



RIDGE

**ATLAS PARK, MANCHESTER
FLOOD RISK ASSESSMENT &
DRAINAGE STRATEGY REPORT**

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ATLAS PARK, MANCHESTER FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY REPORT

Prepared for

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1. EXECUTIVE SUMMARY

- 1.1.1. This report details the Flood Risk and Drainage Strategy for the proposed planning application for the proposed industrial development at Atlas Park. The proposals are for 5no. B2 B8 Industrial units totalling approximately 411,300 sq. ft and associated offices, service yards, car parking, access, and landscaping. Table 1 below provides a summary of the Flood Risk and Drainage / SuDS Strategy for the scheme.

Table 1 – Drainage and Flood Risk Summary

Item	Brief Description
Flood Zone	The site in Fluvial Flood Zone 1 (Low Risk). See Figure 2. Pluvial (Surface Water Flooding) Generally very low Risk with areas of Low, Medium and High Risk at site Low Spots. For events up to and including the 100 year design event (medium risk), there is minimal risk to off-site property. The 1000 year, residual flood risk does involve some off site flow paths contributing to on site flooding. These have been mapped using Environment Agency, Risk of Flooding from Surface Water (RoFSW) mapping and have been mitigated through the design See Figures 3 and 4 The site is at low risk of flooding from all other sources, surface water flood risk will be mitigated through appropriate levels design.
Geology	The BGS 1:50,000 mapping shows the site to be predominantly underlain by Devensian Till (silty gravelly clays) superficial deposits over Bollin Mudstone Bedrock. There is a small area of the north-eastern corner of the site shown to include Helsby Sandstone formation bedrock. No site investigation has been undertaken. Though it is expected that made ground is present to the western 2/3rds of the site due to previous development. BGS Onshore borehole records close to the site indicate that the BGS 1:50,000 mapping is likely to be correct. The site aquifer designations Superficial – Secondary (undifferentiated) Aquifer Bedrock (Bollin) – Secondary B Aquifer Bedrock (Helsby) – Principal Aquifer
Infiltration Rate	At the time of writing this report a ground investigation and infiltration testing had not been conducted for the development. Falling head tests will be procured at the time of the site investigation to inform whether infiltration is feasible at the site. If infiltration is found to be feasible – BRE365 testing will be carried prior to construction to inform the design.
Nearest Watercourses	There is a Main River (Gatley Brook) 200m east of the site. The main river flows north to the River Mersey and is a mixture of open channel and culverted watercourse. Gatley Brook is a principal flood risk generator within Gatley Town Centre. There is a culverted ordinary watercourse approximately 400m west of the site (a tributary of Baguley Brook). This watercourse is shown as a flood risk generator through Sharston.
Nearest Adopted Sewers	There is a public Combined Water Sewer which crosses the entrance to the site. There is a UU Surface Water Sewer approximately 400m west of the site which discharges to the Baguley Tributary described above. The previous development is assumed to have drained to the public combined

	sewer.
Surface Water Outfall and SuDS Hierarchal Approach	Based on the above, Infiltration – Infiltration will be investigated further once the Phase 2 SI is progressed, however, from a review of the BGS it is considered unlikely that infiltration will be feasible. Watercourse – Both of the adjacent watercourses are considered to be flood risk generators downstream of the site. As no existing flows from the site enter either watercourse, any new connection, even at greenfield run off rates would increase flows within the watercourse and potentially increase the number of properties at risk of flooding within Gatley and Sharston. Surface Water Sewer – Connection to the surface water sewer east of the site would have the same potential impact on downstream properties (the UU SW Sewer discharges to the Baguley Brook Tributary). Combined Sewer – Discharge to the combined sewer is considered the most sustainable method for the discharge of surface water as it is the only option that does not increase flood risk downstream.
Existing Discharge Rate	0.338 ha hardstanding (modified Rational method, 35mm/hr) 32.9 l/s 9.512 ha greenfield run off – QBAR – 48.9 l/s Total site – 81.8 l/s
Proposed Discharge Rate	In accordance with the SFRA, existing run off rates will be reduced by 50%. The remainder of the site will discharge as greenfield, in accordance with the Non Statutory Standards for Sustainable Drainage Systems , QBAR Rates will be used to limit discharge from greenfield areas. Greenfield Discharge Rates below. Brownfield Discharge – 16.4 l/s Greenfield QBAR – 48.9 l/s Total Discharge From Site – 65.3 l/s
Allowance for Climate Change	Upper Mersey Management Catchment, Upper End Allowance, 2070's 3.3% AEP – 40% 1% AEP 45% To be applied to the modelled drainage calculations
Proposed Attenuation Method and Volume	Geocellular Storage Tank SW Sewer Outfall – 4,800 m³ to contain the 100year + 45% event.
SuDS features	Geocellular Storage Tank, oversized pipes & Petrol interceptors.
Maintenance Responsibility	Management Company / Site owner.
Foul Drainage Outfall	Gravity Connection to the public combined sewer at the entrance to the site, via an existing private connection

- 1.1.2. There is no residual flood risk from the development site to the surrounding district due to the reduction of existing storm water flow rates. Therefore, the development does not increase the risk of flooding to the other adjacent properties and roads. The site surface water drainage system will be designed in accordance with the requirements of the NPPF. Events up to the 30 year will be stored below ground. Events in excess of 30 year and up to 100 year +40% may be allowed to flood, but this will be controlled on site and not flood buildings. Out of chamber or gully flooding for the events in excess of the 100-year plus 40% climate change event may occur within the development site and is classed as exceedance flows. Flood water from this event will be contained within the development site and directed away from the buildings to the external hard and soft landscaped areas.

