding is defined as flooding caused by the emergence of water originating from underground. This water may emerge from either point or diffuse locations. Groundwater flooding is a significant but localised issue that has attracted an increasing amount of public concern in recent years. Unlike flooding from rivers and the sea, groundwater flooding does not pose a significant risk to life. It is however associated with significant damage to property, with some types of groundwater flooding persisting over many weeks.

A Phase 1 Preliminary Geo-environmental Risk Assessment was undertaken in June 2020 by RPS, an extract from the report is provided in Appendix E for reference. The site is underlain by Cheltenham Sand and Gravel, in the southern part of the site, and Blue Lias Formation and Charmouth Mudstone Formation across the remainder of the site. According to Groundwater vulnerability mapping, the site is in a zone of medium vulnerability associated with groundwater flow through poorly connected rock fractures.

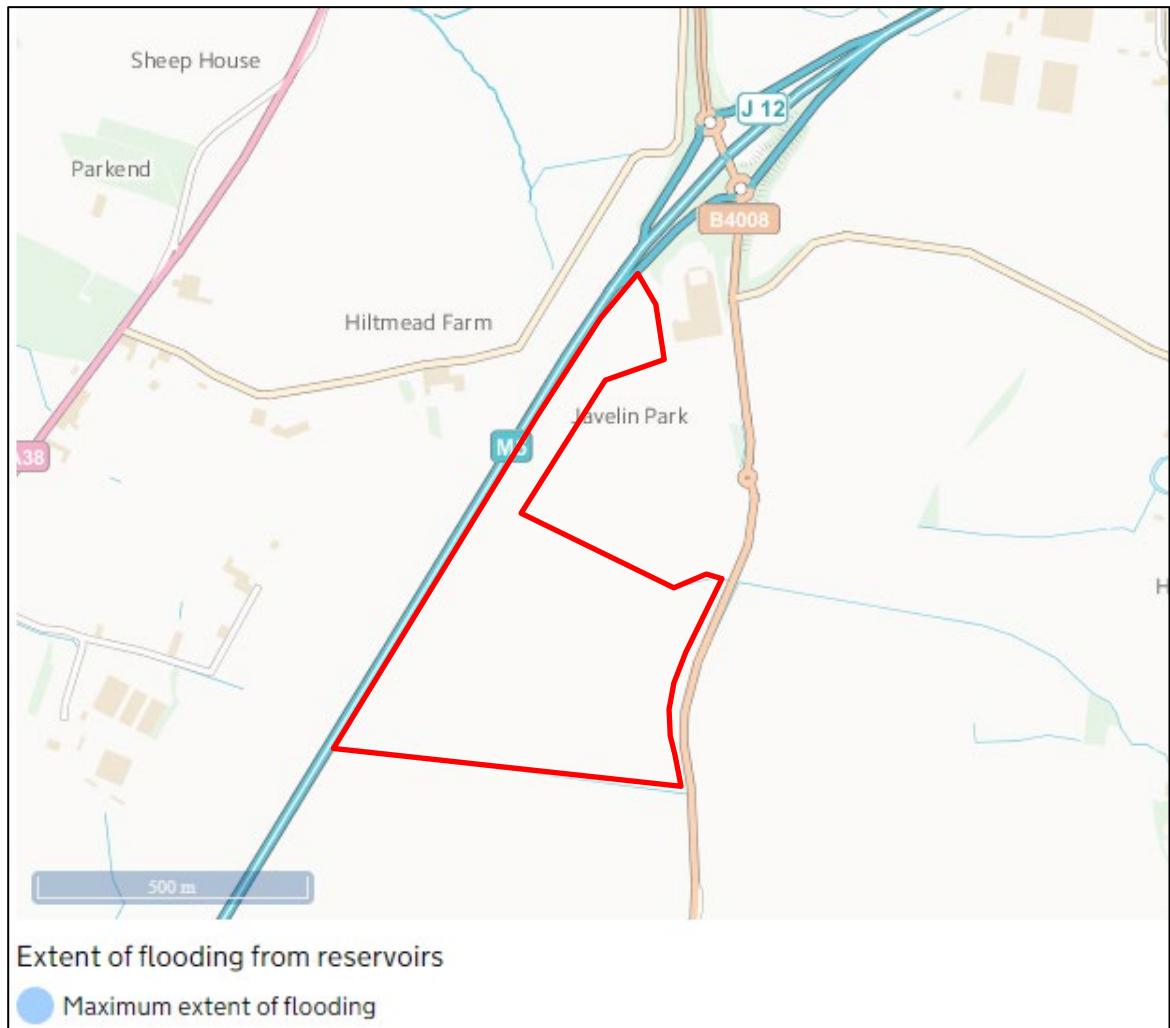
The Risk of Flooding from Groundwater Map provided within the SFRA, illustrates that the site is fully located within an area with less than 25% change of groundwater emergence. Therefore, it is not considered that groundwater flooding poses a considerable risk to the proposed development site. It is recommended that groundwater monitoring is undertaken prior to the site being developed, to get a better understanding of the groundwater regime.

4.5 Reservoir

An area is considered at risk from reservoir flooding if peoples' lives could be threatened by an uncontrolled release of water from a reservoir. If a location is at risk, flooding from reservoirs is extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925.

Long term flood risk information is hosted on the 'GOV.UK' website (<https://flood-warninginformationsservice.gov.uk/long-term-flood-risk/map>). The assessment provides mapping to illustrate the probability that a location will flood and the possible causes of flooding including flood risk from reservoirs.

The Flood Risk from Reservoirs Map in Figure 4.3 demonstrates that the whole site is outside of the maximum flood extent. No major reservoirs are located within close vicinity of the site. Therefore, reservoir flooding will not pose a risk to the proposed development site.



Approximate site boundary indicated in red, for location purposes only.

Figure 4.3:EA Flood Map, Flood risk from Reservoirs (accessed 08.07.2020)

5 DRAINAGE STATEMENT

5.1 Introduction

To demonstrate that all forms of flooding have been considered a Foul and Surface Water Drainage Statement has been developed. The aim of including this strategy is so that it can easily be seen that the Proposed Development will not adversely affect the surface water regime in the area and that overall the current situation will be improved.

5.2 Existing Surface Water Drainage

Sewer records from STW are provided in Appendix F for reference, indicating that there are no public surface water sewers located within the boundary of the site or within the vicinity of the site.

The greenfield nature of the site means that surface water will slowly soak into the ground (infiltrate), be intercepted by vegetation or run off by way of overland flow, according to the soil characteristics and following the topography of the site. Greenfield runoff rates for the site have been calculated by way of Interim Code of Practice for Sustainable Drainage Systems (ICP SUDS). This implements a pro rata IOH124 methodology, for sites below 50ha in size. The calculation has been included for reference within Appendix G and outputs are summarised within Table 5.1, below, based upon a hypothetical 1ha area.

Return Period	Greenfield Runoff Rate (l/s)
Q1	3.0
QBar	3.6
Q30	7.1
Q100	9.3

Table 5.1: Greenfield Runoff (for hypothetical 1ha area)

5.3 Existing Foul Water Drainage

STW sewer records are included in Appendix F for reference, indicating that there are no public foul water sewers located within the site boundary. Two foul pumping stations are located to the east of the site, along with a foul rising main that heads in a north easterly direction and connects into a combined sewer.

5.4 Proposed Surface Water Drainage

Under the terms of Section 3 of Approved Document H3 of the Building Regulations 2010 (2015 edition), soakaways should be utilised as the primary means of surface water disposal. If infiltration testing undertaken in accordance with BRE DG 365 (2016) provides an unfavourable infiltration rate across the site or contaminated ground is present within the site, other methods of sustainable drainage should be considered. A surface water connection to an existing watercourse should be considered prior to a connection into the public sewerage system.

A Phase 1 Preliminary Geo-environmental Risk Assessment was undertaken in June 2020 by RPS, an extract from the report is provided within Appendix E for reference. The site is underlain by Cheltenham Sand and Gravel, in the southern part of the site, and Blue Lias Formation and Charmouth Mudstone Formation across the remainder of the site. As the majority of the site consists of mudstone, which generally has a poor infiltration rate, it is likely that soakaway drainage will not

be suitable for the disposal of surface water. Consequently, the proposed surface water drainage system will need to consider the use of local attenuation and treatment with a positive outfall. At the detailed design stage, it would be beneficial to carry out soil permeability testing to inform SuDS design.

Preliminary calculations have been undertaken based on the current site layout. The MicroDrainage calculations are provided within Appendix H for reference and the parameters are outlined in Table 5.2 below.

Surface water drainage requirements	Units	Value
Site information		
Total Site Area	(ha)	27.142
Developable Area	(ha)	19.583
Impermeable Area (assuming 90% impermeable)	(ha)	17.625
Runoff rates		
QBAR Greenfield Runoff Rate	(l/s/ha)	3.6
Restricted runoff rate for site	(l/s)	63.5
Surface water storage requirements		
Storage volume requirement (1:100+40% increase for climate change)	(m ³)	13500
Storage area requirement (estimated) 1.5m deep basin with 1:3 banks	(m ²)	14200

Table 5.2: Breakdown of Surface Water Drainage Calculations

At the detailed design stage, it is anticipated that surface water will be captured within a gravity sewer system and attenuated prior to discharge within SuDS features, with a preference for above ground storage. Flows should be restricted to the greenfield runoff rate, ensuring the peak discharge rate up to the 1 in 100 year +40% Climate Change event does not exceed the peak greenfield runoff rate for the same event, as outlined within the Gloucestershire SuDS Design & Maintenance Guide.

The most appropriate location for SuDS features within the site would be along the western boundary, in particular in the north western and south western corners, as the topography of the site falls towards the western boundary as indicated in Appendix A. The surface water attenuation should be suitably sized to accommodate a 1 in 100 year +40% Climate Change storm event. This will ensure that surface water arising from the development is sustainably managed such that it does not pose a flood risk, either to existing or proposed development.

Surface water from the site should be discharged into a nearby watercourse or drainage ditch. Further investigation and surveying should be undertaken at the detailed design stage to confirm the most suitable outfall point.

No existing surface water drainage has been identified within the boundary of the site. Should any drainage features be located serving off site areas, it may be necessary that these are diverted or incorporated within the on-site drainage proposals.

Any proposed SuDS features should provide an easily managed landscape structure for temporary storage of water and to trap and treat pollutants prior to discharge. The location and design should also create opportunities for ecological and amenity benefits in the context of the development, subject to detailed landscape proposals. The designs should recognise the requirements of the Gloucestershire SuDS Design & Maintenance Guide.

5.5 Proposed Foul Water Drainage

Considering the location of the nearest public sewers, it is likely that foul water will have to be conveyed by a gravity sewer network to a new foul pumping station located within the site. A rising main will then convey the foul flows from the site to the nearest suitable connection point within the existing STW sewer network.

A Developer Enquiry was submitted to STW for the site, their response is provided in Appendix F for reference. STW confirm that there may be a need to undertake hydraulic modelling to determine whether Bath Road and RAF Quedgeley pumping stations require upgrading to increase capacity in the area.

Once a layout is fixed for the site, further liaison should be undertaken with STW in order to confirm whether the local network requires reinforcement works to accommodate the proposed development.

5.6 Maintenance and Adoption

A foul water connection into the existing network will be subject to the successful submission of a Section 106 agreement under the Water Industry Act and approval from STW.

Subject to detailed engineering designs, it is likely that both foul and surface water drainage systems within the development will be adopted by STW.

A specialist management company could be identified at the detailed design stage and appointed to maintain the proposed SuDS features for the lifetime of the development. The SuDS features should be maintained in line with the guidance provided in The SuDS Manual (C753).

6 CONCLUSIONS AND RECOMMENDATIONS

The proposed development at Land west of Gloucester Road, Gloucester has been assessed with regards to flood risk. It is not considered that flooding poses a risk to the proposed development of the site subject to and implementation of the recommended measures and drainage statement.

6.1 Review of Flood Risk

Based on the current proposals and masterplan;

- The proposed development will not be affected by current or future fluvial flooding;
- The development will not increase flood risk elsewhere;
- Multiple sources of flooding have also been assessed and it has been found that there will be no increase in risk of flooding from land, groundwater or sewers as a result of this development;
- There are no anticipated negative impacts associated with the proposed development;
- Positive social, economic and environmental impacts will result from the proposed development provided the layout and design consider the recommendations.

6.2 Review of Drainage Statement

Based on the current proposals and masterplan;

- Under the terms of Section H of the Building Regulations 2010, as the underlying ground conditions indicate that infiltration drainage may be unsuitable, soakaway testing should be undertaken to confirm this.
- The on site drainage solution should be suitable to attenuate flows up to and including the 1 in 100 year + 40% rainfall event.
- Surface water from the site should be discharged into a nearby watercourse or drainage ditch. Further investigation and surveying should be undertaken at the detailed design stage to confirm the most suitable outfall point.
- The onsite sewers are likely to be adopted by Severn Trent Water.
- A foul water connection to the existing public sewerage system will be subject to Section 106 approval from Severn Trent Water.
- A specialist management company could be identified at the detailed design stage and appointed to maintain the SuDS features for the lifetime of the development.

