13 Water Quality and Hydrology

13.1 Introduction

This section deals with the assessment of the potential impacts of the proposed development on water quality and hydrology in the study area. The study area is defined as that within a 1 km radius of the site.

The assessment of effects encompasses surface water and groundwater quality, surface water and groundwater resources (in terms of water quantity) and flooding. Groundwater issues are also addressed briefly in the soils and hydrogeology chapter (*Section 14*).

Changes to the original Phase 2 and 3 plans required a review of the previous Chapter 13 (Water Quality and Hydrology) of the original Environmental Statement[1]. These changes are typically considered to be of limited significance.

13.2 Legislation and Policy Context

13.2.1 European Legislation

With regard to the protection of specific water resources, permissible water quality standards and related policy are set out in the following European legislation:

- EC Water Framework Directive (2000/06/EC);
- EC Water Framework Directive (2000/06/EC);
- EC Surface Water Abstraction Directive (75/440/EEC);
- EC Bathing Water Directive (76/160/EEC);
- EC Freshwater Fish Directive (78/659/EEC);
- EC Shellfish Directive (79/923/EEC);
- EC Dangerous Substances Directive (76/464/EEC);
- EC Groundwater Directive (80/68/EEC);

1 Environmental Statement Beorma Quarter, Salhia Investments Limited, ENVIRON UK Limited, January 2009

- EC Urban Waste Water Treatment Directive (91/271/EEC); and
- EC Nitrate Directive (91/676/EEC).

Since the original document was prepared in 2009, there have been two amendments to the policy documentation namely the EC Dangerous Substances Directive (76/464/EEC) has been incorporated within EC Water Framework Directive (2000/06/EC).

13.2.2 National Policy

The aim of water policy in England is to protect both public health and the environment by maintaining and improving the quality of natural waters. These include surface water bodies (*e.g.* rivers, streams, lakes, ponds) and groundwater (whether or not it is used as a water resource).

The Department of the Environment, Food and Rural Affairs (DEFRA) is responsible for all aspects of water policy in England. Management and enforcement of water policy is the responsibility of the Environment Agency (EA). A summary of principal UK water legislation is provided below:

- *Water Resources Act 1991* – consolidated previous water legislation with regard to both the quality and quantity of water resources;
- *Water Industry Act 1991* – consolidated previous legislation relating to water supply and the provision of sewerage services;
- *Environment Act 1995* – this established a new body (the Environment Agency) with responsibility for environmental protection and enforcement of legislation. This Act introduced measures to enhance protection of the environment including further powers for the prevention of water pollution;
- *Anti-Pollution Works Regulations 1999* – provides powers to the EA to stop any activity (*e.g.* construction) that gives rise or is likely to give rise to environmental pollution or to adequately enforce pollution control measures; and
- *Water Act 2003* – extends the provisions of the *Water Resources Act 1991* and the *Environment Act 1995* with regard to abstractions and discharges, water conservation and pollution control.

Planning Policy Statement 23 *'Planning and Pollution Control'* (PPS 23) and Planning Policy Statement 25 *'Development and Flood Risk'* (PPS 25) was effectively replaced by the National Planning Policy Framework (NPPF) (DCLG, 2012) which became enforceable in March 2012.

The NPPF confirms that land contamination and its risk to health should be a material consideration under planning and development control (*i.e.* land contamination and its risk to human health in the context of the intended end use of the site).

Section 109 of the NPPF states that:

"The planning system should contribute to and enhance the natural and local environment by:

- *Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and*
- *Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."*

A core planning principle described in Section 111 of the NPPF states that:

- "Planning policies and decisions should encourage the effective use of land by re-using land that has been previously developed (brownfield land), provided that it is not of high environmental value."

In Section 121 it also states that:

"Planning policies and decisions should also ensure that:

- *The site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;*
- *After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and*
- *Adequate site investigation information, prepared by a competent person is presented."*

13.2.3 Regional Policy

There are no regional policies.

13.2.4 Local Policy

There are no relevant local policies.

13.3 Assessment Methodology and Significance Criteria

The initial assessment was undertaken in accordance with current Government guidance on EIA and involved a review of the following sources of baseline data:

- Landmark Envirocheck data for the site and a 1 km radius; providing data on surface water and groundwater discharges and abstractions, river quality, baseline hydrogeology, groundwater vulnerability and pollution incidents;
- EA data records on groundwater Source Protection Zones (SPZs), chemical and biological river quality and the location of the indicative floodplain (www.environment-agency.gov.uk);
- consultation with the EA; and
- consultation with Severn Trent Water via the project engineers.