2. INTRODUCTION

- 2.1.1 Ridge & Partners LLP have been appointed by Aviva Life and Pensions Ltd to prepare this Flood Risk Assessment (FRA) and Drainage Strategy Report to proposed planning application for the proposed industrial development at Atlas Park. The proposals are for a 5no. B2 B8 Industrial units totalling approximately 411,300 sq. ft and associated offices, service yards, car parking, access, and landscaping. The assessment has been undertaken in line with the new 'National Planning Policy Framework' (NPPF), plus the accompanying 'Flood Risk and Coastal Change' chapter of the National Planning Practice Guidance.
- 2.1.2 The assessment is based on the development proposals as described by the Architectural plan which is included in **Appendix A**.
- 2.1.3 The report has been commissioned to identify any drainage-related issues associated with the proposed development and which are subsequently addressed within this report;
- Identify available data relating to flood risk at the site.
 - Determine whether the site is at risk from flooding from all sources, including from breach or overtopping of any existing flood defences, surface water flooding and/or groundwater flooding.
 - Consider the flood risk from all other sources.
 - Determine the current surface water drainage regime and assess any potential increase in surface water runoff as a result of the proposed development.
 - Discuss Sustainable Drainage Systems (SuDS) as an option for reducing surface water flood risk.
 - Devise an appropriate outline surface water drainage strategy (including calculation where appropriate) to deal with any potential increase in surface water runoff and include for climate change.
 - Devise an appropriate outline foul water drainage strategy.
 - Consider the recommendations of West Lancashire Strategic Flood Risk Assessment (SFRA).
 - Assess mitigation measures & off-site impacts and define any residual risks.

3. PLANNING POLICY AND CONSULTATION

3.1 Planning Policy Framework

- 3.1.1. The flood maps provided by the Environment Agency (EA) locate the site as within Flood Zone 1, i.e., land defined as having an annual probability of fluvial flooding of less than 1 in 1000 in any year (<0.1%). As a requirement of the NPPF (2019) and accompanying National Planning Practice Guidance (NPPG), the proposed development has to satisfy the requirements of the Sequential Test and where applicable the Exception Test.
- 3.1.2. Sequential Test:
Under the NPPF (2019), Zone 1 is defined as low probability flood risk. The proposal is for new industrial development, which in line with Table 2 is classified as 'Less Vulnerable'.
- 3.1.3. Placing both these criteria into Table 3 (Flood Risk Vulnerability and Flood Zone 'Compatibility'), Less Vulnerable development in Flood Zone 1 determines that 'Development is Appropriate'.
- 3.1.4. Exception Test:
As the Sequential test is passed, the Exception test is not required.

3.2. Strategic Flood Risk Assessment (SFRA)

- 3.2.1. SFRA's assess the risk associated with all types of flooding and provide the information required to identify the amount of development permitted in an area; how drainage systems in the area should function and also how risks in vulnerable areas can be reduced and/or mitigated. The NPPF states that Regional Planning Bodies (RPB's) or Local Planning Authorities (LPA's) should prepare SFRA's in consultation with the EA.
- 3.2.2. Manchester, Salford, and Trafford Council prepared a Strategic Flood Risk Assessment Level 1 in 2010 for its administrative area. The Level 2 report was published in 2011. The purpose of the SFRA is to assess and map all known sources of flood risk including fluvial, surface water, sewer, groundwater, and all impounded water bodies, taking into account future climate change predictions.
- 3.2.3. A summary of the main elements from the SFRA associated with the development site is detailed below. The full report can be found on the Manchester City Council Website.
- SFRA provides a detailed understanding of flood risks across the borough from all sources.
 - Development is located within a Flood Zone 1 with some areas of Flood Zone 2 and is at low to medium risk of fluvial flooding.
 - Little or no incidents of sewer flooding.
 - Little or no incidents of historical flooding.
 - Little or no incidents of groundwater flooding.
 - Small, localised areas of surface water flooding within the site at existing low spots
 - Site is located within the Manchester and Trafford South Critical Drainage Area (CDA).

- Full sequential and exception tests to be carried out where applicable.
- New developments surface water runoff rates leaving the site reduced by 50% from those previously discharged.

4. THE SITE

4.1. Site Details

4.1.1. The site details are summarised in **Table 2** below:

Table 2 - Site Details

Item	Brief Description
Site name	Atlas Park, Manchester
Site address and location	Land off Simonsway, Manchester, M22 5RR
Planning Authority	Manchester City Council
Lead Local Flood Authority	Manchester City Council
Drainage Statutory Undertaker	United Utilities
Site Area	9.85 ha
Approximate Grid Reference	OS: 383877,386026
General Locality	The site is located close to Manchester Airport, between Heald Green and Woodhouse Park

4.2. Site Description

- 4.2.1. The existing site and surrounding boundary conditions is shown **Figure 1**. The redline boundary denotes the detailed application boundary.
- 4.2.2. The site area is approximately 9.85 ha, in the Wythenshawe district of Manchester, north east of the airport. The site is bound to the north by Simonsway, the east by Styal Road.
- 4.2.3. The west of the site was formerly used as a works building, which has now been demolished, existing infrastructure is still present at the site. The east of the site has been used as sports pitches previously but is now scrubland.



Figure 1 - Aerial Photograph of Existing Site

4.3. Proposed Development

- 4.3.1. As discussed in the earlier sections, the report is prepared to support a proposed planning application for the proposed industrial development at Atlas Park. The proposals are for 5no. B2 B8 Industrial units totalling approximately 411,300 sq. ft and associated offices, service yards, car parking, access, and landscaping.
- 4.3.2. The site is approximately 9.85 ha in area.
- 4.3.3. Access into the development parcel will be from the existing adopted highway, Simonsway.
- 4.3.4. The current outline Architectural Master Plan in Appendix A provides an indication of the proposals of the site.