Appendix A – Topographic Survey



N

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
GH1	380205.207	210822.193	22.628
GH2	380274.109	210851.015	21.440
GH3	380465.063	210657.218	23.100
GH4	380406.791	210549.685	23.033
GH5	380226.846	210583.074	22.107
GH6	380207.588	210706.503	22.040
GH7	380235.651	210481.234	22.235
GH8	380214.233	210315.297	22.469
GH9	380115.945	210105.905	23.120
GH10	380021.260	209938.534	24.341
GH11	379777.251	209973.396	23.183
GH12	379599.191	209907.552	21.750
GH13	379639.328	210220.448	20.883
GH14	379725.297	210359.678	21.044

OS Note:
Some services may have been omitted due to parked vehicles.
The Ordnance Survey file is to be used as a guide only.

OS Buildings **Surveyed Buildings**

This survey has been orientated to the Ordnance Survey (OS) National Grid (OSGB36) via Global Navigation Satellite Systems (GNSS) and the O.S. Active Network (OS Net). A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGB15GB transformation models.
The survey has been correlated to this point and a further one or more OSGB36 (15) points established to create a true O.S. bearing for angle orientation.
No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.
Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Legend:

IC	Overhead Cable	IC	Overhead Cable	IC	Overhead Cable
PL	Plot	PL	Plot	PL	Plot
CP	Contour	CP	Contour	CP	Contour
...

greenhatch group

Topographical Surveys Measured Building Surveys
 Site Engineering 3D Laser Scanning
 Utility / CCTV Surveys Robotic BIM Models

**Rowan House
Duffield Road
Little Eaton
DE21 5DR**

Tel (01332) 830044 Fax (01332) 830055
 admin@greenhatch-group.co.uk
 www.greenhatch-group.co.uk

St Albans Unit B, The Courtyard St Albans West Yorkshire AL1 6LZ T: (01727) 854481	Newcastle 24 Riverside Studios Newcastle Bus Park Newcastle-Upon-Tyne NE4 7YL T: (0191) 2796391	London 25, Cornhill Terrace House London WC2R 0JL T: (0207) 241806
---	--	--

CLIENT
Tritax Symmetry

PROJECT
Symmetry Park,
Gloucester, GL10 3DP

TITLE
Topographical
Survey

SCALE A0@ 1: 1000	DATE 20.02.2020
DRAWN LB	QUALITY REF GH7006

Level datum See note
Grid orientation See note

Job number 36073

Drawing No **36073_T** Rev. **0**

Comments
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.
All dimensions should be checked on site prior to design and construction.
Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

Appendix B – Masterplan

NOTES
 This drawing and design is the copyright of aja architects ltd and must not be reproduced in part or in whole without prior written consent. Contractors must verify all dimensions on site before commencing work or preparing their drawings.
 Where this drawing contains any Ordnance Survey mapping material, it has been reproduced under license from the Ordnance Survey.
 Where this drawing contains any Ordnance Survey mapping material, it has been reproduced under license from the Ordnance Survey.
 Ordnance Survey © Crown Copyright

Symmetry Park - Gloucester East



Schedule of Accommodation

All areas are square feet gross internal

Unit	B8	Offices	Total	Parking	Net Site Area
04	385,000	17,500	402,500	312no. cars	21.29 acres
05	605,000	30,000	635,000	492no. cars	27.54 acres
	B2/B8				
06	10,000	1,000	11,000	7no. cars	2.65 acres
07	10,000	1,000	11,000	7no. cars	
08	10,000	1,000	11,000	7no. cars	
09	10,000	1,000	11,000	7no. cars	
10	40,000	2,000	42,000	32no. cars	3.05 acres
Total			1,123,500 sq.ft.		54.53 acres
Gross Site Area					66.71 acres

A 10/9/20 Layout and notes updated mjl
 no. date revision by

aja architects

aja architects ltd
 1170 Elliott Court
 Harold Avenue
 Coventry Business Park
 COVENTRY CV5 6UB
 E: aja@aja-architects.com
 W: www.aja-architects.com
 aja architects ltd is a limited liability partnership registered in England no. OC338721
 client

T: 024 7625 3200
 F: 024 7625 3210

TRITAX SYMMETRY
 A TRITAX BIG BOX COMPANY

project
 symmetry park
 Junction 12, M5
 Gloucester

drawing
 Illustrative Masterplan

scale 1:1250 drawn mjl
 checked mjl date 14/1/19

no
 6440 - 3 Rev A

Appendix C – Correspondence with Gloucestershire County Council

In response to the request for pre-application advice on surface water drainage on the above application the Lead Local Flood Authority (LLFA) can advise as follows. It should be noted that the LLFA is a statutory consultee on major development only and the applicant might want to seek advice from Stroud District Council should the development not meet our criteria.

A surface water drainage strategy is required for all applications and for sites greater than 1 ha or those within the Environment Agency's flood zones 2 or 3, a site specific flood risk assessment (FRA) is also required. Guidance on FRAs can be found at: <https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications>. The northern corner of the site is in flood zones 2 and 3. The Flood Map for Planning can be seen here: <https://flood-map-for-planning.service.gov.uk/>

The Risk of Flooding from Surface Water (RoFfSW) maps from the Environment Agency show there are areas of the site at high risk of surface water flooding. These maps can be found here: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>. The LLFA has a report of the M5 Junction 12 southbound slip road and carriageway flooding in 2007. The LLFA also has a report of highway flooding to the northeast of the site, on the road marked as Stonehouse on the location plan, in 2007 and a report of property flooding in 2012 from surface water to the east of the site.

The drainage strategy should comply with the principles of Sustainable Drainage Systems (SuDS) hierarchy for surface water. In doing so, consideration should be given first to infiltration, then discharge to a watercourse, then connecting to a public surface water sewer and finally connecting to a public combined sewer (with the necessary permissions from the relevant water company) if there are no other viable options. Where connections require crossing of third party land, agreement in principle from the relevant party should be included.

Where necessary, infiltration tests should be completed to BRE Digest 365 standard and the results provided. Please note that discharging to an ordinary watercourse (which includes ditches) may require Land Drainage Consent from Stroud District Council. If the strategy is to discharge into a watercourse then there would need to be proof that the site will still be able to drain or there is sufficient storage onsite for when the watercourse is in high flow or when the watercourse is in flood. If the site doesn't currently drain into the watercourse then we would need to provide proof that the risk of flooding is not increased as a result of increasing the discharge into it.

There should be no surface water flooding on site for rainfall events up to and including the 1 in 30 year event and no internal flooding to properties (including basements) up to the 1 in 100 year event (plus 40% for climate change). Development should not increase flood risk outside of the site. Exceedance flow routes for events greater than the 1 in 100 year storm should be identified and

should avoid properties including gardens. When developing next to a watercourse, it is recommended a 5-8m strip of land be kept free for maintenance purposes.

Any attenuation features should be shown including calculations for stored volumes and discharge rates. For greenfield developments, the peak discharge rate up to the 1 in 100 year rainfall event (plus 40% for climate change) should never exceed the peak greenfield runoff rate for the same event. For brownfield developments, the peak discharge rate from the development up to the 1 in 100 year rainfall event (plus 40%) should be as close as is reasonably practicable to the greenfield runoff rate for the same event. If this is not feasible then Gloucestershire County Council will accept a 40% reduction over the pre development discharge rate. It should never exceed the pre-development discharge rate for the same event.

For greenfield developments, the runoff volume up to the 1 in 100 year, 6 hour rainfall event (plus 40% climate change) should not exceed the greenfield runoff volume for the same event. For brownfield sites the runoff volume up to the 1 in 100 year, 6 hour event (plus 40% climate change) should be constrained to a value as close as is reasonably practicable to the Greenfield runoff volume. Where this isn't practicable, the runoff volume should be reduced by 40% of the existing volume and should never exceed it.

The strategy should not result in any deterioration in water quality and the use of SuDS should improve water quality wherever possible. Information provided by the SuDS manual, CIRIA C753, should be considered when designing the SuDS system.

For more information and to access our "Standing Advice and Development Guidance" and "Gloucestershire SuDS Design and Maintenance Guide" documents please visit our website: <http://www.gloucestershire.gov.uk/planning-and-environment/flood-risk-management/surface-water-drainage-and-major-planning-applications/>.

Appendix D – Correspondence with the Environment Agency

Product 4 (Detailed Flood Risk Data) for ‘land off Gloucester Road’, Haresfield, GL10 3DP

Reference number: 176095

Date of issue: 16 July 2020

We are unable to provide you with a full product 4 response because:

- There is no detailed modelled information available for this site
- We do not have any records of flooding in this area

Flood Map for Planning (Rivers and Sea)

The Flood Map for planning (Rivers and Sea) indicates the area at risk of flooding, **assuming no flood defences exist**, for a flood event with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring for fluvial (river) flooding (flood zone 3). It also shows the extent of the Extreme Flood Outlines (Flood zone 2) which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater. The flood zones refer to the land at risk of flooding and **does not** refer to individual properties. It is possible for properties to be built at a level above the floodplain but still fall within the risk area.

The Flood Map only indicates the extent and likelihood of flooding from rivers or the sea. It should also be remembered that flooding may occur from other sources such as surface water sewers, road drainage, etc.

To find out which flood zone a location is in please use: <https://flood-map-for-planning.service.gov.uk/>

Definition of flood zones

- **Zone 1** - The area is within the lowest probability of flooding from rivers and the sea, where the chance of flooding in any one year is less than 0.1% (i.e. a 1000 to 1 chance).
- **Zone 2** - The area which falls between the extent of a flood with an annual probability of 0.1% (i.e. a 1000 to 1 chance) fluvial and tidal, or greatest recorded historic flood, whichever is greater, and the extent of a flood with an annual probability of 1% (i.e. a 100 to 1 chance) fluvial / 0.5% (i.e. a 200 to 1 chance) tidal. (Land shown in light blue on the Flood Map).

- **Zone 3** - The chance of flooding in any one year is greater than or equal to 1% (i.e. a 100 to 1 chance) for river flooding and greater than or equal to 0.5% (i.e. a 200 to 1 chance) for coastal and tidal flooding.

Note: The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the [Strategic Flood Risk Assessment](#) when considering location and potential future flood risks to developments and land uses.

Areas Benefitting From Defences

Where possible we show the areas that benefit from the flood defences, in the event of flooding:

- from rivers with a 1% (1 in 100) chance in any given year, or;
- from the sea with a 0.5% (1 in 200) chance in any given year.

If the defences were not there, these areas would flood. Please note that we do not show all areas that benefit from flood defences.

The associated Dataset is available here: <https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-areas-benefiting-from-defences>

Recorded Flooding

Following examination of our records of historical flooding we have no record of flooding in the area. The absence of coverage for an area does not mean that the area has never flooded, only that we do not currently have records of flooding in this area. It is also possible that the pattern of flooding in this area has changed and that this area would now flood or not flood under different circumstances.

You may also wish to contact your Local Authority or Internal Drainage Board, to see if they have other relevant local flood information.

Flood Defences

Flood defences do not completely remove the chance of flooding. They can be overtopped by water levels which exceed the capacity of the defences.

If flood defences are located in your area, you can access this data here:

<https://data.gov.uk/dataset/spatial-flood-defences-including-standardised-attributes>

Planning developments

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments. You can also request pre application advice:

<https://www.gov.uk/planning-applications-assessing-flood-risk>

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Supporting Information

Surface Water

Managing the risk of flooding from surface water is the responsibility of Lead Local Flood Authorities. The 'risk of flooding from surface water' map has been produced by the Environment Agency on behalf of government, using information and input from Lead Local Flood Authorities.

You may wish to contact your Local Authority who may be able to provide further detailed information on surface water.

It is not possible to say for certain what the flood risk is but we use the best information available to provide an indication so that people can make informed choices about living with or managing the risks. The information we supply does not provide an indicator of flood risk at an individual site level. Further information can be found on the Agency's website:

<https://flood-warning-information.service.gov.uk/long-term-flood-risk>

Flood Risk from Reservoirs

The Flood Risk from Reservoirs map can be found on the Long Term Flood Risk Information website:

<https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?map=Reservoirs>

Flood Alert & Flood Warning Area

We issue flood alert/warnings to specific areas when flooding is expected. If you receive a flood warning you should take immediate action.

You can check whether you are in a Flood Alert/Warning Area and register online using the links below:

<https://www.gov.uk/check-flood-risk>

<https://www.gov.uk/sign-up-for-flood-warnings>

If you would prefer to register by telephone, or if you need help during the registration process, please call Floodline on 0345 988 1188.