In addition a site investigation was undertaken which included groundwater measurement and quality assessment.

The findings of the Phase I and Phase 2 Site Investigations provided sufficient data on the site geology and hydrogeology; the specific methodology for these studies has been summarised in *Section 14*.

In accordance with PPS25 (Development and Flood Risk) now replaced by the NPPF, as the site is less than 1 hectare and is located within a Flood Risk Zone 1 (low risk), a detailed Flood Risk Assessment (FRA) is not required.

13.4 Baseline Conditions

The baseline conditions remain unchanged from the original Environmental Statement; although some additional groundwater and ground gas monitoring works have been undertaken. This work is outlined within *Chapter 14* which should be read in conjunction with this section.

Surface Water Quality

The baseline condition in respect of surface water quality remains as previously identified in the former EIA. These are presented below.

The nearest surface watercourse to the development area is the River Rea. The River Rea flows approximately 364 m to the east of the site, at its closest point. The water quality of the

river is classified by the EA under the General Quality Assessment scheme as Grade D, *i.e.* of poor water quality, during the last monitoring round in 2000.

Information provided by Landmark Envirocheck shows there has been one pollution incident to controlled waters associated with the study site, which related to the release of firewater in 1999. The incident was classified by the EA as a Minor Incident.

Landmark Envirocheck has no record of consented discharges associated with the site, however, details of sewage and trade effluent discharge consents within a 1 km radius of the site are summarised in Table 13.1. The nearest consented discharge is located 34 m to the south of the site; Severn Trent Water Limited is authorised for the discharge of storm sewage overflow into the River Rea via a surface water sewer.

Table 13.1: details of discharges consents

Consent No.	Distance and Direction from Site	Operator	Details	Receiving Watercourse
Dt/9825	34 m S	Severn Trent Water Limited	Public Sewage: Storm Sewage Overflow	River Rea (River Tame)
T/09/36135/O	326 m SE	Severn Trent Water Limited	Public Sewage: Storm Sewage Overflow	River Rea (River Tame)
T120/1	353 m SE	The Phosphor Bronze Co Ltd	Cooling Water	River Rea (River Tame)
T2072/2	366 m NE	Charles Clifford Ltd	Trade Discharge – process water	Unknown
T/09/36117/O	404 m SE	Severn Trent Water Limited	Public Sewage: Storm Sewage Overflow	River Rea
T/09/35424/O	478 m E	Severn Trent Water Limited	Public Sewage: Storm Sewage Overflow	River Rea
T/09/36042/T	716 m S	Severn Trent Water Limited	Public Sewage: Storm Sewage Overflow	River Rea
T/09/21162/O	822 m N	Severn Trent Water Limited	Public Sewage: Storm Sewage Overflow	Hockley Brook
T/09/01214/T1	917 m NE	Tannel Portland Cement Ltd	Trade discharge – process water	Digbeth Arm Canal
T839/1	968 m E	United Non Ferrous Metals Ltd	Trade Discharge – Process Water	Unknown

Consent No.	Distance and Direction from Site	Operator	Details	Receiving Watercourse
T/09/08852/O	998 m NE	Severn Trent Water Limited	Public Sewage: Storm Sewage Overflow	River Rea (Tame)

Source: Landmark Envirocheck

According to Landmark Envirocheck there are two licensed surface water abstractions within a 1 km radius of the site. The nearest is located 495 m to the east. Francis D Wilmott Limited (Forward Works) is authorised for the abstraction of surface water from the River Rea for cooling purposes. The second is located 933 m to the west. British Waterways Boards is authorised for the abstraction of surface water from The Mailbox – Worcester and Birmingham Canal for cooling purposes.

Hydrology and Flood Risk

The EA's floodplain map for Digbeth (*Figure 13.1*) indicates that the site is not located within an area that may be affected by flooding, being located within Flood Risk Zone 1 *i.e.* where the risk of flooding from rivers or the sea is classified as low (assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%). Landmark Envirocheck indicates that the nearest area at risk of extreme flood (without flood defences) is located 72 m to the south east.

Figure 13.1: *EA Indicative Floodplain Map*

The Environment Agency has confirmed that as the site is located in an area where the risk of flood is very low a formal Flood Risk Assessment in not necessary. As such, no further discussion is made in relation to flood risk at the site.