5. DEFINITION OF FLOOD HAZARD

5.1. Sources of information

- 5.1.1. The NPPF (2019) requires the developer to consider the impact of runoff generated by the proposed development onto the downstream catchment, and to assess the risk of runoff from the surrounding district impacting on the development footprint. Further, the report is to consider flood risk from all other sources. The following section defines the flood risk receptors and anticipated flood risk. Section 5 then discusses in further detail the probability of flooding and the likely impacts.

Table 3 - Sources of information used in the identification of flood risk

Source of Information	Details
Environment Agency Flood Map	Indicative Flood Maps
United Utilities	Sewer Records
Historic Maps	From various websites
Manchester, Salford, and Trafford Level 1 and 2 SFRA's, 2010 & 2011 respectively	Report & Various Maps from SFRA

5.2. Flooding from Rivers (Fluvial)

- 5.2.1. The EA flood risk mapping indicates that the site is in Flood Zone 1 (>1000 year).
- 5.2.2. There is a main river 200m east of the site, Gatley Brook. This is a mixture of open watercourse and culverted watercourse as it flows to the north, to the River Mersey. Gatley Brook is a is the source of flooding in Gatley Town Centre.
- 5.2.3. **Figure 2** below locates the site on the Environment Agency's indicative floodplain map. It is clear from this that the proposed building parcel sits outside of a fluvial generator of flood water from the main river.
- 5.2.4. Access and egress from the site in a are not impacted by Fluvial Flooding.
- 5.2.5. The flood risk to the site from Fluvial generators is considered low.

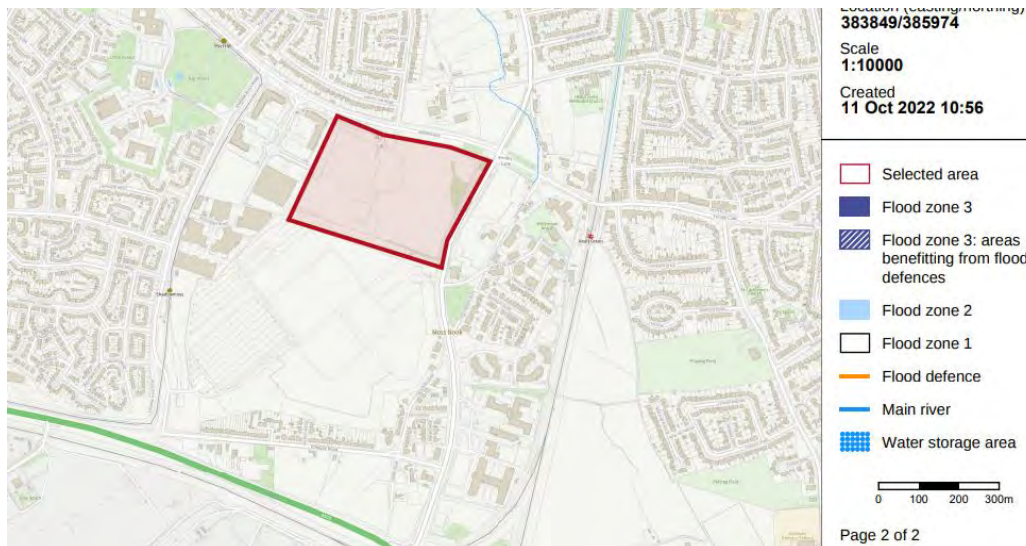


Figure 2 - The EA's Flood Zone Map

5.3. Flooding From Land (Overland Flow)

- 5.3.1. A review of the Gov.uk surface water map shows majority of the site not being at risk of surface water flooding as illustrated in **Figure 3 and 4**. The maps identified small areas within existing development to be in a low / medium / high risk of surface water flooding. These ponding areas are due to low spots in the site.
- 5.3.2. Beyond the southern boundary, there is low risk (0.1% AEP) of surface water flooding, from the land off site. These flow paths must be maintained through the development.
- 5.3.3. The various instances of flooding for low, medium, and high risk events have been mapped and annotated. Consideration in the design is to mitigate the risk of the high and medium risk storms, whilst taking account of the residual risk posed by the low risk events. The drawings are included in **Appendix E** and are tabulated below.

Table 4 - Surface Water Flood Risk Areas

SW Flood Reference	30 year (high risk)	100 year (medium risk)	1000 year (low risk / residual)	Comments
On site 01	Only on site flows contributing – will be mitigated through the installation of a Surface Water Drainage System	Only on site flows contributing – will be mitigated through the installation of a Surface Water Drainage System	Only on site flows contributing – the development will reduce the off-site flooding that currently occurs.	Off site flood risk will be reduced in the 1000 year event through completing this development
On site 02	No 30 year risk	No 100 year risk	Only on site flows contributing – will be mitigated through the installation of a Surface Water Drainage System	Flood risk mitigated through development.
On site 03	No 30 year risk	Only on site flows contributing – will be mitigated through the installation of a Surface Water Drainage System	Only on site flows contributing – the development will reduce the off-site flooding that currently occurs.	Off-site flood risk will be reduced in the 1000 year event through completing this development
On site 04	Only on site flows contributing – will be mitigated through the installation of a Surface Water Drainage System	Only on site flows contributing – will be mitigated through the installation of a Surface Water Drainage System	Off site flows contribute to the 1000 year flood extents. FFL to be raised above existing levels with land set aside for the residual risk to the site from the 1000 year event.	Mitigation through raising of on site levels. Storage area set aside for worst case event.
Off site01	No Flood risk to development site.	No Flood risk to development site	Off-site flows contribute to the 1000 year flood extents. FFL to be raised above existing levels with land set aside for the residual risk to the site from the 1000 year event.	Mitigation through raising of on-site levels. Storage area set aside for 1000 year event