The associated dataset for flood warning areas is available here:

<https://data.gov.uk/dataset/flood-warning-areas3>

The associated dataset for flood alert areas is available here: <https://data.gov.uk/dataset/flood-alert-areas2>

Flood Risk Activity Permits

We now consider applications for works, which may be Flood Risk Activities, under Environmental Permitting Regulations. This replaces the process of applying for a Flood Defence Consent. You may need an environmental Permit for flood risk activities if you want to do work:

- in, under, over or near a main river (including where the river is in a culvert)
- on or near a flood defence on a main river
- in the flood plain of a main river
- on or near a sea defence

Please go to this website to find out more about how to apply:

<https://www.gov.uk/guidance/flood-risk-activities-environmental-permits>.

Please be aware that Bespoke and Standard Rules permits can take up to 2 months to determine and will incur a charge.

Further details about the Environment Agency information supplied can be found on the GOV.UK website:

<https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>

Appendix E – Extract from Geo-Environmental Risk Assessment

PHASE 1 PRELIMINARY GEO-ENVIRONMENTAL RISK ASSESSMENT

Symmetry Park West, Gloucester



JER8631
PHASE 1 PRELIMINARY RISK
ASSESSMENT
00
June 2020

REPORT

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
00	Draft	[REDACTED]	[REDACTED]	[REDACTED]	26/06/2020

Approval for issue

[REDACTED] Associate Director 26 June 2020

© Copyright RPS Group Plc. All rights reserved.

The report has been prepared for the exclusive use of our client and unless otherwise agreed in writing by RPS Group Plc, any of its subsidiaries, or a related entity (collectively 'RPS'), no other party may use, make use of, or rely on the contents of this report. The report has been compiled using the resources agreed with the client and in accordance with the scope of work agreed with the client. No liability is accepted by RPS for any use of this report, other than the purpose for which it was prepared. The report does not account for any changes relating to the subject matter of the report, or any legislative or regulatory changes that have occurred since the report was produced and that may affect the report. RPS does not accept any responsibility or liability for loss whatsoever to any third party caused by, related to or arising out of any use or reliance on the report.

RPS accepts no responsibility for any documents or information supplied to RPS by others and no legal liability arising from the use by others of opinions or data contained in this report. It is expressly stated that no independent verification of any documents or information supplied by others has been made. RPS has used reasonable skill, care and diligence in compiling this report and no warranty is provided as to the report's accuracy. No part of this report may be copied or reproduced, by any means, without the prior written consent of RPS.

Prepared by:

RPS

[REDACTED]
Senior Geo-Environmental Consultant

8 Exchange Quay
Manchester, M5 3EJ

[REDACTED]

Prepared for:

Tritax Symmetry

[REDACTED]
Graduate Development Surveyor

2 Milthorpe, Lois Weedon
Towcester, NN12 8PP

[REDACTED]

Contents

EXECUTIVE SUMMARY	3
1 INTRODUCTION	5
1.1 Preamble	5
1.2 Objectives	5
1.3 Legislation and Guidance	5
2 SITE RECONNAISSANCE AND DESK STUDY	6
2.1 Site Reconnaissance	6
2.2 Site History	7
2.3 Environmental Setting	8
2.4 Authorised Processes and Pollution Incidents	11
2.5 Unexploded Ordnance	12
3 PRELIMINARY CONCEPTUAL SITE MODEL	13
3.1 Background	13
3.2 Potential Pollutant Linkages	13
3.3 Preliminary Conceptual Site Model	14
4 PRELIMINARY GEOTECHNICAL ASSESSMENT	16
4.1 Preliminary Geotechnical Risk Register	16
5 CONCLUSIONS AND RECOMMENDATIONS	18

Tables

Table 1 – Summary of on-site activities.....	6
Table 2 – Neighbouring Land Uses	7
Table 3 – Historical Site Uses	7
Table 4 – Historical Neighbouring Site Uses	7
Table 5 – Descriptions of Geological Strata	9
Table 6 – Nearby Watercourses and Water Bodies	10
Table 7 – Landfill / Waste Transfer / Waste Treatment Sites	11
Table 8 – Environmental Permits	12
Table 9 – Preliminary Conceptual Site Model	15
Table 10 – Preliminary Geotechnical Risk Register	16

Figures

Site Location Plan
Site Boundary Plan
Historical Map Extract 1882 - 1883
Historical Map Extract 1921 - 1924
Historical Map Extract 1954
Historical Map Extract 1968 - 1972
Historical Map Extract 2001
Historical Map Extract 2020

Appendices

Appendix A General Notes
Appendix B Photographs
Appendix C Part 2A (The Contaminated Land Regime)

EXECUTIVE SUMMARY

RPS Consulting Services Ltd (RPS) was commissioned by Tritax Symmetry to undertake a Phase 1 Preliminary Geo-Environmental Risk Assessment of land known as Symmetry Park West, Gloucester. The report has been commissioned prior to the proposed redevelopment of the site.

The principal objectives of the assessment will be to determine the potential for soil and groundwater contamination to be present which could impact future site users/occupiers and the wider environment, significantly constrain the proposed use of the site or significantly affect the development process. The site's suitability for its proposed use would be determined in accordance with the National Planning Policy Framework.

Current Site and Surrounding Land Use

The site currently comprises undeveloped agricultural land, comprising three adjoining arable farmed fields. The site is in a predominantly rural location, surrounded by farmland on three sides. The M5 Motorway bounds the site to the west and the Quedgeley Interchange (J12) is located to the north. To the east of the site, a recently constructed energy recovery facility has replaced a former light industrial estate. To the northeast there is also a Garden Centre with a small retail park.

History of Site and Surrounding Land use

A review of historical maps indicates that the site's use has remained unchanged, however between 1954 and 1971 the site is located in an area annotated as a Airfield. Off-site historical potential sources of contaminants of concern include the former industrial estate, which featured sewage beds and tanks, and the garden centre.

Environmental Setting

The site is indicated to be underlain by a Secondary Undifferentiated Aquifer associated with the Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated). The Cheltenham Sand and Gravel are indicated to be present in the southern part of the site and is classified as a Secondary A Aquifer. The site is in a zone of medium groundwater vulnerability.

The site is not located in a groundwater Source Protection Zone (SPZ) and there are no sensitive groundwater abstractions in the vicinity of the site.

The nearest surface water features are a series of field boundary ditches, the closest of which is located adjacent to the northeastern boundary of the site.

The closest residential property is located approximately 250m from the west of the site, however there are no other adjacent residential properties, schools, hospitals, care homes or other sensitive land uses in the near vicinity of the site.

Outline Conceptual Site Model

An outline conceptual site model (CSM) has been derived on the basis of the desktop study and site reconnaissance, which has identified a limited number of potential sources of contamination and associated pollutant linkages. There is also the potential the generation of ground gas associated with infilled land on site and made ground/infilled land near the site.

Recommendations

It is recommended that the potential for contamination and associated pollutant linkages is assessed through a Phase 2 Geo-Environmental Site Investigation. The investigation should be targeted to provide information on the concentrations of contaminants of concern (if present) within the soils and shallow groundwater beneath the site and the generation of ground gases. If the site investigation identifies the presence of

potentially significant contamination or ground gases further investigation, monitoring, risk assessment and remediation may be necessary.

If contamination is present, increased materials management/disposal costs may be realised as part of the redevelopment. If excavated materials are to be reused on site a Materials Management Plan may be required and appropriate licenses/exemptions will be required.

It would be prudent to combine any site investigation undertaken for geo-environmental purposes with geotechnical testing. Soakaway testing could also be undertaken - low permeability soils could prevent the use of soakaways.

Given the potential for part of the site to be located within a historical Airfield, it is recommended that a Desk Based UXO Bomb Threat Assessment should be undertaken prior to any intrusive ground works.

1 INTRODUCTION

1.1 Preamble

- 1.1.1 RPS Consulting Services Ltd (RPS) was commissioned by Tritax Symmetry to undertake a Phase 1 Preliminary Geo-Environmental Risk Assessment of Symmetry Park West, Gloucester. The report has been commissioned prior to the proposed redevelopment of the site.
- 1.1.2 The site covers an area of approximately 23.75 hectares and currently comprises undeveloped agricultural land. A site location plan is presented as Figure 1.
- 1.1.3 Development plans have not been made available for review at this time.

1.2 Objectives

- 1.2.1 The principal objectives of the assessment are to determine the potential for soil and groundwater contamination to be present which could impact future site users/occupiers and the wider environment, significantly constrain the proposed use of the site or significantly affect the development process.
- 1.2.2 The key tasks of this assessment were as follows:
- To assess potential sources of contamination at the site, associated with historical and current land uses both on site and in the surrounding area;
 - To review the environmental setting to assess the sensitivity of the surrounding area to ground contamination;
 - To produce an outline Conceptual Site Model (CSM) identifying the pathways by which potential contamination may impact the identified receptors via pollutant linkages; and,
 - To provide recommendations for further assessment/ investigation of potential pollutant linkages, where considered necessary

1.3 Legislation and Guidance

- 1.3.1 This report has been produced in general accordance with:
- Contaminated Land (England) Regulations 2006 (as amended);
 - DEFRA Environmental Protection Act 1990: Part 2A - *Contaminated Land Statutory Guidance* (2012);
 - DEFRA and Environment Agency (2004) Contaminated Land Report 11 (CLR 11): *Model Procedures for the Management of Land Contamination*;
 - National Planning Policy Framework (2019);
 - CIRIA Document C665: *Assessing Risks Posed by Hazardous Ground Gases to Buildings*;
 - British Standard requirements for the '*Investigation of potentially contaminated sites - Code of practice*' (ref. BS10175:2011+A1:2017);
 - British Standard requirements for the '*Code of practice for ground investigations*' (ref. BS5930:2015); and
 - British Standard requirements for the '*Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*' (ref BS8485:2015+A1:2019).
- 1.3.2 Details of the limitations of this type of assessment are described in Appendix A.

2 SITE RECONNAISSANCE AND DESK STUDY

2.1 Site Reconnaissance

2.1.1 This section of the report is based upon observations made during a site visit carried out on 30th June 2020. A site boundary plan is provided as Figure 2. Selected photos are shown in Appendix B.

The Site

Table 1 – Summary of on-site activities

Section	Description
Background:	The site is located south of Gloucester, near to the M5 Quedgeley Interchange at National Grid Reference SO 79766,10181. It is irregularly shaped and occupies an area of approximately 23.75ha. The site is relatively flat and low lying with typical elevations of approximately 20m to 25mAOD.
Site Layout:	The site largely comprises open arable fields. There was a field of long overgrown grass separated by fencing in the northern extremity of the site. In the northern area of the open fields, the ground appeared to have been reworked with no crops present at the time of the site inspection. There is an access road running north to south in the eastern section with stockpiles of materials and soils to the immediate east of this road. Access was gained via a gate off the Gloucester Road (B4008) from the central area of the eastern edge of the site. The area immediately adjacent to the eastern boundary was covered in dense vegetation as was the northeastern area. The site is mainly bounded by hedgerows and trees.
Activity / Operations:	The site appears to be used primarily for arable use at the current time with storage of soils and materials along the eastern access road, and storage of materials in the far northern corner.
Building Structure(s):	There were no buildings or structures present on site.
Surface Cover:	The majority of the site had topsoil cover with compacted stone evident on the access road in the eastern area.
Drainage:	Drainage ditches appeared to be present along the boundaries of the site although these were typically obscured by heavy vegetation. On the southern boundary, the base of the drainage ditch was observed with very low level of water present. On the northwestern corner near the top of the northern branch of the crop field, a broken concrete slab was identified with two pipe outlets identified (estimated at approximately 0.5 m below ground level). These were facing towards the M5 motorway and suggested a possible drainage route below this road. No water was observed flowing from these outlets. In the northeastern corner of the site, a culvert was observed underneath the Gloucester Road with water flowing at a medium rate to the west onto the site in a drainage channel of several metres width. This flowed underneath a metal grated fence into a heavily vegetated area. The route could not be traced any further due to the heavy vegetation.
Bulk Storage / Tanks:	There were no tanks observed to be present on the site. In the northern corner of the northern branch of the site, there was some storage of equipment including a large metal storage container, chapter 8 fencing, wooden pallets and wooden storage units. To the immediate east of the access road in the eastern area of the site, large stockpiles of soil, concrete and various materials were present as is detailed in the 'Waste' section below.
Waste:	To the immediate east of the access road, in the southeastern corner a large pile of organic waste / manure was identified with a strong organic odour. To the north of this, large stockpiles of concrete and soil were identified. Further up the road on its eastern edge, piles of stone, wooden blocks, fencing and piles of potentially asbestos cement bound roof sheeting were identified. To the north of the access point, still to the immediate east of the road, were large piles of broken tarmacadam, soil and concrete rings and bricks. These appeared to be underlain by ground with minimal stone cover.