Hydrogeology and Groundwater Quality

Baseline conditions determined during the initial EIA are detailed below.

An intrusive Phase II Environmental Assessment of the site was carried out by ENVIRON (2007) to provide supporting information for the EIA, with a number of window samples and boreholes being excavated. The objective of the investigation was to provide information on the current environmental condition of the soils and groundwater underlying the site. This was used to determine if significant risk and/or liabilities are associated with land contamination at the site in its current condition and in terms of potential risks for the proposed future end uses.

According to the British Geological Survey (BGS) 1:50,000 solid and drift map of the area (Sheet 168, Birmingham) the site is located directly on Bromsgrove Sandstone, which generally comprises red brown sandstone, pebbly in parts, interbedded with mudstone in upper parts. Overlying the solid strata in the western site area is made ground.

During the 2007 site investigation, the field observations of the geological conditions beneath the site were found to be largely consistent with published information and generally comprise the following strata:

- **Made Ground** was encountered in all sampling locations. This generally comprises either of the following: hardstanding (tarmac) of varying thickness (BH1, BH2 and BH4), cemented brick (BH6, BH7 and TP1), a pre-formed concrete slab (BH9), gravel 'black-top' (BH3 and BH8), rough vegetation (WS1, WS1A, WS2 and BH5) and concrete (WS3 and WS4). These surfaces were underlain by a brown/grey sand, silt or clay with various quantities of brick, gravel concrete, whole cobbles and ash. At BH4, a possible infilled basement with a red-brick floor was observed. TP1 was terminated within the made ground, whilst all other locations were terminated within the natural strata. Generally, the made ground was thicker on the north-western elevation of the site.

- **Natural deposits** comprising a variable depth of silty gravelly sand (possible head deposits derived from Bromsgrove Sandstone) (BH1, BH6, WS3 and WS4). At all other locations, the made ground was found to be directly underlain by the solid geology of either Bromsgrove Sandstone or Mercia Mudstone. The solid geology at the site can be broadly stated as comprising Mercia Mudstone on the southern and eastern elevations of the site, with the Bromsgrove Sandstone Formation on the northern and western elevations.

The ground investigation indicated that a normal fault traverses through the site, with Mercia Mudstone encountered beneath the south eastern third of the site and Bromsgrove Sandstone outcropping beneath the larger north western part of the site. The fault passes through the site somewhere beneath the Cold Store and could either be the Birmingham Fault, or possibly a separate fault associated with and running parallel to the Birmingham Fault. The fault is not considered to be geologically active and no significant movement is anticipated.

A summary of the general site geology is provided in *Table 13.2*.

Table 13.2: *General Summary of the Site's Geology*

Strata	Description	Depth Encountered (m bgl)	Thickness
Made Ground	Black-top, concrete, per-formed concrete slab, concreted brick, tarmac or soil/clay matrix.	From ground level.	Generally between 0.1 m and 0.4 m thickness
	Variable reddish brown – dark grey gravelly/sandy clayey brick fill with localised pockets of black ashy sandy gravel, cobbles.	Between 0.1 m and 0.6 m bgl.	Between 0.8 m and 2.4 m thickness
Head Deposits	Light grey silty gravelly sand	Between 0.9m and 1.3 m bgl.	Between 0.3 m and 0.9m thickness
Bromsgrove Sandstone	Reddish brown silty fine-medium SAND with occasional very thin to thin beds of calcareous, well-cemented and uncemented silty sand.	Between 1.2m and 2.5m bgl.	Not proven in excess of 48.50m thickness
Mercia Mudstone	Very weak reddish brown fractured MUDSTONE with clay partings and occasional thin light grey dolomite beds.	Between 1.2 – 2.1m bgl.	Not proven, in excess of 48.6m thickness

The site investigation included sampling of the soil and groundwater for a number of parameters including:

- a range of dissolved metals (As, Cd, Cr, Pb, Hg, Se, Cu, Ni, Zn and Fe);
- pH, sulphate, total organic content and total cyanide;
- nitrate as N, ammonia as N, total organic carbon and alkalinity as $CaCO_3$;
- speciated Polyaromatic Hydrocarbons (PAHs), monohydric phenol and hydrocarbons; and
- VOCs and SVOCs.