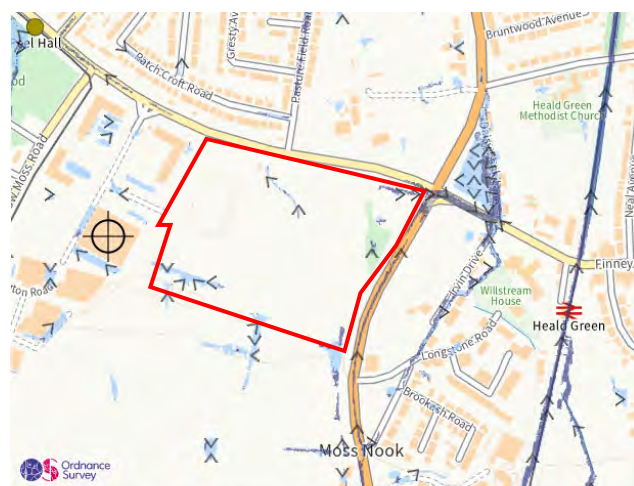
Off-site 02	No Flood risk to development site.	Limited flood risk within site boundary, no impact on development area	Off-site flows contribute to the 1000 year flood extents. Ground levels to be raised above existing levels with land set aside to maintain flow paths in the 1000 year event.	Mitigation through raising of on-site levels. Flow path maintained for 1000 year event.
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Extent of flooding from surface water

High Medium Low Very low Location you selected

Figure 3 - Site Wide Surface Water Flood Areas



Surface water flood risk: water velocity in a medium risk scenario
Flood velocity (metres/second)

Over 0.25 m/s Less than 0.25 m/s Direction of water flow Location you selected

Figure 4 - The EA's Indicative Surface Water Flow Routes – Medium Risk, 100 year, Velocity

- 5.3.4. Whilst the existing surface water flood risk to the development is considered in some areas to be Medium / High, by incorporating appropriate mitigation measures and designing the drainage strategy to ensure that any surface water flooding is controlled, the risk of flooding from overland flow is considered to be low.

5.4. Flooding from Artificial Drainage

- 5.4.1. There are no canals or reservoirs in close proximity to the site.
- 5.4.2. United Utilities (UU) sewer records have been reviewed and public sewers pass to the north of the site. An extract of the UU sewer records is shown in **Figure 5**.
- 5.4.3. The existing on site infrastructure is believed to discharge into the public combined sewer to the north of the site.
- 5.4.4. As such the risk of flooding at the site is regarded as low.

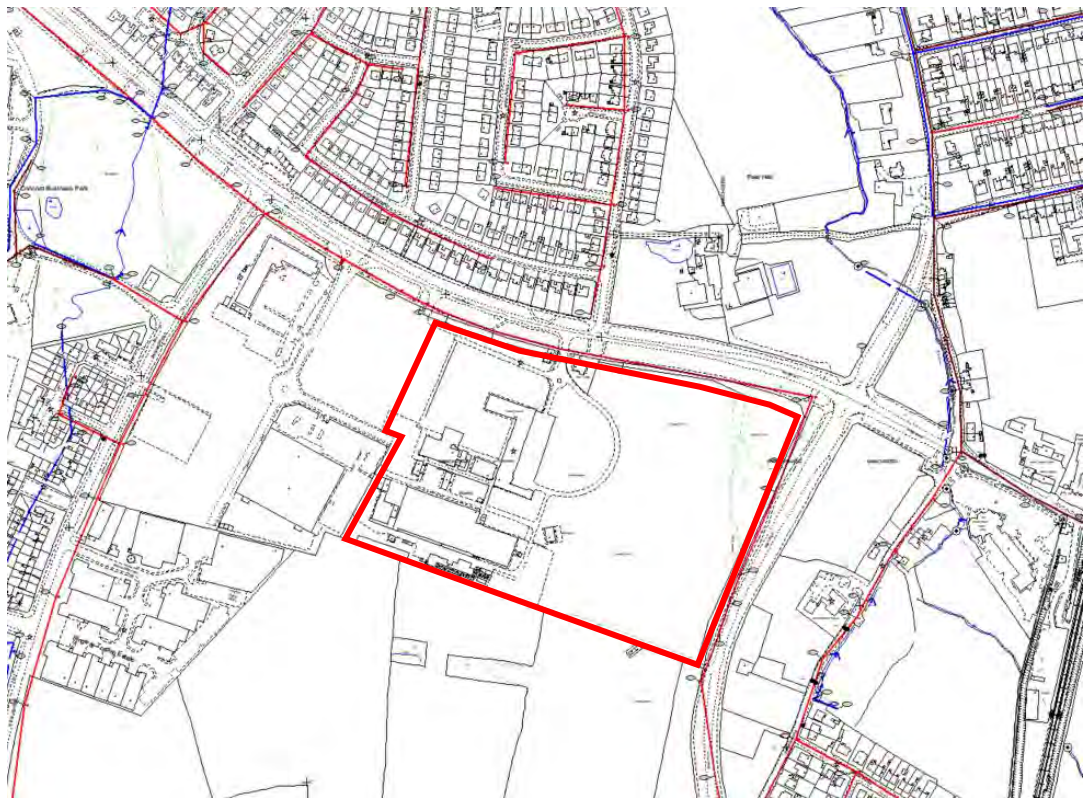


Figure 5 - Extract of United Utilities Sewer Records

5.5. Flooding from Groundwater

- 5.5.1. The SFRA groundwater vulnerability map suggests the site to be located within an at low risk of groundwater flooding.
- 5.5.2. Online mapping confirmed the bedrock and superficial strata for the whole site is designated as a Secondary (undifferentiated with the bedrock geology predominantly considered a Secondary B aquifer with a small area of Principal Aquifer to the northeast corner.
- 5.5.3. The proposed site will have an FFL that is elevated from existing ground levels with a service yard

and car park that falls away. These mitigation measures will mitigate the risk of groundwater entering buildings.