Section	Description
Air Emissions:	The site does not operate any licensed air emissions.
Electricity Sub-Stations /Transformers:	No electricity substations or transformers were identified on site.
Visual Evidence of Contamination:	Organic waste material was present in the southeastern section. Large piles of broken tarmacadam were present to the immediate east of the access road running north to south. What appeared to be cement bonded asbestos sheeting was stored adjacent to the access road.
Statutory Nuisance:	RPS is not aware of any statutory nuisance complaints associated with the site.
Other Issues:	None identified.

The Surrounding Area

2.1.2 The site is located in an area of mixed agricultural, retail, commercial and industrial land use. At the time of the site inspection, neighbouring land consisted of the following:

Table 2 – Neighbouring Land Uses

Direction	Description
North:	Garden centre with associated car parking and retail park. To the north of this, is Junction 12 of the M5 motorway. Energy recovery facility.
East:	Gloucester Road (B4008) with agricultural land beyond.
South:	Agricultural land.
West:	M5 motorway, Agricultural land and residential properties.

2.2 Site History

Historical Map Review

2.2.1 The following review is based on past editions of readily available Ordnance Survey (OS) maps. These include scales of 1:1,250, 1:2,500 and 1:10,000 dated 1882 to 2020. Extracts from selected historical maps are provided as Figure 3 to Figure 8. The review is also based on available aerial photography dated 1999 to 2018.

Table 3 – Historical Site Uses

On-site Land Use and Features	Dates
Undeveloped agricultural land with associated field boundaries. Footpath through the northern part of the site A unnamed road crosses the very northern corner of the site, shown on the 1903 and 1923 plans	1882 - present
Stream/drain flowing to the north through the northern part of the site	1921 - 1968
Airfield, the site is indicated to be part of an Airfield. No features are shown on site or in the land immediately to the west which suggests it could have been in military use.	1954 - 1968

Table 4 – Historical Neighbouring Site Uses

Surrounding Land Uses (250m radius)	Orientation	Distance	Dates	
			From	To
Lane – Truncates the site in the north – Diverts nearer to north western corner circa 1974	N	0m	1882	present

Surrounding Land Uses (250m radius)	Orientation	Distance	Dates	
			From	To
Lane – Becomes A419 circa 1971, r – Becomes B4008 circa 1990	E	0m	1882	present
Airfield (possibly military)	SW/W	0m	1954	1968
M5 Motorway, forming the western site boundary	W	0m	1971	present
Sewage Beds	E	0m	1980	2001
Javelin Park EfW facility	E	0m	2018	present
Garden Centre Glasshouse – Becomes 'Countryside Centre', numerous additional structures circa 2001 – Smaller structures replaced by car park, large retail garden centre structure circa 2010	E	50m	1986	present
Bilton Industrial Estate – Becomes Bilton Cargo Centre circa 1990	E	100	1974	present
M5 Motorway, Quedgeley Interchange – Junction road improvements, construction of roundabouts circa 2010	N	200m	1971	Present
Old Airfield Farm – Becomes Martin Clack Motor Engineering	W	350	2001	present

2.2.2 Aerial photographs dated 1999 to 2018 suggest that the site use has remained unchanged. The photographs suggest that the land to the northeast of the site has undergone demolition of structures and redevelopment during this period.

Site Planning History

2.2.3 Relevant planning records for the site, obtained from Stroud district and Gloucestershire County Council planning websites are summarised as follows:

- Land adjacent to the East: Application references:
 - 12/0008/STMAJW Proposed development of an Energy from Waste (EfW) facility for the combustion of non-hazardous waste and the generation of energy, comprising the main EfW facility, a Bottom Ash processing facility and Education/Visitor Centre, together with Associated/Ancillary Infrastructure including Access Roads, Weighbridges, Fencing/Gates, Lighting, Emissions Stack, Surface Water Drainage Basins and Landscaping.
 - S.19/2135/FUL Erection of four buildings (5 units) for B1c (Light Industry), B2 (General Industry) and B8 (Storage and Distribution) uses and associated access and drainage infrastructure

2.3 Environmental Setting

Geology

2.3.1 Based on British Geological Survey (BGS) mapping (1:50,000-scale) and the Environment Agency (EA) Groundwater Vulnerability mapping (1:100,000-scale), the stratigraphic sequence and aquifer classifications beneath the site are indicated to be as follows:

Table 5 – Descriptions of Geological Strata

Strata	Description	Aquifer Classification
Cheltenham Sand and Gravel (Southern part of site only)	Sand and Gravel Gravel is largely Middle Jurassic ooidal Limestone	Secondary A Aquifer
Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated)	Mudstone. Marine calcareous mudstone and silty mudstone, and limestone.	Secondary Undifferentiated Aquifer

2.3.2 Superficial deposits consisting of the Cheltenham Sand and Gravel are shown to be underlay the southern part of the site only.

2.3.3 There are a number of BGS borehole records located approximately 50 to 250m to the north and 10 to 125m to the west of the site. These are likely to be associated with the construction of the M5 Quedgeley Interchange and M5 motorway. BGS borehole reference SO71SE5, located approximately 10m to the north of the site, was extended to a depth of 3.0m and the encountered stratigraphic sequence can be summarised as follows:

- Topsoil 0.0 – 0.3m bgl
- brown sandy silty CLAY 0.0 – 0.6m bgl
- Slightly clayey and silty gravelly SAND 0.6 – 1.2m bgl
- Firm mottled blue and brown silty CLAY 1.2 – 1.6m bgl
- Stiff blue silty CLAY 1.6 – 3.1m bgl

2.3.4 BGS borehole reference SO70NE94, located 50m to the southwest, was extended to a depth of 9.37m bgl and the encountered stratigraphic sequence can be summarised as follows:

- Made Ground: 0.0 – 2.25
comprised slightly sandy slightly gravelly clay over sandy gravel with low cobble content. Gravel comprised rubber, mudstone, sandstone and ceramics
- Stiff to very stiff blue grey CLAY 2.25 – 3.0
- Very stiff blue grey thinly laminated Clay with shell fragments 3.00-4.5
- No recovery 4.5 – 6.00
- Blue grey CLAY 6.0 – 6.8
- Very weak grey blue thinly laminated calcareous MUDSTONE 6.8 – 9.37

2.3.5 There is the potential for Made Ground to be present on site, associated with its agricultural history and associated shallow soil workings. However, Made Ground of significant thickness is not anticipated to be widespread owing to the site’s limited history of development. There is the potential for infilled ground associated with a former pond identified in the centre of the site on historical mapping. At present the nature and thickness of any Made Ground on site is unknown.

Hydrogeology

2.3.6 The majority of the site is located above a Secondary Undifferentiated Aquifer relating to the Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated). These formations have

varying characteristics in different locations. According to Groundwater vulnerability mapping, the site is in a zone of medium vulnerability associated with groundwater flow through poorly connected rock fractures.

- 2.3.7 The Cheltenham Sand and Gravel deposits which are indicated to be present in the south of the site are classified as a Secondary A Aquifer. These formations contain permeable layers which are capable of supporting water supplies at a local rather strategic scale and in some cases form an important source of base flow to rivers.
- 2.3.8 According to EA data, the site not located in a groundwater Source Protection Zone (SPZ).
- 2.3.9 Under the Water Framework Directive, the Environment Agency’s local River Basin Management Plan classifies groundwater chemical quality beneath the site as good quality (2016).
- 2.3.10 Information provided by the EA indicates that there are no records of active licensed groundwater abstractions within 2km of the site.

Surface Water

- 2.3.11 There are no watercourses within 1km of the site which are classified within the River Basin Management Plan published by the EA under the European Water Framework Directive (2000). A list of all nearby watercourses and water bodies within 250m of the site is as follows:

Table 6 – Nearby Watercourses and Water Bodies

Watercourse / Body	Quality Classification	Approx. Distance and Direction from Site
Ditch/field drain	N/A	Adjacent northeast boundary
Pond	N.A	250m south

- 2.3.12 Information provided by the EA indicates that there is one record of active licensed surface water abstractions within 2km of the site, located 1835m south west and is for spray irrigation.
- 2.3.13 There is one record of active surface water discharge consents within 500m of the site. This relates to the release of treated effluent/process effluent to tributaries of Beaurepair Brook (166m north west).
- 2.3.14 According to the Environment Agency (EA) flood risk mapping, the site has a number of locations at medium or high risk of surface water flooding, including in the north and west of the site. the highest risk on site is recorded as 1 in 30 year event with water depths greater than 1.00m.

Fluvial / Tidal Flood Risk

- 2.3.15 According to the Environment Agency (EA) flood map, the northern tip of the site is located within Flood Zone 2, with the annual probability of flooding classified as greater than 1 in 1000 (0.1%) but less than 1 in 100 (1%). The remaining site area is not located in an indicative fluvial floodplain, with the annual probability of flooding classified as less than 1 in 1000 (0.1%).
- 2.3.16 Land immediately to the north is indicated to be in within Flood Zone 3, with the annual probability of flooding classified as greater than 1 in 100 (1%).

Ecologically Sensitive Sites

- 2.3.17 Natural England data indicates that there are no ecologically sensitive sites, that constitute environmental receptors as defined within Table 1 of the DEFRA Environmental Protection Act 1990: Part 2A - Contaminated Land Statutory Guidance (2012), located within a 1km radius of the site.

2.3.18 According to Natural England data, the site is located within a designated SSSI impact risk zone, these require consultation for all developments including infrastructure, energy and residential.

2.3.19 **Other Sensitive Sites**

2.3.20 There are no records of World Heritage Sites, National Parks, Listed Buildings, Conservation Areas or Scheduled Ancient Monuments within 250m of the site.

Radon

2.3.21 According to the Indicative Atlas of Radon in England and Wales published by the Health Protection Agency (part of Public Health England) and the British Geological Survey, the site is located within an area where less than 1% of properties are affected by radon and no radon protection measures are required.

Coal Authority

2.3.22 The Interactive Map Viewer on the Coal Authority website indicates that the site is not located in a coal mining reporting area.

Non-Coal Mining

2.3.23 There are no records of natural cavities, surface or underground workings, non-coal mining or other mineral extraction operations within 1km of the site.

Natural Land Stability

2.3.24 BGS data indicates that the site is located within an area at low risk from shrink swell clays and very low risk from collapsible deposits and landslides. The risk associated with compressible deposits and ground dissolution is indicated to be negligible. The risk associated with running sands from the bedrock is indicated to be negligible and from the superficial deposits is indicated the be very low.

2.4 Authorised Processes and Pollution Incidents

Landfills and Waste Sites

2.4.1 Data provided by the EA, Local Authority and BGS indicates that there are no recorded licensed or known historical landfill sites located within 250m of the site.

2.4.2 Information provided by a number of sources (detailed below) shows that there is one waste treatment/transfer sites recorded within 250m of the site. This is described within the following table.

Table 7 – Landfill / Waste Transfer / Waste Treatment Sites

Source of Record	Approx. Distance and Direction	Licence Details	Waste Type and Details
Waste Transfer / Treatment Sites			
Waste Treatment Project	101m NW	Application date 2013	Application associated with construction of an energy from waste project. Incineration and mechanical biological treatment of residential waste.

Environmental Permits

- 2.4.3 EA and Local Authority data indicates that there are processes regulated by an Environmental Permit (under the Environmental Permitting Regulations 2010) within 500m of the subject site. This is described within the following table.

Table 8 – Environmental Permits

Licence Holder	Approx. Distance and Direction from Site	Permitted Activity
Urbaser Environmental Limited Javelin Park Energy Recovery Facility EPR/CP3535CK Permit Number: KP3439YD Status: Effective	162m north west	Process: Incineration of non-hazardous waste
St Josephs Travellers Park, Hiltmead Lane, Moreton Valence, Gloucester, Gloucestershire, GL2 7NQ EPRDP3327GC	166m north west	Discharge of sewage to tributary of Beaufort Brook

- 2.4.4 There are a number of waste exemptions within 500m of the site associated with agricultural processes including screening and blending, storage, and use of wastes.

COMAH Sites

- 2.4.5 There is one record of operations under the Control of Major Accident Hazards (COMAH) Regulations 1999, located within 500m of the site. This relates to WL Vallance Ltd, Unit 11 Javelin Park, immediately east of the site. This is a historical NIHHS site.

Pollution Incidents

- 2.4.6 Environment Agency data indicates that there are no records of ‘major’ or ‘significant’ pollution incidents within 500m of the site.

2.5 Unexploded Ordnance

- 2.5.1 Reference to the online interactive Zetica Regional Unexploded Bomb Risk map for indicates that the site is in an area of low potential risk from Unexploded Bombs. However, the site is in an area of possible military history, with the site and land immediately to the west and south annotated as an Airfield on the 1954 map. In addition, RAF Quedgeley site 6 is located 750m north. In general accordance with CIRIA Report consideration of undertaking further risk assessment in the form of a Desk Based Threat Assessment should be considered.