The nature and level of contaminants identified at the site are not considered to pose a significant risk of environmental impairment to groundwater quality as no significant pollution source was found to exist on the site and the site is not significantly contaminated.

Resting groundwater levels were monitored following the installation of the wells and prior to purging and sampling. The resting groundwater levels provide a more accurate representation of groundwater levels across the site compared to inflow depths observed during drilling. Following the conclusion of the investigation, the groundwater levels of all nine boreholes were calculated in relation to ordnance datum, as shown in Table 13.3 below:

Position	Date	Groundwater level (m bgl)	Ground Elevation (m AOD)	Groundwater level (m AOD)
BH1	18.02.2008	6.80	106.887	100.087
	25-26.03.2008	2.39	106.887	104.497
	23.04.2008	2.48	106.887	104.407
BH2	13.02.2008	DRY	108.237	-
	18.02.2008	DRY	108.237	-
	25-26.03.2008	DRY	108.237	-
	23.04.2008	DRY	108.237	-
BH3	13.02.2008	1.83	108.524	106.694
	25-26.03.2008	1.79	108.524	106.734
BH4	13.02.2008	1.67	108.336	106.666
	25-26.03.2008	1.61	108.336	106.726
	23.04.2008	1.67	108.336	106.666
BH5	13.02.2008	DRY	109.610	-
	25-26.03.2008	2.63	109.610	106.98
	23.04.2008	DRY	109.610	-
BH6	13.02.2008	1.41	105.920	104.51
	25-26.03.2008	1.42	105.920	104.5
	23.04.2008	1.61	105.920	104.31
BH7	13.02.2008	DRY	106.822	-
	25-26.03.2008	DRY	106.822	-
	23.04.2008	DRY	106.822	-
BH8	13.02.2008	1.87	108.465	106.595
	18.02.2008	0.75	108.465	105.715
	25-26.03.2008	1.72	108.465	106.745
	23.04.2008	DRY	108.465	-
BH9	13.02.2008	2.90	109.686	106.786
	25-26.03.2008	2.58	109.686	107.106
	23.04.2008	2.90	109.686	106.786

m AOD = m Above Ordnance Datum
m bgl = m below ground level
BH2, BH5, BH7 and BH8 installed with a 50mm diameter standpipe within the Made Ground deposits.
BH1, BH3, BH4, BH6 and BH9 installed with a 50mm diameter standpipe within the solid geology.

Table 13.3: *Resting Groundwater Levels*

The groundwater records to date indicate one relatively shallow groundwater body to be present beneath most of the site, with the exception of borehole BH1. The groundwater within the Sherwood Sandstone (predominantly to the north and west elevations of the site) appears to be slightly higher (above ordnance datum) than the groundwater within the Mercia Mudstone (southern and eastern elevations). The hydraulic gradient across the site is anticipated to flow parallel to the slope i.e. from North West to south east. It is suspected that the fault that has juxtaposed the highly permeable Bromsgrove Sandstone against the less permeable Mercia Mudstone is effectively acting as an underground dam. The shallow groundwater level is probably due to its through flow being impeded by the fault line and the Mercia Mudstone. It should be noted that the deposits are possibly in hydrologically continuity with the River Rea to the east of the site.

According the *Groundwater Vulnerability Map of South Staffordshire and East Shropshire (Sheet 22)*, the site is located on a major aquifer, relating to the sandstone solid stratum. Major aquifers are highly permeable formations, being highly productive, capable of supporting large abstractions for public supply and other purposes.

As the site is within an urban area, any underlying soils are automatically classified as having high leaching potential (HU), *i.e.* they have little ability to diffuse source pollutants and liquid pollutants have the potential to move rapidly into underlying strata (it should be noted that all soils within urban areas are classified according to the worst case scenario).

Source Protection Zones (SPZs) are defined for groundwater sources such as wells, boreholes and springs used for public drinking water supply. The site is not located within a designated Source Protection Zone (SPZ). However, there are a number of designated SPZs and a groundwater source in the surrounding area. The details of theses se are summarised in the *Table 13.4* below.