5.6. Flooding from Infrastructure Failure

- 5.6.1. The proposed site levels mean that the building will be higher than the surrounding ground levels. As such, the risk of building flooding from infrastructure failure is low.
- 5.6.2. On this basis, the risk of flooding from infrastructure failure is considered to be low following mitigation.

6. DEFINITION OF FLOOD HAZARD

6.1 Summary

Section 5 has defined the anticipated flood risks from all sources. **Table 5** below considers each of the sources and defines in tabular format the Probability of Flood Risk associated to each and the likely impacts to the development. Below is a table summary of the flood risks associated with the development site.

Table 5 - Flood Risk Summary

Source	Flood Risk	Likely Impacts	Remarks
Tidal	Low	Low	Site not tidally influenced.
Fluvial (Watercourse)	Low	Low	Site located in Flood Zone 1 (low risk). Majority of the site is circa 2m above the 1000 year flood level
Overland Flow	Low /Medium / High	Low/medium	Indicative EA mapping shows areas within the site is at medium to high risk. These areas are to be mitigated as part of the development intent.
Infrastructure Failure	Low	Low	Risks from infrastructure failure will be managed by appropriate levels design and maintenance policies.
Groundwater	Low	Low	No below ground structures are proposed and risk to be mitigated through appropriate levels design.
Artificial Sources	Low	Low	

7. OUTLINE DRAINAGE STRATEGY

7.1 Existing Surface Water Run Off

- 7.1.1 The existing site in total comprises of approximately 0.338 ha of existing impermeable areas consisting of remaining tarmac roads, that have a positive drainage system. The site has a single known point of discharge to the public combined sewer. A copy of the topographical survey is included in **Appendix B**.
- 7.1.2 The site network has been assessed as to the areas they service based on a GPR surveys undertaken at the site (included in **Appendix B**). There are some areas of hardstanding that are drained by gullies.
- 7.1.3 The calculations to demonstrate existing discharge rates have been carried using the Modified Rational Method for the area, using a rainfall intensity of 35mm/hr. Calculations are included in Below.
- 7.1.4 The remainder of the site has been assessed as greenfield.

Table 6 - Pre-development Brownfield Runoff Rates

	Area (m ²)	Assessed Discharge
Existing Hardstanding	3,380	32.9 l/s
Greenfield Area	95,120	1 year – 42.5 l/s QBAR – 48.9 l/s 30 year – 82.8 l/s 100 Year – 101.6 l/s

7.2 Geology

- 7.2.1 According to the BGS, the site is underlain by Devensian Till superficial deposits, which are classed as a Secondary, undifferentiated Aquifer. The superficial deposits are underlain by, predominantly, Bollin Mudstone formation (Secondary B Aquifer), with a small area of Helsby Sandstone formation (principal Aquifer to the northeast corner of the site).
- 7.2.2 When the Phase 2 Site Investigation is undertaken, falling head tests will be undertaken at the site to assess feasibility of infiltration. From the BGS descriptors, it is considered unlikely that infiltration will be feasible. If it is found to be feasible, BRE 3658 testing will be undertaken to inform the design of any infiltration structures.

7.3 Hydrology

- 7.3.1 Gatley Brook is a main river and is located approximately 200m east of the site. Gatley brook is considered a flood risk generator downstream of the site, **see Figure 6**. Gatley Brook currently places properties in Gatley at Risk of Flooding.

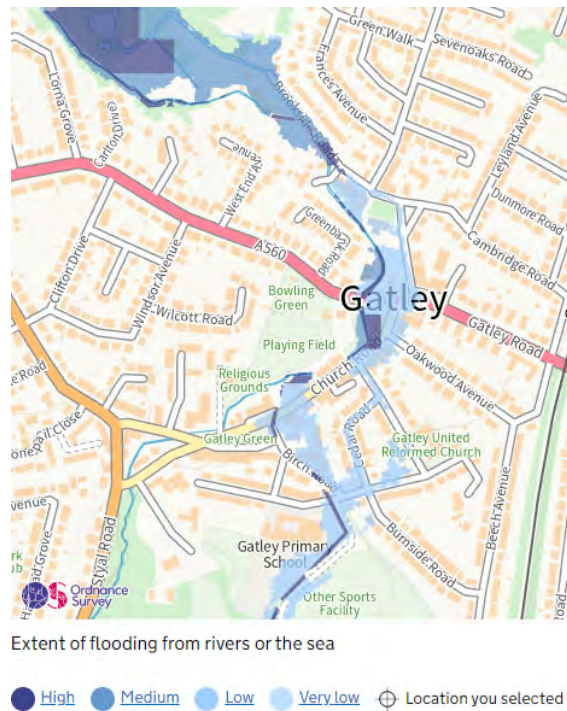


Figure 6 - Gatley Brook Flood Risk in Gatley

- 7.3.2 There is an ordinary Watercourse approximately 400m west of the site. This is a tributary of Baguley Brook (main river). This tributary is shown on both the SW flood Risk Mapping and Fluvial Flood Risk Mapping as placing properties at risk of flooding in Sharston, downstream of the site. **See figures 7 and 8.**