3 PRELIMINARY CONCEPTUAL SITE MODEL

3.1 Background

3.1.1 An preliminary conceptual site model (CSM) consists of an appraisal of the *source-pathway-receptor* 'contaminant linkages' which is central to the approach used to determine the existence of 'contaminated land' according to the definition set out under Part 2A of the Environmental Protection Act 1990. For a risk to exist (under Part 2A), all three of the following components must be present to facilitate a potential 'pollutant linkage'.

- **Source** referring to the source of contamination (Hazard).
- **Pathway** for the contaminant to move/migrate to receptor(s).
- **Receptor** (Target) that could be affected by the contaminant(s).

3.1.2 Receptors include human beings, controlled waters and buildings / structures. The National Planning Policy Framework, used to address contaminated land through the planning process, follows the same principles as those set out under Part 2A. Further details on the Part 2A regime are presented within Appendix C.

3.2 Potential Pollutant Linkages

3.2.1 Each stage of the potential pollutant linkages have been assessed individually on the basis of information obtained during the site reconnaissance, and desk study exercise and are discussed in the following section.

Potential Contaminant Sources

On Site – Current Land Use

3.2.2 Current agricultural use of the site is unlikely to result in significant contamination. There is the potential for diffuse pesticide/herbicide contamination to be present and a potential for localised hydrocarbon contamination associated with any fuel/oils spills associated with vehicles and agricultural machinery.

3.2.3 There is the potential for localised contamination associated with the stockpiling materials to the immediate east of the access road including soil, broken tarmac and potential cement bonded asbestos sheeting.

3.2.4 Made Ground may be present beneath the site. Where present this could represent a potential source of contamination and / or ground gas and could contain contaminants such as asbestos.

On Site – Historical Land Uses

3.2.5 Historical use of the site appears to be limited to agricultural use and a short period as an airfield (possibly military) circa 1954. There is the potential for diffuse pesticide/herbicide contamination to be present and the potential for hydrocarbon contamination associated with any fuel/oils spills associated with vehicle and machinery use and associated tanks.

3.2.6 Other potential contaminants associated with the sites use an airfield may include metals, asbestos and a range of organic contaminants including hydrocarbons, solvents and glycols. Depending on the nature of the use of the airfield there may be the potential for explosive residues and munitions. There is the potential that the site may have been used to store/test munitions.

Off-site – Current Land Uses

- 3.2.7 Current off-site potential sources of contamination include the Javelin Park Energy Recovery Facility. Waste processing and other operations at the facility represent a potential source of contaminants including metals, hydrocarbons and other organic compounds.

Off-Site – Historical Land Uses

- 3.2.8 Historical use of the area surrounding the site which includes Bilton Industrial estate, tanks, sewage beds, airfield, garden centre, Quedgeley Interchange, etc may have resulted in a wide range of inorganic and organic contaminants including metals, asbestos, hydrocarbons and solvents. There is also the potential for the generation of ground gas associated with any filled land.
- 3.2.9 Construction of the Quedgeley Interchange to the north west of the site may have included cut/fill schemes creating significant volumes of made ground which may represent a potential source of ground gas.

Potential Pathways

- 3.2.10 In areas of the completed development covered by buildings or hardstanding, the risks to human health receptors associated with ground contamination (if present) via the pathways of dermal contact, ingestion and dust inhalation will be mitigated by the surface cover. However, in areas of soft landscaping, these pathways could be active. In addition, there would be potential for the airborne migration of soil/dust from these areas to the wider site and off site.
- 3.2.11 There is the potential for ground gas and volatile contaminants of concern in soil and/or groundwater (if present) beneath the site to impact future site users via the inhalation pathway in indoor areas of the completed development.
- 3.2.12 The site is indicated to be underlain by the low permeability Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated), which will likely limit the vertical migration of contaminants of concern to deeper groundwater and mitigate the lateral off-site and on-site migration of contaminants of concern via shallow groundwater (where present). In the south of the site where Cheltenham sands and gravel are present, localised lateral migration may occur. However, vertical migration will be limited by the presence of the underlying low permeability bedrock.

Potential Receptors

- 3.2.13 Post development human health receptors include site users and neighbouring site users.
- 3.2.14 During the redevelopment process, construction personnel and neighbouring site users may be at increased risk from ground contamination, especially if soils are being disturbed. Providing construction workers adopt appropriate levels of hygiene and personal protective equipment based on appropriate risk assessment in accordance with the requirement of the CDM Regulations 2015, they are not considered to be at significant risk from potential contaminants of concern and have not been considered further as part of this assessment. Dust mitigation measures may be necessary to protect neighbouring sites users.
- 3.2.15 The nearest surface water features are a series of field drains/ditches which cross the site and off-site ones, the closest of which is located adjacent to the south of the site. Measures may need to be implemented during the redevelopment process to protect surface water receptors

3.3 Preliminary Conceptual Site Model

- 3.3.1 A preliminary CSM has been developed on the basis of the site reconnaissance and desk study. The CSM is used to identify potential sources, pathways and receptors (i.e. potential pollutant linkages) on site and is summarised in the table below:

Table 9 – Preliminary Conceptual Site Model

Potential Source	Contaminants of Concern	Via	Potential Pathways	Post Development Linkage Potentially Active?	Receptors
On site : Undeveloped agricultural land Potentially Airfield (extent of use currently unknown). Stockpiling of materials including soils, tarmacadam and possible cement bonded asbestos sheeting,	Metals, asbestos, hydrocarbons, pesticides / herbicides, solvents, munitions	Soil	Direct contact/ingestion	✓	Future site users
			Inhalation of volatiles	✓	
			Airborne migration of soil or dust	✓	Off-site users
			Leaching of mobile contaminants	✗	Secondary Undifferentiated Aquifer Field drains and ditches
		Groundwater	Direct contact/ingestion	✗	Future site users Off-site users
			Inhalation of volatiles	✓	Future site users Off-site users
Vertical and lateral migration in permeable strata	✗		Secondary Undifferentiated Aquifer Field drains and ditches		
Off-site – current: Energy Recovery Facility Off site – historical: Industrial estate, including tanks and sewage beds, airfield, RAF site, garden centre.	Metals, asbestos, hydrocarbons, solvents,	Groundwater	Direct contact/ingestion	✓	Future site users
			Inhalation of volatiles	✓	Future site users
On and off-site – Made Ground	Carbon dioxide and methane	Ground Gas	Inhalation of ground gas	✓	Future site users
				✓	
			Explosive risks	✓	Future site users
				✓	Off-site users

3.3.2 The risk assessment is based upon the available information relating to the site. Should ground conditions inconsistent with those outlined in this report be encountered RPS should be contacted to enable further assessment.

4 PRELIMINARY GEOTECHNICAL ASSESSMENT

4.1 Preliminary Geotechnical Risk Register

4.1.1 The following table provides a summary of key potential geotechnical hazards including preliminary indication of whether the site is likely to be affected by the hazard.

Table 10 – Preliminary Geotechnical Risk Register

Hazard Description	Potential for Hazard Low/Moderate/High	Comments
Sudden lateral / vertical changes in ground conditions	Low to Moderate	<p>Published BGS information indicates the ground conditions across the site have the potential to be inconsistent in the south of the site, where superficial deposits comprising Cheltenham Sand and Gravel are mapped. Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated) is mapped either at ground level or underlying the Cheltenham Sand and Gravel across the whole site area.</p> <p>Although Made Ground is not mapped across the site it may be present locally at variable thickness associated with the former use and may give rise to some inconsistency.</p> <p>Variation in the nature and distribution of soils may result in the potential for excessive differential and total settlement for proposed structures, dependent on the foundation solutions adopted.</p>
Deeper pockets of Made Ground	Low to Moderate	<p>There is the potential for deeper pockets of Made Ground to be present associated with historical infilling of any ponds and hollows.</p> <p>Made Ground has the potential for uncontrolled settlement which could result in excessive creep, differential and total settlement of buildings and infrastructure.</p> <p>Made Ground is generally not a suitable founding strata and foundation may be required to penetrate the full thickness and found in competent underlying natural strata.</p> <p>There is a potential for buried obstructions to be present within any Made Ground associated with the historical land uses.</p>
Highly compressible / low bearing capacity soils, (including peat and soft clay)	Low to Moderate	<p>There is a potential for pockets of low strength clays to be present within the weathered portion of the Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated).</p> <p>Low strength weathered strata could result in excessive differential and total settlement of buildings and infrastructure.</p>
Ground dissolution features / natural cavities	Low	Ground conditions beneath the site are not consistent with these hazards.
Shrinking and swelling clays	Moderate	<p>The near surface soils may be of low to moderate volume change potential (this should be confirmed via geotechnical laboratory testing), which could result in settlement / heave of foundation and earthworks in particular when located within the influences of trees.</p> <p>Mature trees have been identified adjacent to the site. The potential effect of these on the depth required for the foundation should be assessed in accordance with the NHBC Manual guidelines.</p>

Hazard Description	Potential for Hazard Low/Moderate/High	Comments
		To mitigate the effects of potential heave or shrinkage, formation levels within these strata should be protected from the action of trees and vegetation and their exposure time kept to a minimum prior to casting and buried concrete.
Ground dissolution features / natural cavities	Low	Ground conditions beneath the site are not consistent with these conditions.
Underground mining	Low	Ground conditions beneath the site are not consistent with these risk factors.
Slope stability issues	Low to Moderate	Any significant slopes present on site or any temporary slopes created as part of the development should be subject to appropriate geotechnical design based on site-specific site investigation information.
High groundwater table (including waterlogged ground)	Low to Moderate	<p>There is the potential for shallow perched groundwater to be present beneath the site associated with the Made Ground and the Cheltenham Sand and Gravels in the south of the site.</p> <p>Groundwater control/exclusion measures may be required to enable formation of any excavations required at the site depending on localised conditions. This may include pump and pumping, dewatering or sheet piled cofferdams in extreme circumstances. However, requirements for this should be confirmed via intrusive investigation and subsequent groundwater level monitoring.</p>
Concrete classification	Moderate	Any Made Ground may contain sulphate bearing soils. Chemical laboratory analysis should be undertaken on soil samples collected from each strata encountered beneath the site to determine a Design Sulphate Class and an Aggressive Chemical Environment for Concrete (ACEC) Classification for proposed buried structures as part of the development.
Seismic Activity	Low	The Eurocode 8 seismic hazard zoning maps for the UK (Musson and Sargeant, 2007) indicate that horizontal Peak Ground Acceleration (PGA) values with 10% probability of being exceeded in 50 years (475 year return period) are between 0.00 and 0.02g, which is considered very low.
Radon	Low	BGS and Public Health England data indicates that the site is located within an area where less than 1% of properties are above the action level. No radon protection measures are necessary.

5 CONCLUSIONS AND RECOMMENDATIONS

- 5.1.1 The outline CSM produced as part of this Preliminary Risk Assessment has identified a number of potential sources of contamination that could have resulted in soil or groundwater contamination. There is also a limited potential for the generation of ground gas.
- 5.1.2 There is the potential for several pollutant linkages to be active on completion of the development that could impact human health receptors. Given the environmental setting, controlled waters receptors are unlikely to be at significant risk.
- 5.1.3 It is therefore recommended that the presence of potential contaminants and ground gas is investigated as part of a Phase 2 Geo-Environmental Site Investigation prior to redevelopment of the site. The scope of this investigation should include the following:
- Drilling of a number of shallow boreholes across the site;
 - Installation of groundwater and gas monitoring wells in boreholes;
 - Collection of representative soil and groundwater samples from beneath the site with chemical analysis of these samples for identified contaminants of concern;
 - Collection of presentative soil samples from beneath the site with geotechnical laboratory testing to allow geotechnical classification of the underlying ground conditions.
 - Ground gas monitoring in wells installed across the site;
 - Assessment of ground conditions and generic quantitative risk assessment of soil and groundwater chemical analysis results to determine the potential for the identified potential pollutant linkages to remain active upon redevelopment of the site;
 - Geotechnical Assessment of ground condition in order to facilitate preliminary foundation and pavement design, and excavatability assessments; and
 - Provision of recommendations (where necessary) for remediation/mitigation measures to ensure that any identified potential pollutant linkages are not active upon redevelopment of the site.
- 5.1.4 If the site investigation identifies the presence of potentially significant contamination or ground gases further investigation, monitoring, risk assessment and remediation may be necessary.
- 5.1.5 It is likely that the pollutant linkages will be such that they could be mitigated by the use of typical measures such as a surface cover system, gas protection measures and 'barrier' water supply pipe. There may however be a requirement for a degree of remediation and increased soil/groundwater disposal cost may be realised. If excavated materials are to be reused on site a Materials Management Plan may be required and appropriate licenses/exemptions will be required.
- 5.1.6 It would be prudent to combine any site investigation undertaken for geo-environmental purposes with a geotechnical site investigation to investigate the characteristics of the underlying Blue Lias Formation and Charmouth Mudstone Formation. It may also be beneficial to incorporate soil permeability testing to inform preliminary SUDS design - low permeability soils could prevent the use of soakaways.
- 5.1.7 Prior to any intrusive investigation or groundworks at the site, owing to the previous use of the site as an airfield, a unexploded ordnance (UXO) desk study should be undertaken.