Table 13.4: *Groundwater Source Protection Zones*

Distance (m) & Direction from site	Designation
349 NW	Zone III (total catchment)
426 W	Zone II (outer protection zone)
475 W	Zone I (inner protection zone)
675 NW	Zone I (inner protection zone)
707 NW	Grand Hotel Zone I (inner protection zone)
525 W	Groundwater Source (Midland Hotel)

The EA defines the zones accordingly:

- **Zone 1 (Inner Protection Zone):** any pollution that can travel to the borehole within 50 days from any point within the zone is classified as being inside zone 1;
- **Zone 2 (Outer Protection Zone):** the outer zone covers pollution that takes up to 400 days to travel to the borehole, or 25% of the total catchment area – whichever area is the biggest; and
- **Zone 3 (Total Catchment):** the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

According to a publicly available third-party environmental database, there are four licensed groundwater abstractions within a 1km radius of the site. The nearest is located 525 m to the west. Burlington Hotel, Hortons Estate Limited, is authorised for the abstraction of groundwater for general use. In addition, there is a public water supply abstraction borehole located circa 716 m to the south. Water for water supply related use (transfer between sources) is abstracted by Severn Trent Water Limited.

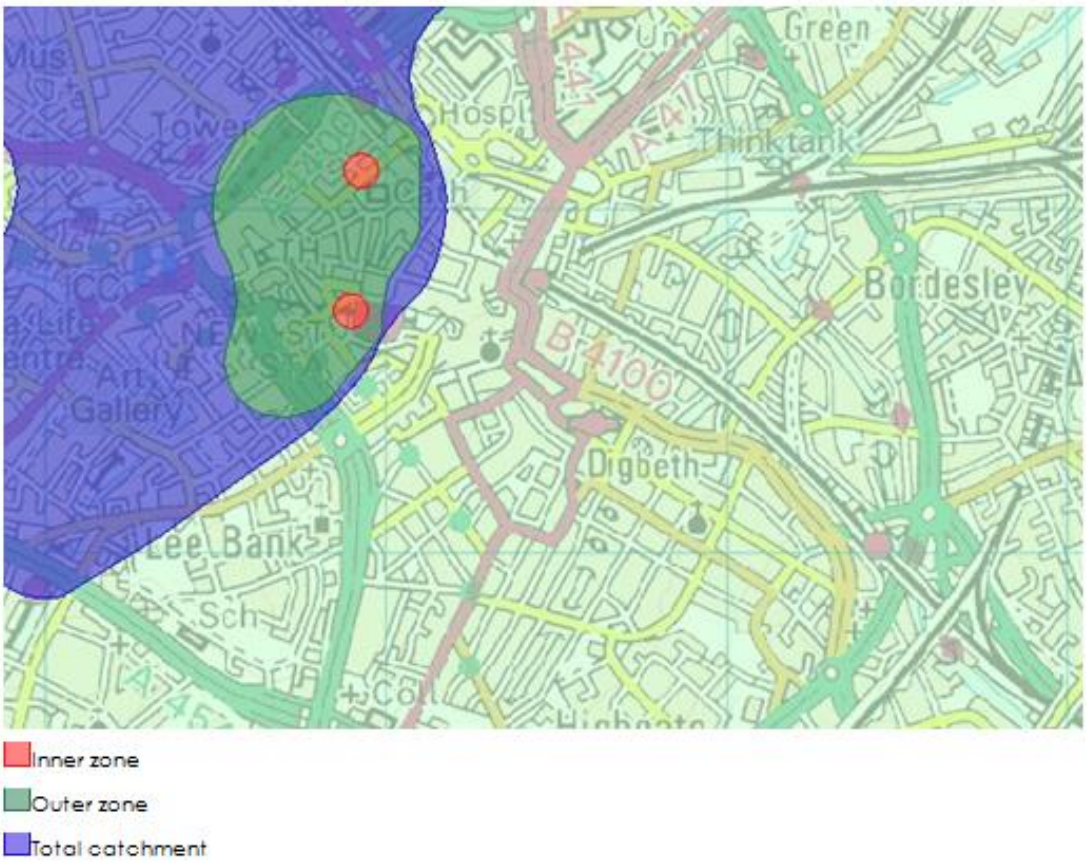

Figure 13.2: *Groundwater Source Protection Zones*

In addition, from borehole logs obtained from the British Geological Society (BGS) there is a groundwater abstraction well beneath the former Cold Store on the site. The well (86 m (282.6 feet) in depth) appears to have been sunk for abstraction purposes when the site manufactured ice, the abstracted water being for ice making and general usage. The well was constructed circa 1899 directly beneath the works, the water being pumped to the surface at approximately 1,200 gallons per hour. A note with the borehole log, dated September 1942, states that the borehole overflowed in 1900; a second note on the log, dated 1948, states that the well was dry and that it had failed in 1937 due to falling yields between 1899 and 1935.