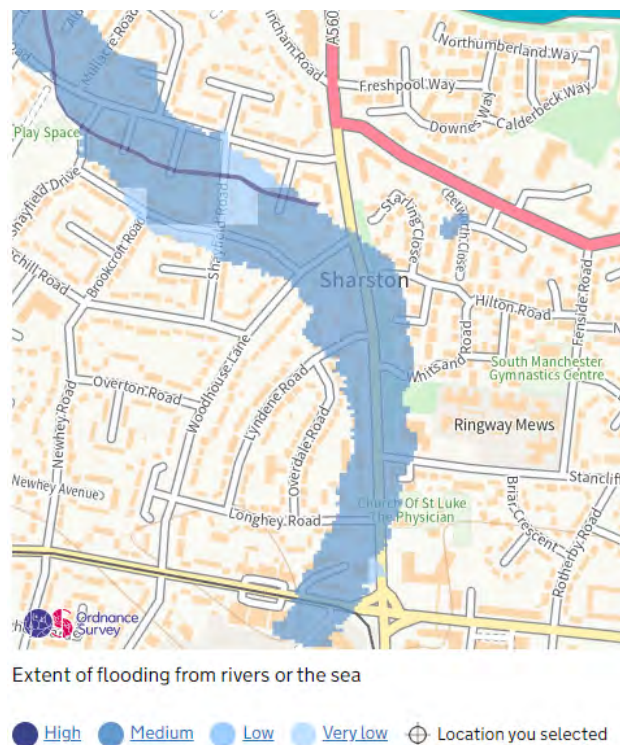


Figure 7 - Fluvial Flood Risk in Sharston from Baguley Brook Tributary



Figure 8 - SW Flood Risk in Sharston from Baguley Brook Tributary

7.4 Existing Drainage

- 7.4.1 The existing surface water network has been surveyed using GPR survey methods. The GPR is included on the topographical survey included in Appendix B.
- 7.4.2 The surveys have illustrated that there is a single point of discharge for the site into the UU Combined Sewer.
- 7.4.3 The total estimated discharge from the site is included in the calculations outlined in 8.1 above.

7.5 Sustainable Drainage Systems

7.5.1 SuDS Objectives

Sustainable drainage developed in line with the ideals of sustainable development is collectively referred to as Sustainable Drainage Systems (SuDS). At a particular site, these systems are designed both to manage the environmental risks resulting from the urban runoff and to contribute wherever possible to environmental enhancement. SuDS objectives are therefore to minimise the impacts from the development on the quantity and quality of the runoff and maximise amenity and biodiversity opportunities (CIRIA C753, 2015).

7.5.2 SuDS's Design Themes

A strong design theme is essential if the maximum aesthetic benefits are to be gained from the SuDS approach. At a more local scale the SuDS should link with the individuals plot structure,

planting, public open space requirements and amenity areas, gaining multiple benefits from a limited area of land.

7.5.3 The SuDS Management Train

The 'Management Train Approach' should be central to the surface water drainage strategy of the proposed site. The main objective is treatment and control of runoff as near to the source as possible protecting downstream habitats and further enhancing the amenity value of the site. This concept uses a hierarchy of drainage techniques to incrementally reduce pollution, flow rates and volumes of storm water discharge from the site, and is as follows:

- i. Prevention – The use of good site design and housekeeping measures to prevent runoff and pollution and includes the use of rainwater reuse / harvesting.
- ii. Source Controls – Control of runoff at source or as close to source as possible (e.g., soakaways, green roofs, pervious pavements).
- iii. Site Control – Management of water in a local area and can include below ground storage / attenuation, detention basins, large infiltration devices.
- iv. Regional Control – Management of water from a site or various sites and can include wetlands and balancing ponds.

7.5.4 SuDS Site Constraints

SuDS techniques are suitable for all sites; therefore, an assessment of the existing site is required so that SuDS limitations can be determined.

- Land Use Characteristics: The size and type of the development plot allows a range of source control and site control SuDS devices to be considered are to be below ground only. Above ground SuDS features have been discounted due to the proximity to the airport and the risk of bird-strike.
- Site Characteristics: Infiltration is to be investigated further, though is thought unlikely to be feasible.
- Catchment Characteristics: The site is currently classed as a mixture of Brownfield and Greenfield.
- Environmental and Amenity Performance: The inclusion of SuDS within the overall development is a key driver in providing both amenity and habitat creation. Safety to all future occupiers is paramount and so best practice guidance will be incorporated so that these devices blend into the surrounding without the need for significant safety precautions. Maintenance plans will be prepared for all SuDS devices that are included.

7.5.5 SuDS Methods

Tables 7 and 8, below, provide an assessment of various above and below ground SuDS methods that can provide water quality treatment and management of flows to reduce runoff rates and volumes and whether they can be suitably incorporated at this development site. The purpose of this assessment is to set out options to be considered at the planning stage with consideration to time constraints, viability, and lifetime maintenance of the development.

Table 7 - Surface SuDS Methods

Method	Comment	Suitability for Development
Green Roofs	Can be used on suitable low-rise buildings to provide retention, attenuation and treatment of rainwater Promotes evaporation and local biodiversity.	<u>Suitable:</u> Architectural proposals for the development suggest that some areas of green roof are be proposed.
Water Butts	Plastic tanks placed at the base of rainwater down pipes to collect rainwater runoff from the roof areas.	<u>Not Suitable</u> This method does coincide with the Siphonic downpipes.
Rainwater Harvesting	Rainwater harvesting reduces the total runoff volume from the developed site and reduces treated water consumption.	<u>Not Suitable:</u> - Additional costs of installation would have severe effect on viability of development. - Running and maintenance costs would not be acceptable to client and future occupiers.
Infiltration Options	Reduces total run off volume from the development.	<u>Not Suitable:</u> Ground conditions indicates infiltration methods are unlikely to be feasible
Permeable Surfacing (Infiltration)	- Reduces total run off volume from the development. - Can be used to enhance water quality.	<u>Not Suitable:</u> Ground conditions indicates infiltration methods are unlikely to be feasible
Permeable Surfacing (Standard)	- Can be used to enhance quality of runoff water. - Sub-base provides 'source' storage and reduces the volume of storage downstream. - The storage can be created with selection of the stone fill or use of plastic box stems. - Impermeable membrane at base of construction to prevent impact on pavement stability.	<u>Not Suitable:</u> Permeable Paving is not thought to be suitable within an industrial setting. Higher frequency of maintenance and shortened serviceable lifetime preclude their use.
Swales, basins, and ponds	- Provide areas for above ground surface runoff storage. - Swales also improve water quality through filtration.	<u>Not Suitable:</u> Proximity to the airport and the risk of bird-strike preclude the use of ponds and basins.