Appendix F – Severn Trent Water Developer Enquiry and Sewer Records

WONDERFUL ON TAP



Severn Trent Water Ltd
Regis Road
Wolverhampton
WV6 8RU

Tel: 0345 2667930
www.stwater.co.uk
net.dev.west@severntrent.co.uk

Contact: Dave Hadley

Your ref:
Our ref: 8418461

RPS Consulting Services Ltd
Salisbury House
Tettenhall Road
Wolverhampton
WV1 4SA
FAO [REDACTED]

13 July 2020

Dear [REDACTED]

Proposed Development at Bath Road/Gloucester Road, Haresfield, Gloucester GL10 3DP

I refer to your 'Development Enquiry Request' in respect of the above site for 10 commercial units. Please find enclosed the sewer records that are included in the fee together with the Supplementary Guidance Notes which refer to surface water disposal from development sites.

Public Sewers in Site – Required Protection

Due to a change in legislation on 1 October 2011, there may be former private sewers on the site which have transferred to the responsibility of Severn Trent Water Ltd, which are not shown on the statutory sewer records, but are located in your client's land. These sewers would have protective strips that we will not allow to be built over. If such sewers are identified to be present on the site, please contact us for further guidance.

Foul Water Drainage

The sewer records show a 150mm diameter foul water sewer feeding into the Bath Road Pumping Station near the garden centre. There is also a 150mm diameter combined sewer to the north east, part of which has recently been diverted. Due to the recently constructed commercial unit site on the Quedgley East Business Park and the possibility of 10 units between the two sites shown on your plan with this application, there may be a need to undertake hydraulic modelling as I feel the Bath Road and RAF Quedgley No.6 Pumping Stations may need upgrading to increase capacity in the area. In this respect I would appreciate an estimation of the average and peak flow rates from each unit based on the type of property proposed. I will then arrange for hydraulic modelling if deemed necessary.

Surface Water Drainage

WONDERFUL ON TAP



The sewer records show a watercourse system to the southern boundary of the site to the east and roughly through the middle of the site to the west. There are other watercourses to the south and north west of the development area also. Under the terms of Section H of the Building Regulations 2010, the disposal of surface water by means of soakaways should be considered as the primary method. In the event that following testing, it is demonstrated that soakaways would not be possible on the site, then satisfactory evidence will need to be submitted. The evidence should be either percolation test results or a statement from the SI consultant (extract or a supplementary letter).

Should the above method prove unsuccessful, a connection to the watercourse system is appropriate with restricted Greenfield flows in accordance with the Lead Local Flood Authority's conditions as statutory consultee in the planning process. Please see the guidance notes attached for further information.

New Connections

For any new connections (including the re-use of existing connections) to the public sewerage system, the developer will need to submit Section 106 application forms. Our New Connections department are responsible for handling all such enquiries and applications. To contact them for an application form and associated guidance notes please call 0800 7076600 or download from www.stwater.co.uk.

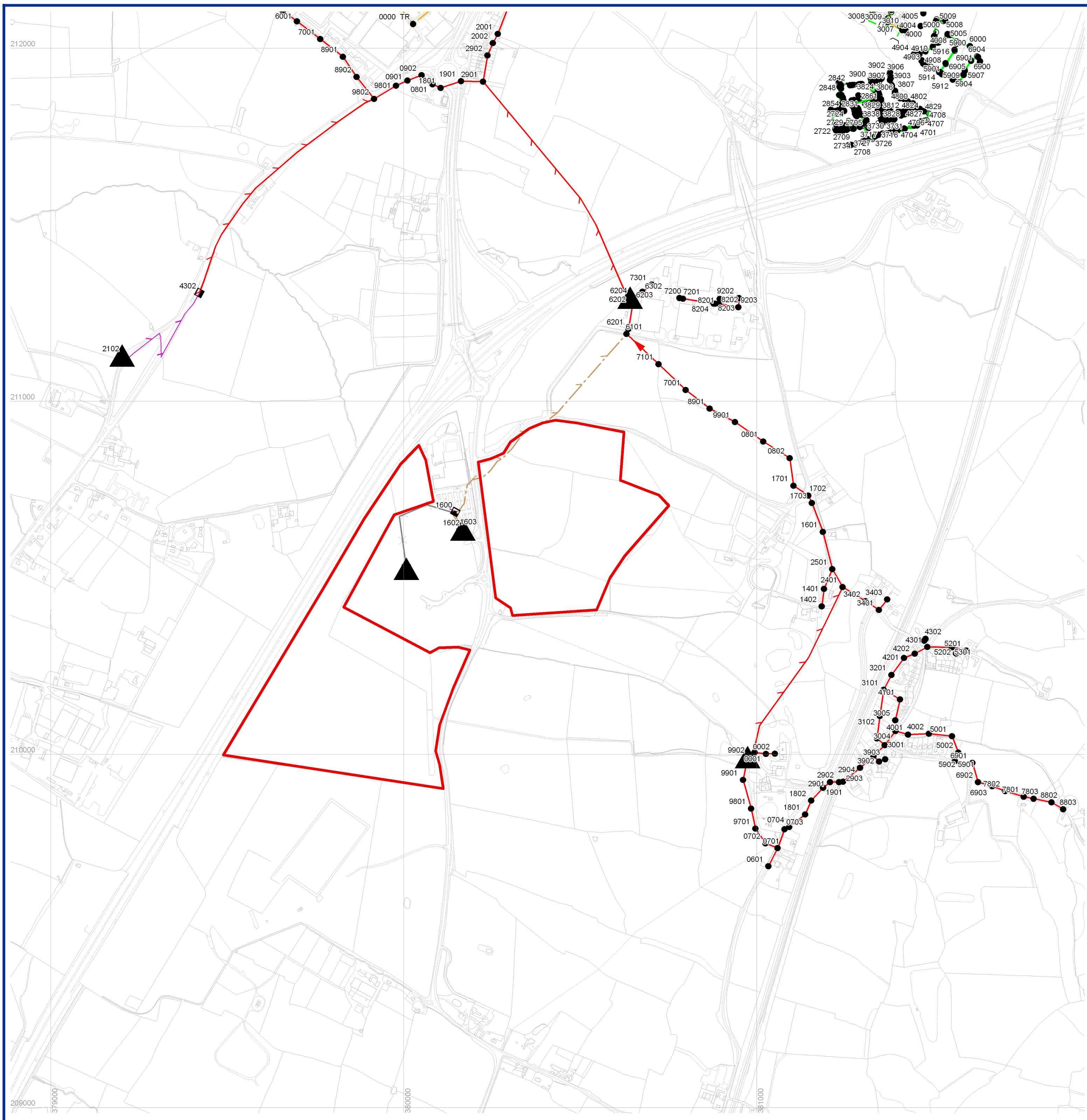
Please quote 8418461 in any future correspondence (including e-mails) with STW Limited. Please note that 'Development Enquiry' responses are only valid for 6 months from the date of this letter.

Yours sincerely

A large black rectangular redaction box covering the signature of the sender.

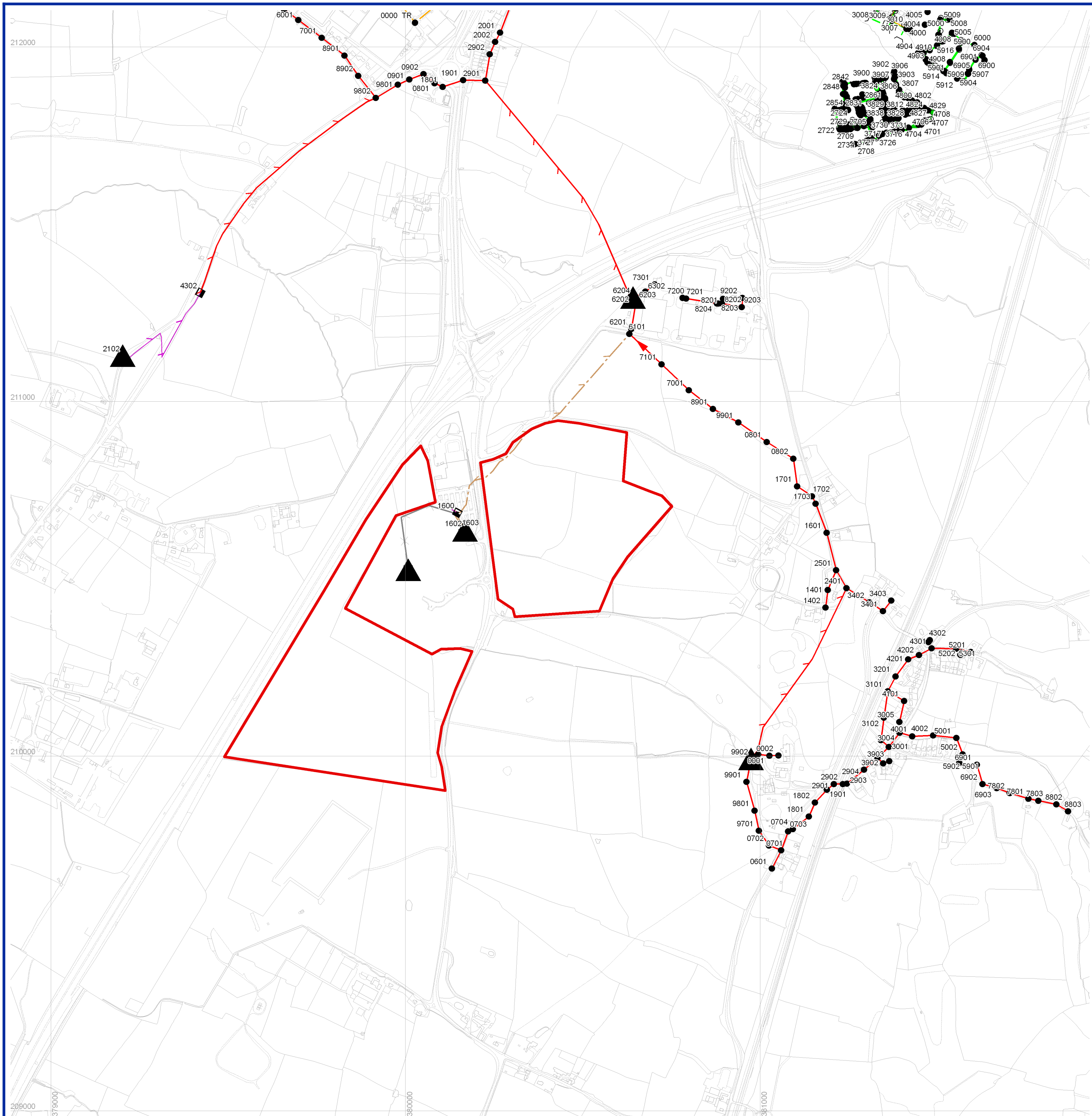
A small black rectangular redaction box covering the name of the sender.