Another note, dated October 1981, states that the well has been disused since 1965 and is sealed at present. The note goes on to state that the cellars and lift shaft have recently become flooded and that the borehole may possibly be opened for investigation. From the drilling log for this borehole, dated circa 1918, it is apparent that the former Cold Store is located directly on sandstone bedrock.

This disused borehole will be decommissioned in accordance with Environment Agency guidance document 'Decommissioning Redundant Boreholes and Wells' prior to demolition and construction activities. A method for the decommissioning of the borehole will be agreed beforehand with the Environment Agency.

Information gleaned from a 1995 archaeological study for the site noted that the former Digbeth Mineral Springs (mineral water manufacture from 1850) was situated in the north eastern area of the site, which reportedly was originally built as a school. Adjoining this building was a cistern at the same location as a spring. In 1889 workmen came across a large tank whilst lowering a yard (the tank was dated 1854), which was fed by a 400 feet deep (122 m) artesian bore. The bore was connected via culverts to a series of wells, which in turn were connected to an underground reservoir circa 40 feet (circa 12 m) long. Workmen noted from the pattern of brick work that this was already quite dated. The wells were amongst many on the Park Street side of upper Digbeth, which was called Well Street in the 18th century, and included wells in many of the cellars fronting Digbeth, which would have provided an extensive water supply.

The different account between the water being pumped (*i.e.* having to be mechanically lifted from the aquifer in the Cold Store) and artesian (*i.e.* was free flowing out of the borehole under its own pressure) could elude to there being two different historic abstraction boreholes on the site, or they could be one and the same that may have originally been artesian but which at a later date required pumping.

None of the aforementioned abstractions are likely to affect or be affected by the proposed development, because there will be no contaminated discharges to groundwater from the site.

The wells and channels have been fed into the Site Constraints drawing to ensure all appropriate measures are taken during construction.

13.5 Assessment of Project Impacts

The effects on water quality and hydrology likely to arise from construction and operational phases of the proposed development are as previously identified:

13.5.1 Construction

Contamination Arising from General Construction Drainage

The Phase II Environmental Assessment concluded that the nature and level of contaminants identified across the site were low and that soil contamination is not providing a significant ongoing source of contamination to groundwater. Furthermore, the near surface soils will largely be excavated to create voids for the basements. Any imported fill material used on site will be inert, uncontaminated material and will not lead to any impact or degradation of the soil and groundwater quality underlying the site.

The operation of construction vehicles and general construction activities give rise to the potential for surface runoff to become contaminated with hydrocarbons, silt or other construction materials. The greatest risk relates to plant and vehicle refuelling activities that may take place on site. Spillages in these refuelling areas could lead to a pollution event should contaminated surface water run-off be allowed to enter surface watercourses or the ground untreated.

Potential Groundwater Interruption during Construction

The site investigation identified one groundwater body at the site, groundwater within the underlying Sherwood Sandstone strata within the depth range of the site investigation. Therefore, during construction, dewatering of excavations may be required. Surface waters generated in this manner will be controlled, treated, if necessary, and discharged as described in Section 13.5.1 for general site drainage.

The proposed development will require piling and the construction of basements that may lie below the resting groundwater level. Such structures have the potential to interrupt or alter groundwater flow.

13.5.2 Operation

Surface Runoff

The operational impacts and mitigation measures in respect of surface run-off remain as previously identified. As stated previously PPS25 has been withdrawn and the current scheme, as presented in Appendix A, has been evaluated in line with current requirements and attenuated as necessary.

An estimate of surface water runoff volumes for the site was calculated for the 2009 report. The storm volume and peak flow figures were generated for the site area (0.77 ha) based on the site having a 100 % impermeable surface area (*i.e.* the worst case scenario). The rainfall depth (mm) has been calculated using the Flood Estimation Handbook software; the runoff volumes were based on a storm duration of 30 minutes. In accordance with the data set out in Table B.2 of PPS25, an increase of 20 % has been allowed on existing rainfall intensities to compensate for the effects of climate change in the next 60 years.

The estimated surface water runoff volumes are presented in Table 13.4 below.