Table 8 - Sub-Surface SuDS Methods

Method	Comment	Suitability for Development
Geocellular Storage	- Suitable for sites with insufficient space for basins etc. - Suitable for sites where topography prevents the use of open basins etc. - Can be very effective infiltration devices subject to ground conditions.	<u>Suitable:</u> The use of geocellular attenuation may be possible to retain excess storm water.
Large Diameter Pipes, Culverts, or Tanks	- Suitable for sites with insufficient space for basins etc. - Provide a volume of below ground storage with a high void ratio and good man entry provision to allow for future maintenance and cleaning. - Generally suitable for adoption by the statutory water company.	<u>Suitable:</u> The use of oversized pipes may be possible to retain excess storm water.

7.5.6 SuDS Hierarchal Approach

Based on the SuDS assessment in Tables 7 and 8, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in greater detail below:

Table 9 - SuDS Hierarchal Approach

Method	Suitability	Suitability for Development
Infiltration to Ground	No	Further investigation to be undertaken to prove feasibility, though it is believed to be unlikely to be suitable.
Connection to Watercourse	No	There are 2 watercourses within 500m of the site. Each of the watercourses already present flood risks to existing settlements. The existing site does not currently drain to either of these watercourses. As such, any new connection to either watercourse has the potential to increase flood risk downstream of the site.
Connection to Surface Water Sewer	No	As the UU SW sewer discharges to the Baguley Brook tributary and the site does not have an existing connection, any new connection to this sewer has the potential to increase flood risk downstream
Connection to Combined Sewer	Yes	The site has been proven to already drain to the combined sewer

7.5.7 SuDS Design Philosophy

The SuDS assessment and hierarchal approach discussed in **Tables 7, 8 and 9** above has defined the overall SuDS strategy. Thus, the SuDS philosophy for the development site is the promotion of

Prevention, Source Control and Site Control techniques with discharge rates to be restricted to greenfield rates, to reduce the risk of both site and downstream flooding.

The following design philosophy is proposed:

- Surface water treatment using the 'Management Train' approach to remove and isolate contamination at all SuDS facilities prior to conveyance to the combined sewer.
- Site control in the form of geocellular storage and oversized pipes.

7.6 Surface Water Drainage Strategy

7.6.1 This section should be read in conjunction with the drawings and calculations provided in **Appendix E and F**.

7.6.2 A drainage strategy has been undertaken for the site to demonstrate that surface water runoff can be effectively managed within the site, without increasing the risk of flooding to the site or elsewhere.

7.6.3 The proposed runoff rates for the developable areas are shown in **Table 10**.

Table 10 - Post-Development Runoff Rates

	Impermeable Area (m ²)	Proposed Discharge	Betterment to existing
Existing hardstanding	3,380	16.4 l/s	50% betterment
Greenfield Areas	95,120	48.9 l/s (QBAR)	Greenfield QBAR
Site Total	98,500	65.3 l/s	

7.6.4 The flows from the proposed site are to be collected via gullies and RWP before being stored in the geocellular storage. Thereafter, the surface water is to be discharged into the public combined water sewer at a maximum allowable rate 65.3 l/s (1:100 year run off rate).

Table 11 - Sustainable Drainage Technical Standards Peak Flow Control

	Statement	Comments	Compliance
S2	For greenfield developments, the peak runoff rate from the development to any highway drain, sewer, or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.	QBAR Rates for greenfield areas are to be used to discharge surface water from site	Complies with S2 for greenfield areas of the site and non-positively drained previously developed areas
S3	For developments which were previously developed, the peak runoff rate from the development to any drain, sewer, or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event but should never exceed the rate of discharge from the development prior to redevelopment for that event.	A 50% betterment in brownfield run off rates alongside QBAR Rates for greenfield areas are to be used to discharge surface water from site	Complied with S3 for previously developed areas.

7.6.5 **Table 12** below defines the outline post-development attenuation volumes. The volumes identified below are preliminary for this outline assessment and may alter at detailed design stage.

Table 12 - Attenuation Volumes

	Maximum Volume Attenuation (m ³)	Long term storage
Main Site Drainage	4,800	Long term Storage not required as QBAR rates are proposed
100 year 6 hour	Existing (m ³)	Proposed (m ³)
Total Volume	2,506	7,784
Average Rainfall Intensity for a 100 year 6 hour storm is 16.732 mm/hr Existing area - 0.338 ha – remainder of the site shown as greenfield volume Proposed Area – 7.748 ha		

Table 13 - Sustainable Drainage Technical Standards Volume Control

Statement	Comments	Compliance
S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer, or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.	Infiltration is not thought to be feasible.	N/A see S5
S5 Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer, or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event but should never exceed the runoff volume from the development site prior to redevelopment for that event.	Due to the development proposals, there is an increase in impermeable area. As infiltration is not practical at the site, there will be an increase in volume discharge from site	Not complied with due to lack of infiltration potential – see S6
S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer, or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.	Proposed discharge rates are significantly below existing – reducing flood risk. The overall discharge from site is at QBAR Rates – this complies with the NW SUDS Proforma	Complied with S6

- 7.6.6 The proposed drainage layout for the new development and car park will be designed in accordance with Design & Construction Guidance (DCG), BS EN 752: 2008 and Building Regulations Part H guidance, i.e., up to the 30-year storm return period including 40% climate change increase and tested for the 1 in 100 year return period including a 50% increase to account for climate change to confirm that there is no flood risk to the properties.
- 7.6.7 Flooding can occur on a local scale beyond the 30-year criterion due to runoff exceeding the capacity of the minor system during extreme events and it can only be addressed on a site-specific basis. Design & Construction Guidance states that developments should be protected against flooding from extreme events (1 in 30 year) and that flood pathways are identified when the drainage system is exceeded.
- 7.6.8 In the case of this development, exceedance flows will be all those over and above the 30-year design criterion set by Design & Construction Guidance. Using storage within the external areas would be achievable and would prevent flood water from entering proposed properties, with flows directed back into the surface water drainage network as water levels in the drainage network receded. The exceedance flows and volumes can be calculated for the new development drainage layout. In the case of this development and due to the fall across the site, consideration will be given to make sure all water is controlled so that it does not impact on any adjoining properties. It should be noted that no flooding is shown for all events up to and including the 100 year +45%.