Asset Protection (Waste Water) West
Chief Engineers Department



Sewer Node		Sewer Pipe Data									
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID	
SO7918901	14.76	13.35	13.00	C	VC	C	225	nil	232.06	nil	
SO7918902	16.05	13.96	13.36	C	VC	C	225	nil	115.57	nil	
SO7918901	nil	nil	14.83	C	VC	C	nil	nil	0.00	nil	
SO7918902	16.65	14.76	14.01	C	VC	C	225	nil	99.60	nil	
SO7918901	14.00	12.52	12.21	C	VC	C	225	nil	158.97	nil	
SO7912701	14.50	12.99	12.54	C	VC	C	225	nil	184.22	nil	
SO2089701	38.63	35.56	35.58	C	VC	C	150	nil	59.85	nil	
SO2089801	37.48	35.58	34.12	C	VC	C	150	nil	57.49	nil	
SO2089901	36.25	34.12	32.89	C	VC	C	150	nil	54.85	nil	
SO2091603	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil	
SO2091801	27.43	25.21	23.72	C	VC	C	150	nil	57.86	nil	
SO2091901	37.14	36.11	32.04	C	VC	C	150	nil	5.86	nil	
SO2091901	28.90	26.52	25.23	C	VC	C	150	nil	63.11	nil	
SO2091081	18.22	16.02	15.89	C	VC	C	225	nil	311.23	nil	
SO2091091	17.42	15.49	nil	C	VC	C	225	nil	0.00	nil	
SO2091092	18.02	15.89	15.58	C	VC	C	225	nil	138.97	nil	
SO2091181	18.38	16.38	16.05	C	VC	C	225	nil	76.00	nil	
SO2091191	18.84	16.73	16.42	C	VC	C	225	nil	195.90	nil	
SO2091291	18.68	17.15	16.77	C	VC	C	225	nil	163.24	nil	
SO2091292	19.33	17.78	17.34	C	VC	C	150	nil	170.75	nil	
SO2091411	22.42	20.74	20.38	C	VC	C	225	nil	40.81	nil	
SO2091421	22.23	20.37	19.89	C	VC	C	225	nil	122.69	nil	
SO2091422	21.66	19.11	19.10	C	VC	C	300	nil	444.33	nil	
SO2091423	22.32	19.67	19.33	C	VC	C	225	nil	26.68	nil	
SO2091432	21.90	19.65	19.18	C	VC	C	nil	nil	72.62	nil	
SO2091701	25.58	23.71	22.47	C	VC	C	150	nil	85.60	nil	
SO2091711	24.49	22.44	22.27	C	VC	C	150	nil	732.47	nil	
SO2091721	23.08	20.92	20.81	C	VC	C	nil	nil	0.00	nil	
SO2091731	nil	nil	19.74	C	VC	C	nil	nil	0.00	nil	
SO2091821	nil	nil	22.48	C	VC	C	nil	nil	0.00	nil	
SO2091822	23.76	22.14	21.97	C	VC	C	150	nil	58.82	nil	
SO2091823	23.77	21.96	21.90	C	VC	C	150	nil	66.67	nil	
SO2091824	23.71	21.90	20.98	C	VC	C	150	nil	96.70	nil	
SO2091922	24.24	23.46	22.84	C	VC	C	100	nil	42.06	nil	
SO2091923	24.27	22.76	22.14	C	VC	C	150	nil	91.76	nil	
SO2092000	nil	nil	nil	F	U	U	nil	nil	0.00	nil	
SO2092201	20.62	18.22	nil	C	VC	C	150	nil	0.00	nil	
SO2092202	nil	nil	nil	C	VC	C	150	nil	0.00	nil	
SO2092601	40.59	39.24	37.72	C	VC	C	150	nil	37.37	nil	
SO2092701	40.09	37.69	37.25	C	VC	C	150	nil	81.95	nil	
SO2092702	39.86	37.22	36.57	C	VC	C	150	nil	77.66	nil	
SO2092703	39.71	38.10	37.74	C	VC	C	150	nil	145.97	nil	
SO2092704	39.84	38.27	38.14	C	VC	C	150	nil	103.23	nil	
SO2091811	nil	nil	38.30	C	VC	C	nil	nil	0.00	nil	
SO2091812	40.20	39.04	nil	C	VC	C	150	nil	0.00	nil	
SO2091911	nil	nil	39.05	C	VC	C	nil	nil	0.00	nil	
SO2092911	42.16	39.71	nil	C	VC	C	150	nil	0.00	nil	
SO2092921	nil	nil	39.71	C	VC	C	nil	nil	0.00	nil	
SO2092923	43.13	40.02	nil	C	VC	C	150	nil	0.00	nil	
SO2092924	43.39	40.16	40.05	C	VC	C	150	nil	580.82	nil	
SO2093301	43.55	40.47	40.16	C	VC	C	150	nil	155.39	nil	
SO2093302	45.13	43.06	42.12	C	VC	C	150	nil	24.26	nil	
SO2093303	44.73	43.20	43.07	C	VC	C	150	nil	138.69	nil	
SO2093901	51.92	49.87	48.61	C	VC	C	150	nil	21.37	nil	
SO2093902	51.76	49.67	48.39	C	VC	C	150	nil	106.25	nil	
SO2093901	nil	nil	50.08	C	VC	C	nil	nil	0.00	nil	
SO2093902	55.11	53.54	nil	C	VC	C	150	nil	0.00	nil	
SO2093903	56.33	54.55	53.56	C	VC	C	150	nil	41.90	nil	
SO2093701	63.94	62.43	62.40	C	VC	C	150	nil	11.01	nil	
SO2093702	58.82	57.36	54.56	C	VC	C	150	nil	14.01	nil	
SO2093703	66.82	64.93	62.45	C	VC	C	150	nil	11.55	nil	
SO2098802	68.78	65.73	64.86	C	VC	C	150	nil	68.77	nil	
SO2098803	68.89	66.06	65.76	C	VC	C	150	nil	128.63	nil	
SO2091001	37.50	36.52	36.13	C	VC	C	150	nil	62.69	nil	
SO2091002	38.44	36.69	36.54	C	VC	C	150	nil	166.67	nil	
SO2091081	30.25	27.87	26.54	C	VC	C	150	nil	72.99	nil	
SO2091092	32.61	30.20	27.87	C	VC	C	150	nil	37.99	nil	
SO2091041	38.36	36.31	33.20	C	VC	C	150	nil	20.01	nil	
SO2091042	37.79	36.34	36.33	C	VC	C	150	nil	5036.00	nil	
SO2091161	35.04	32.15	31.37	C	VC	C	150	nil	111.19	nil	
SO2091171	33.46	31.02	30.22	C	VC	C	150	nil	98.48	nil	
SO2091172	32.99	31.11	31.03	C	VC	C	150	nil	631.00	nil	
SO2091173	33.58	31.36	31.11	C	VC	C	150	nil	98.92	nil	
SO2091241	37.79	35.92	33.20	C	VC	C	150	nil	31.54	nil	
SO2091251	36.00	33.18	32.15	C	VC	C	150	nil	105.50	nil	
SO2091301	44.10	40.49	40.48	C	VC	C	150	nil	4528.00	nil	
SO2091302	43.86	40.52	40.50	C	VC	C	150	nil	1453.00	nil	
SO2091304	44.39	42.71	40.49	C	VC	C	150	nil	23.15	nil	
SO2091305	44.57	44.15	42.09	C	VC	C	150	nil	29.33	nil	
SO2091311	42.56	40.62	40.56	C	VC	C	150	nil	1246.83	nil	
SO2091312	43.63	40.55	40.54	C	VC	C	150	nil	6450.00	nil	
SO2091321	42.92	40.67	40.65	C	VC	C	150	nil	2370.50	nil	
SO2091341	40.55	39.03	37.89	C	VC	C	150	nil	39.90	nil	
SO2091342	39.26	37.85	36.95	C	VC	C	150	nil	41.07	nil	
SO2091343	41.15	39.51	39.07	C	VC	C	150	nil	86.95	nil	
SO2091401	46.35	44.39	42.72	C	VC	C	150	nil	22.37	nil	
SO2091402	47.89	nil	44.40	C	VC	C	nil	nil	0.00	nil	
SO2091401	44.03	42.05	40.63	C	VC	C	150	nil	37.26	nil	
SO2091421	43.65	41.98	40.67	C	VC	C	150	nil	153.85	nil	
SO2091422	44.33	41.48	41.07	C	VC	C	150	nil	71.80	nil	
SO2091431	44.02	41.72	41.54	C	VC	C	150	nil	328.78	nil	
SO2091432	nil	nil	nil	F	VC	U	100	nil	0.00	nil	
SO2091501	49.97	48.08	nil	C	VC	C	150	nil	0.00	nil	
SO2091502	50.15	48.60	48.09	C	VC	C	150	nil	96.86	nil	
SO2091503	45.63	43.99	nil	C	VC	C	150	nil	0.00	nil	

Sewer Node		Sewer Pipe Data									
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID	
SO2092501	45.19	43.03	41.78	C	VC	C	150	nil	0.00	nil	
SO2092502	27.07	25.12	24.72	F	U	C	nil	nil	151.79	nil	
SO2092701	27.08	23.89	23.66	S	U	C	nil	nil	239.02	nil	
SO2091272	27.38	24.78	24.16	F	U	C	nil	nil	76.51	nil	
SO2091273	25.65	25.20	25.10	F	U	C	nil	nil	38.17	nil	
SO2091274	26.00	25.60	25.60	F	U	C	nil	nil	74.20	nil	
SO2091275	25.60	25.45	25.45	F	U	C	nil	nil	75.62	nil	
SO2091276	25.45	25.40	25.40	F	U	C	nil	nil	81.14	nil	
SO2091277	26.80	26.70	26.70	F	U	C	nil	nil	72.12	nil	
SO2091278	26.70	26.55	26.55	F	U	C	nil	nil	80.22	nil	
SO2091279	26.55	26.30	26.30	F	U	C	nil	nil	85.02	nil	
SO2091271	26.35	25.95	25.95	F	U	C	nil	nil	48.53	nil	
SO2091271	25.50	25.45	25.45	F	U	C	nil	nil	83.85	nil	
SO2091272	25.25	25.25	25.25	F	U	C	nil	nil	0.00	nil	
SO2091273	25.20	25.12	25.12	F	U	C	nil	nil	61.30	nil	
SO2091274	25.25	25.20	25.20	F	U	C	nil	nil	48.46	nil	
SO2091275	25.60	25.50	25.50	F	U	C	nil	nil	85.43	nil	
SO2091276	25.40	25.25	25.25	F	U	C	nil	nil	78.94	nil	
SO2091278	25.85	25.48	25.48	F	U	C	nil	nil	33.90	nil	
SO2091279	25.95	25.95	25.95	F	U	C	nil	nil	29.89	nil	
SO2091273	26.30	26.20	26.20	F	U	C	nil	nil	79.85	nil	
SO2091273	26.10	25.95	25.95	S	U	C	nil	nil	72.47	nil	
SO2091272	25.95	25.15	25.15	S	U	C	nil	nil	15.64	nil	
SO2091273	25.15	23.89	23.89	S	U	C	nil	nil	4.49	nil	
SO2091274	26.25	26.10	26.10	S	U	C	nil	nil	66.45	nil	
SO2091275	26.20	25.95	25.95	S	U	C	nil	nil	33.82	nil	
SO2091276	26.35	26.10	26.10	S	U	C	nil	nil	63.07	nil	
SO2091277	25.80	25.70	25.70	S	U	C	nil	nil	48.80	nil	
SO2091278	26.05	25.80	25.80	S	U	C	nil	nil	67.82	nil	
SO2091279	25.95	25.70	25.70	S	U	C	nil	nil	39.60	nil	
SO2091273	26.40	25.95	25.95	S	U	C	nil	nil	6.58	nil	
SO2091273	26.65	26.25	26.25	S	U	C	nil	nil	72.08	nil	
SO2091272	26.25	25.16	25.16	S	U	C	nil	nil	6.11	nil	
SO2091273	26.40	26.15	26.15	S	U	C	nil	nil	75.72	nil	
SO2091											