Table 13.4 – Estimated Surface Water Runoff Volumes

Return Period	FEH Rainfall	Storm Volume	Storm Volume with 20% climate change correction	Peak Flow	Peak Flow with 20% climate change correction
years	(mm)	V (m^3)	V (m^3)	Q (l/s)	Q (l/s)
2	9.9	92.44	11.88	51.40	61.68
5	14.3	133.53	17.16	74.24	89.09
10	18.3	170.88	21.96	95.01	114.01
25	24.9	232.51	29.88	129.28	155.14
50	31.3	292.27	37.56	162.50	195.0
100	39.4	367.91	47.28	204.56	245.47

The proposed development will result in an increase in surface water runoff given that the majority of the site will be hard surfaced; by comparison the current site has some areas of unsurfaced ground, notably the unsurfaced car park, which allows for the percolation of rainwater to ground rather than surface water run-off.

The new development proposal comprises a number of buildings with an open central public space. The area of impermeable surface will increase, however there will be some landscaping at the site including terraces, green and brown roofs. Approximately 64 % (3,010 m^2) of the site by area will comprise terraces and green roofs, with 36 % (1,700 m^2) comprising brown

roofs. Approximately 50 m^2 of ground level planting will include the planting of shrubs and trees.

Detailed surface water runoff volumes will be calculated in due course. These calculations will also include an assessment of the impacts of climate change for the operational lifetime of the development. The calculated runoff volumes will be submitted to the Environment Agency in order to enable a consent to be granted for the groundwater discharge. This will aid recharge of the water levels in the aquifer and is typically regarded as a beneficial action.

Contamination of Surface Water or Groundwater from Routine Site Drainage

The majority of the site will be covered in hardstanding which will reduce infiltration rates on site and there is no evidence of significant soil contamination source. Given this and the amount of excavation and infilling with clean materials there is negligible likelihood of site drainage causing groundwater contamination.

Foul Drainage Capacity

There are existing connections to the municipal foul drainage system for the site. All foul water generated at the site, during construction and operational phases, will be discharged to the municipal foul sewer.

Severn Trent Water has confirmed that there are existing off-site municipal foul sewers in Digbeth, Allison Street and Park Street, and that it considers there to be sufficient capacity in the receiving municipal foul sewer system for the estimated increased flows.

13.6 Assessment of Cumulative Impacts

There are no other projects in the locality that are likely to interact with the groundwater or surface water systems of the site and cumulative impacts are not anticipated.

13.7 Impact Mitigation and Residual Effects

13.7.1 Construction

Mitigation of Contamination Arising from General Construction Drainage

Depending upon the weather conditions, excavations may require dewatering (of accumulated rainfall or runoff) during construction. In such circumstances, care will be taken to ensure the quality of this water is sufficiently high to allow discharge into the municipal sewer. Where it is not it will be tinkered off site to an appropriate treatment centre.

All site works will be undertaken in accordance with the EA's Pollution Prevention Guidance Note 6 'Working at Construction and Demolition Sites'. Construction vehicles will be properly maintained to reduce the risk of hydrocarbon contamination and will only be active when required. Construction materials will be stored, handled and managed with due regard to the sensitivity of the local aquatic environment and thus the risk of accidental spillage or release will be minimised. Construction contractors will also take full account of the requirements of the EA's General Guide to the Prevention of Pollution of Controlled Waters (PPG1) and guidance set out in PPG2 (Above Ground Oil Storage Tanks) and PPG3 (The Use and Design of Oil Separators).

In accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001, any tanks storing more than 200 litres of oil will have secondary bunding. Bunding will be specified having a minimum capacity of "not less than 110% of the container's storage capacity or, if there is more than one container within the system, of not less than 110% of the largest container's storage capacity or 25% of their aggregate storage capacity, whichever is the greater." Above ground storage tanks will be located on a designated area of hardstanding. No underground storage tanks will be used during the construction period. Storage of liquids such as degreasers, solvents, lubricants and paints would be in segregated, bunded enclosures.

The construction drainage system will be designed and managed to comply with BS6031:198 "The British Standard Code of Practice for Earthworks", which details methods that should be considered for the general control of drainage on construction sites. Further advice is also contained within the British Standard Code of Practice for Foundations (BS8004, 1986).

Furthermore, these mitigation measures will be incorporated into a Construction Environmental Management Plan (CEMP), which will set out measures for the control of site drainage, reducing the risk of accidental spillages and the storage and handling of materials.