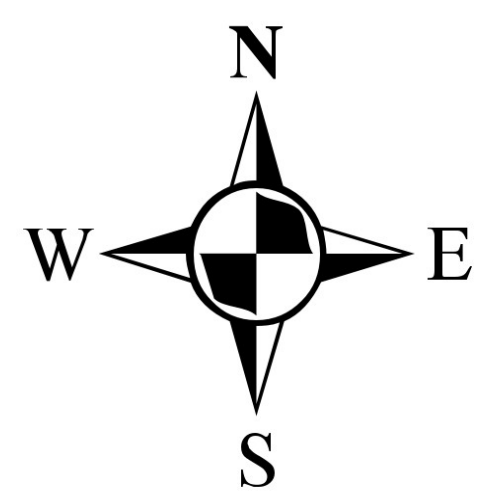
Sewer Node		Sewer Pipe Data									
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID	
S0811912	27.94	25.28	25.05	S	U	C	525	nil	164.84	nil	
S0811913	27.53	25.05	25.02	S	U	C	525	nil	201.80	nil	
S0811914	27.44	24.95	24.88	S	U	C	600	nil	230.21	nil	
S0811915	28.12	26.14	25.32	S	U	C	225	nil	52.89	nil	
S0811916	28.16	26.66	26.22	S	U	C	150	nil	102.21	nil	
S0811917	27.17	24.88	24.82	S	U	C	600	nil	239.27	nil	
S08116900	28.67	26.84	26.62	F	U	C	150	nil	151.85	nil	
S08116901	29.19	26.98	26.84	F	U	C	150	nil	164.25	nil	
S08116902	29.07	27.57	26.98	F	U	C	100	nil	22.44	nil	
S08116903	29.05	27.63	27.39	S	U	C	150	nil	81.65	nil	
S08116904	29.20	27.24	26.93	S	U	C	300	nil	65.11	nil	
S08116905	28.66	26.93	26.54	S	U	C	300	nil	84.56	nil	
S08123000	26.65	24.41	24.39	S	U	C	750	nil	410.30	nil	
S08123001	26.65	24.39	24.35	S	U	C	750	nil	286.74	nil	
S08123002	26.25	24.35	nil	S	U	C	nil	nil	0.00	nil	
S08123003	nil	nil	nil	S	U	C	300	nil	0.00	nil	
S08123004	nil	24.39	nil	S	U	C	nil	nil	0.00	nil	
S08123005	26.65	nil	nil	F	U	C	225	nil	0.00	nil	
S08123006	26.65	24.05	24.00	F	U	C	225	nil	141.16	nil	
S08123103	26.65	24.62	24.48	S	U	C	675	nil	328.24	nil	
S08123130	nil	nil	nil	S	U	C	300	nil	0.00	nil	
S08124000	26.65	24.85	24.54	S	U	C	600	nil	152.20	nil	
S08124001	nil	nil	24.85	S	U	C	nil	nil	0.00	nil	
S08124002	nil	nil	24.85	F	U	C	nil	nil	0.00	nil	
S08124003	26.65	24.25	24.05	F	U	C	225	nil	238.24	nil	
S08124005	27.45	26.24	nil	F	U	U	nil	nil	0.00	nil	
S08124006	27.04	26.12	nil	F	U	U	nil	nil	0.00	nil	
S08124007	27.39	25.69	25.52	F	U	C	150	nil	147.50	nil	
S08124008	27.37	25.00	24.92	S	U	C	375	nil	293.64	nil	
S08125000	28.18	26.65	26.29	F	U	C	100	nil	73.43	nil	
S08125001	27.75	26.24	25.96	F	U	C	150	nil	152.27	nil	
S08125002	27.23	25.96	25.87	F	U	C	150	nil	123.88	nil	
S08125003	27.34	25.87	25.81	F	U	C	150	nil	171.98	nil	
S08125004	27.57	25.81	25.69	F	U	C	150	nil	148.76	nil	
S08125005	27.89	26.39	25.86	F	U	C	100	nil	69.63	nil	
S08125006	27.97	26.67	26.39	F	U	C	100	nil	24.24	nil	
S08125007	28.35	26.59	26.43	F	U	C	150	nil	153.49	nil	
S08125008	28.17	26.64	25.67	S	U	C	150	nil	20.65	nil	
S08125009	27.89	25.78	25.67	S	U	C	150	nil	95.19	nil	
S08125010	27.80	25.59	25.34	S	U	C	225	nil	189.38	nil	
S08125011	27.29	25.34	25.29	S	U	C	225	nil	198.49	nil	
S08125012	27.39	25.29	25.22	S	U	C	225	nil	167.65	nil	
S08125013	27.59	25.07	25.00	S	U	C	375	nil	309.65	nil	
S08125014	27.92	26.38	25.14	S	U	C	300	nil	25.77	nil	
S08125015	28.00	26.50	26.45	S	U	C	225	nil	160.92	nil	
S08125016	28.24	26.92	26.50	S	U	C	225	nil	57.63	nil	
S08125017	28.38	27.07	26.92	S	U	C	225	nil	70.29	nil	
S08125018	27.42	26.75	nil	S	U	U	nil	nil	0.00	nil	
S08126000	28.85	26.81	26.59	F	U	C	150	nil	148.55	nil	
S08126001	28.89	27.42	27.07	S	U	C	225	nil	91.22	nil	

- X — X — X — X — Abandoned 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)
- Cable, Earthing
- Cable Junction
- Cable, Optical Fibre/Instrumentation
- Cable, Low Voltage
- Cable, High Voltage
- Cable, Other
- [B] Housing, Building
- [K] Housing, Kiosk
- [US] Disposal Site
- [STW] 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 Chemical Injection Point
- Sewer Junction
- ◆ Sewerage Air Valve
- ▣ Sewerage Hatch Box Point
- Sewerage Isolation Valve
- ⊕ Soakaway
- Surface Water Manhole
- Vent Column
- Waste Water Storage
- Culverted Watercourse
- Pre-1937 Properties

- ### MATERIALS
- 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
 - MAC - 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
 - XXX - OTHER
- ### CATEGORIES
- W - WEIR
 - C - CASCADE
 - DB - DAMBOARD
 - SE - SIDE ENTRY
 - FV - FLAP VALVE
 - BD - BACK DROP
 - S - SIPHON
 - HD - HIGHWAY DRAIN
 - S104 - SECTION 104
 - C - CIRCULAR
 - E - EGG SHAPED
 - O - OTHER
 - R - RECTANGLE
 - S - SQUARE
 - T - TRAPEZOIDAL
 - U - UNKNOWN
 - C - COMBINED
 - E - FINAL EFFLUENT
 - F - FOUL
 - L - SLUDGE
 - S - SURFACE WATER

- ### 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...

SEVERN TRENT WATER LIMITED
Asset Data Management
 PO Box 5344
 Coventry
 CV3 9FT
 Telephone: 0845 601 6616




SEWER RECORD (TABULAR)

O/S Map 1:7500
Scale:
Date of issue: 13.07.20
Sheet No. 3 of 3

This map is centred upon:
 O / S Grid reference:
x : 380407
y : 210543

Disclaimer Statement:
 1. Do not scale off this Map.
 2. This map and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this Map and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of Severn Trent Water's assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems.
 3. On 1 October 2011 most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2012 (date to be confirmed). Private pumping stations, which form part of these sewers or lateral drains, will transfer to the ownership of Severn Trent Water on or before 1 October 2016. Severn Trent Water does not possess complete records of these assets.
 4. Reproduction by permission of Ordnance Survey on behalf of HMSO. © Crown Copyright and database right 2004. All rights reserved. Ordnance Survey licence number 100014202. Document users other than Severn Trent Water business users are advised that this document is provided for reference purpose only and is subject to copyright, therefore, no further copies should be made from it.

Appendix G – QBAR Greenfield Runoff Rate

RPS Group Plc		Page 1
Highfield House Quinton Business Park Birmingham B32 1AF	Land off Gloucester Road Gloucester QBAR	
Date 03/07/2020 File	Designed by [REDACTED] Checked by	
Micro Drainage	Source Control 2020.1	

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 741 Urban 0.000
Area (ha) 1.000 Soil 0.400 Region Number Region 4

Results 1/s

QBAR Rural 3.6
QBAR Urban 3.6

Q100 years 9.3

Q1 year 3.0
Q30 years 7.1
Q100 years 9.3

Appendix H – Preliminary MicroDrainage Calculations

Summary of Results for 100 year Return Period (+40%)


Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	100.275	0.275	61.2	3853.8	O K
30 min Summer	100.369	0.369	62.9	5164.7	O K
60 min Summer	100.471	0.471	63.2	6592.7	O K
120 min Summer	100.578	0.578	63.2	8094.8	O K
180 min Summer	100.640	0.640	63.2	8960.9	O K
240 min Summer	100.681	0.681	63.2	9539.3	O K
360 min Summer	100.734	0.734	63.2	10276.7	Flood Risk
480 min Summer	100.770	0.770	63.2	10784.5	Flood Risk
600 min Summer	100.796	0.796	63.2	11141.0	Flood Risk
720 min Summer	100.814	0.814	63.2	11390.8	Flood Risk
960 min Summer	100.835	0.835	63.2	11684.1	Flood Risk
1440 min Summer	100.843	0.843	63.2	11803.7	Flood Risk
2160 min Summer	100.832	0.832	63.2	11653.9	Flood Risk
2880 min Summer	100.815	0.815	63.2	11411.8	Flood Risk
4320 min Summer	100.768	0.768	63.2	10753.1	Flood Risk
5760 min Summer	100.713	0.713	63.2	9976.0	Flood Risk
7200 min Summer	100.658	0.658	63.2	9206.0	O K
8640 min Summer	100.605	0.605	63.2	8469.7	O K
10080 min Summer	100.557	0.557	63.2	7796.8	O K
15 min Winter	100.309	0.309	62.0	4320.0	O K
30 min Winter	100.414	0.414	63.2	5792.9	O K
60 min Winter	100.529	0.529	63.2	7400.9	O K
120 min Winter	100.650	0.650	63.2	9098.2	O K
180 min Winter	100.720	0.720	63.2	10085.4	Flood Risk
240 min Winter	100.768	0.768	63.2	10751.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	118.165	0.0	2867.1	26
30 min Summer	79.488	0.0	3837.0	41
60 min Summer	51.110	0.0	6159.2	70
120 min Summer	31.795	0.0	7533.0	130
180 min Summer	23.759	0.0	8307.9	190
240 min Summer	19.197	0.0	8808.9	248
360 min Summer	14.105	0.0	9395.1	368
480 min Summer	11.340	0.0	9691.6	486
600 min Summer	9.566	0.0	9776.5	606
720 min Summer	8.321	0.0	9716.1	724
960 min Summer	6.671	0.0	9435.0	964
1440 min Summer	4.876	0.0	8859.0	1428
2160 min Summer	3.557	0.0	15990.0	1752
2880 min Summer	2.840	0.0	16564.6	2136
4320 min Summer	2.064	0.0	16353.1	2944
5760 min Summer	1.644	0.0	20852.3	3744
7200 min Summer	1.377	0.0	21831.1	4536
8640 min Summer	1.190	0.0	22548.8	5280
10080 min Summer	1.054	0.0	22999.7	6056
15 min Winter	118.165	0.0	3220.1	26
30 min Winter	79.488	0.0	4244.1	41
60 min Winter	51.110	0.0	6854.0	70
120 min Winter	31.795	0.0	8322.4	128
180 min Winter	23.759	0.0	9101.0	186
240 min Winter	19.197	0.0	9553.2	244

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
360 min Winter	100.829	0.829	63.2	11608.4	Flood Risk
480 min Winter	100.871	0.871	63.2	12193.6	Flood Risk
600 min Winter	100.900	0.900	63.2	12603.2	Flood Risk
720 min Winter	100.921	0.921	63.2	12897.9	Flood Risk
960 min Winter	100.948	0.948	63.2	13265.3	Flood Risk
1440 min Winter	100.964	0.964	63.2	13499.2	Flood Risk
2160 min Winter	100.948	0.948	63.2	13273.0	Flood Risk
2880 min Winter	100.924	0.924	63.2	12930.2	Flood Risk
4320 min Winter	100.860	0.860	63.2	12045.3	Flood Risk
5760 min Winter	100.783	0.783	63.2	10960.4	Flood Risk
7200 min Winter	100.695	0.695	63.2	9726.6	O K
8640 min Winter	100.613	0.613	63.2	8575.4	O K
10080 min Winter	100.539	0.539	63.2	7544.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
360 min Winter	14.105	0.0	9954.4	362
480 min Winter	11.340	0.0	10007.8	478
600 min Winter	9.566	0.0	9895.4	594
720 min Winter	8.321	0.0	9772.0	710
960 min Winter	6.671	0.0	9526.1	940
1440 min Winter	4.876	0.0	9063.5	1386
2160 min Winter	3.557	0.0	17586.4	1992
2880 min Winter	2.840	0.0	17968.1	2252
4320 min Winter	2.064	0.0	16799.7	3196
5760 min Winter	1.644	0.0	23355.7	4096
7200 min Winter	1.377	0.0	24420.8	4904
8640 min Winter	1.190	0.0	25205.5	5704
10080 min Winter	1.054	0.0	25762.6	6456

RPS Group Plc		Page 3
Highfield House Quinton Business Park Birmingham B32 1AF	Western Parcel Land off Gloucester Road Attenuation Volume	
Date 14/08/2020 File AAC5655 - Western Parcel.SRCX	Designed by [REDACTED] Checked by	
Micro Drainage		Source Control 2020.1


Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.100	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 17.625

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	4 5.875	4	8 5.875	8	12 5.875

RPS Group Plc		Page 4
Highfield House	Western Parcel	
Quinton Business Park Birmingham B32 1AF	Land off Gloucester Road Attenuation Volume	
Date 14/08/2020	Designed by [REDACTED]	
File AAC5655 - Western Parcel.SRCX	Checked by	
Micro Drainage	Source Control 2020.1	

Model Details

Storage is Online Cover Level (m) 101.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	14000.0	1.000	14000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0325-6350-1050-6350
Design Head (m)	1.050
Design Flow (l/s)	63.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	325
Invert Level (m)	99.950
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.050	63.5	Kick-Flo®	0.830	56.6
Flush-Flo™	0.485	63.2	Mean Flow over Head Range	-	50.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.7	0.800	58.0	2.000	86.7	4.000	121.5	7.000	159.7
0.200	33.2	1.000	62.0	2.200	90.8	4.500	128.7	7.500	165.2
0.300	58.7	1.200	67.7	2.400	94.7	5.000	135.5	8.000	170.5
0.400	62.7	1.400	72.9	2.600	98.5	5.500	141.9	8.500	175.7
0.500	63.2	1.600	77.8	3.000	105.6	6.000	148.1	9.000	180.6
0.600	62.5	1.800	82.4	3.500	113.8	6.500	154.0	9.500	185.5