Residual impact after mitigation: Insignificant

Mitigation of Potential Groundwater Interruption during Construction

The site, is very small and will have a soakaway borehole for surface water run-off and will have a groundsource heat pump and piles, all of which may interact with the shallow groundwater but the system will reach equilibrium after the construction phase. Overall, there is expected to be minimal impact of the development on groundwater flow characteristics in the aquifer given the small size of the site and associated disturbance.

Residual impact after mitigation: Insignificant

13.7.2 Operation

Surface Runoff

It is proposed that surface water runoff from all areas of the site, with the exception of trafficked areas, will be discharged, via a silt trap, to the major aquifer via a dedicated on-site borehole. The small volume of surface water runoff from trafficked areas will be discharged to the municipal storm water drainage system. Prior to discharge into this municipal sewer the runoff will be passed via an oil water interceptor.

A feasibility assessment for the proposed surface water discharge borehole will be undertaken. The assessment will be presented to and discussed with the Environment Agency.

Residual impact after mitigation: insignificant.

Mitigation of Contamination of Surface Water or Groundwater from Routine Site Drainage

The principal source of contamination from routine operation of the site is hydrocarbon contamination from vehicles parked on site. The proposed development will provide an internal road and an area of car parking space with oil/water interceptor systems at strategic locations. Therefore, routine site drainage will have a low risk of contamination, especially given the potentially benign nature of the occupiers' activities.

Residual impact after mitigation: Minor Positive

Increased Water Consumption

Water efficiency measures can reduce consumption by 20-25% (EA). Therefore, water minimisation and conservation measures are important considerations for the proposed development, to minimise the increase in water demand. Water demand will be reduced as far as possible, by the incorporation of appropriate water saving devices, wherever practicable. The buildings are designed to maximise water efficiency through low water use sanitary appliances, optimising hot water use, dual flush toilets and low flow and aeration taps in appropriate locations. Given that the site is effectively being completely redeveloped, the entire water supply infrastructure and uses will be new and more efficient than the ad-hoc systems that currently exist.

Severn Trent Water will be contacted regarding mains water supply for the site.

Residual impact after mitigation: Minor Negative

13.8 Summary

Given the foregoing, there has been very little change in terms of water quality and hydrology to the situation presented in the Environmental Statement prepared in 2009. As such, the original assessment that 'the development will have a minor positive impact on the surrounding area' still applies.

A summary of the key impacts and mitigation measures concluded in the original report are provided below:

- the development will have a minor positive impact on the surrounding area as it will assist in reducing the risk of contamination to the wider area through the resurfacing of the site;
- all construction activities will be carried out in accordance with the EA's pollution prevention guidelines, notably PPG 6 'Working at Construction and Demolition Sites'. This will reduce the risk of surface water or groundwater contamination during construction;
- the on-site disused borehole will be decommissioned in accordance with Environment Agency guidance document 'Decommissioning Redundant Boreholes and Wells' prior to demolition and construction activities. A method statement for the decommissioning of the borehole will be agreed beforehand with the Environment Agency;
- the site is not located within an area that may be affected by flooding, being located within Flood Risk Zone 1 i.e. where the risk of flooding from rivers or the sea is classified as low (assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1)), as such the site is not at risk of flooding;
- the surface runoff from non-trafficked areas of the site will be discharged to the underlying major aquifer via a dedicated on-site borehole/s thereby avoiding excessive loading of the local drainage system and recharging the aquifer with clean water. Run off from trafficked areas of the site, which will equate to small volumes, will be discharged to surface sewer via an oil/water interceptor. Whilst the overall volume of run-off will be increased, the run-off will be from a newly developed site with no pollution loading from site contaminants;
- the redevelopment of the site will increase the number of site users which will cause an increase in water demand to meet the needs of the new occupants. These increases will be offset by the adoption of a variety of water-saving devices in the buildings and more efficient delivery and management of the supplied water; and

- similarly, the redevelopment will increase the volume of foul drainage generated at the site. However, Severn Trent Water has confirmed that it considers there to be sufficient capacity in the receiving municipal foul sewer system for the estimated increased flows.

Based upon the appraisal of water quality and hydrology impacts discussed above, the residual impacts associated with the **Construction Phase** are deemed to be of **LOW** significance and short-term and temporary in nature. The residual impacts associated with the **Operational Phase** are deemed to be of **LOW** significance and long-term or permanent in nature (**Minor Positive**).