- 7.6.9 Any future drainage calculations carried out as part of a site-wide drainage strategy or for the development layouts themselves must include the appropriate increase in rainfall to satisfy the future Climate Change allowances.

7.7 Pollution Control

- 7.7.1 There are to be multiple levels of treatment incorporated into the development, including trapped gullies, channels with silt traps and petrol interceptors. These provide filtration at various points in the system to improve water quality.

7.8 Foul Water Strategy

- 7.8.1 The foul water drainage strategy is to connect to the existing public combined water sewer using a new connection within the site. A gravity connection is feasible.

8. MANAGEMENT MEASURES, OFF SITE IMPACTS AND RESIDUAL RISKS

8.1. Flood Risk Management Measures

- 8.1.1 Existing brownfield rates at the site will be reduced by 50%. The remainder of the site will discharge at QBAR rates.
- 8.1.2 The use of SuDS in the form of Source Control and Site Control measures, with controlled (restricted) outflow, will help to minimise the flood risk impact to the surrounding sewer network.
- 8.1.3 Existing pluvial flow paths for up to the 1000 year event will be maintained.
- 8.1.4 Proposed external levels will fall away from the building.
- 8.1.5 There will be a site management health and safety document prepared in respect of the final development. This will include the required maintenance regime for the on-site drains and drainage facilities such as the channels, gullies, pipes, manholes and all SuDS facilities. This should be conditioned. Maintenance responsibility will be with the site owner until such a time that the site is tenanted, then the maintenance will be the responsibility of the site tenant.
- 8.1.6 The site users will be responsible for site cleanliness, gully emptying and drain cleansing to ensure that the surface water drainage system will always operate at its maximum efficiency.
- 8.1.7 Should any flooding occur from the new sewers and drains it will be directed away from the buildings to the external areas. Calculations have shown that no flooding occurs up to the 100 year +45% event.

8.2. Off Site Impacts

- 8.2.1 Up to and including the 100-year plus increase in rainfall allowance due to climate change (CC) event, the report has justified that there is no risk of flooding.
- 8.2.2 Surface water runoff is reduced from the pre-development regime and utilises SuDS solutions to satisfy the site constraints, the proposed development will therefore not increase flood risk onto its locality.

8.3. Residual Risks

- 8.3.1 With careful design of the drainage elements as described above there will be no residual flood- related risks that will remain after the development has been completed.

APPENDIX A – ARCHITECTURAL SITE LAYOUT



Disclaimer:
Subject to survey.

01020304050

N

Notes:

KEY

Approx Site Boundary
(98,454m² / 24.33 acres / 9.84 ha)

Manchester Airport no build zone

S/S

Existing Electrical Substation

Area: Gross Internal

UNIT 1 (GIA)

Warehouse

Office (FF)

Office (SF)

Car parking spaces

84,100ft²

77,700ft²

3,200ft²

3,200ft²

84

UNIT 2 (GIA)

Warehouse

Office (FF only)

Car parking spaces

37,300ft²

34,700ft²

2,600ft²

37

UNIT 3 (GIA)

Warehouse

Office (FF only)

Car parking spaces

49,500ft²

46,900ft²

2,600ft²

50

UNIT 4 (GIA)

Warehouse (incl. office Undercroft)

Office (FF)

Office (SF)

Car parking spaces

74,200ft²

66,000ft²

4,100ft²

4,100ft²

75

UNIT 5 (GIA)

Warehouse (incl. office Undercroft)

Office (FF)

Office (SF)

Car parking spaces

166,200ft²

158,000ft²

4,100ft²

4,100ft²

167

TOTAL (GIA)

Total Scheme Car Spaces

411,300ft²

413

Area: Gross External

UNIT 1 (GEA)

Warehouse

Office (FF)

Office (SF)

Car parking spaces

8,086m²

7,391m²

347m²

347m²

84

UNIT 2 (GEA)

Warehouse

Office (FF only)

Car parking spaces

3,621m²

3,331m²

289m²

37

UNIT 3 (GEA)

Warehouse

Office (FF only)

Car parking spaces

4,785m²

4,495m²

289m²

50

UNIT 4 (GEA)

Warehouse (incl. office Undercroft)

Office (FF)

Office (SF)

Car parking spaces

7,214m²

6,325m²

444m²

444m²

75

UNIT 5 (GEA)

Warehouse (incl. office Undercroft)

Office (FF)

Office (SF)

Car parking spaces

15,830m²

14,950m²

440m²

440m²

167

TOTAL (GEA)

Total Scheme Car Spaces

39,536m²

413

A Drawing revised and renumbered
PL201

02.08.2022 PL HA

- First Issue

24.02.2022 PL HA

Client:

AVIVA
INVESTORS

hale

ARCHITECTURE | DESIGN MANAGEMENT

22c Leathermarket Street, London, SE1 3HP

Project:

Atlas Business Park
Manchester

Drawing Title:

Proposed Site Plan

Project No:

20071

Scale @ -

1:1000

Drawing No:

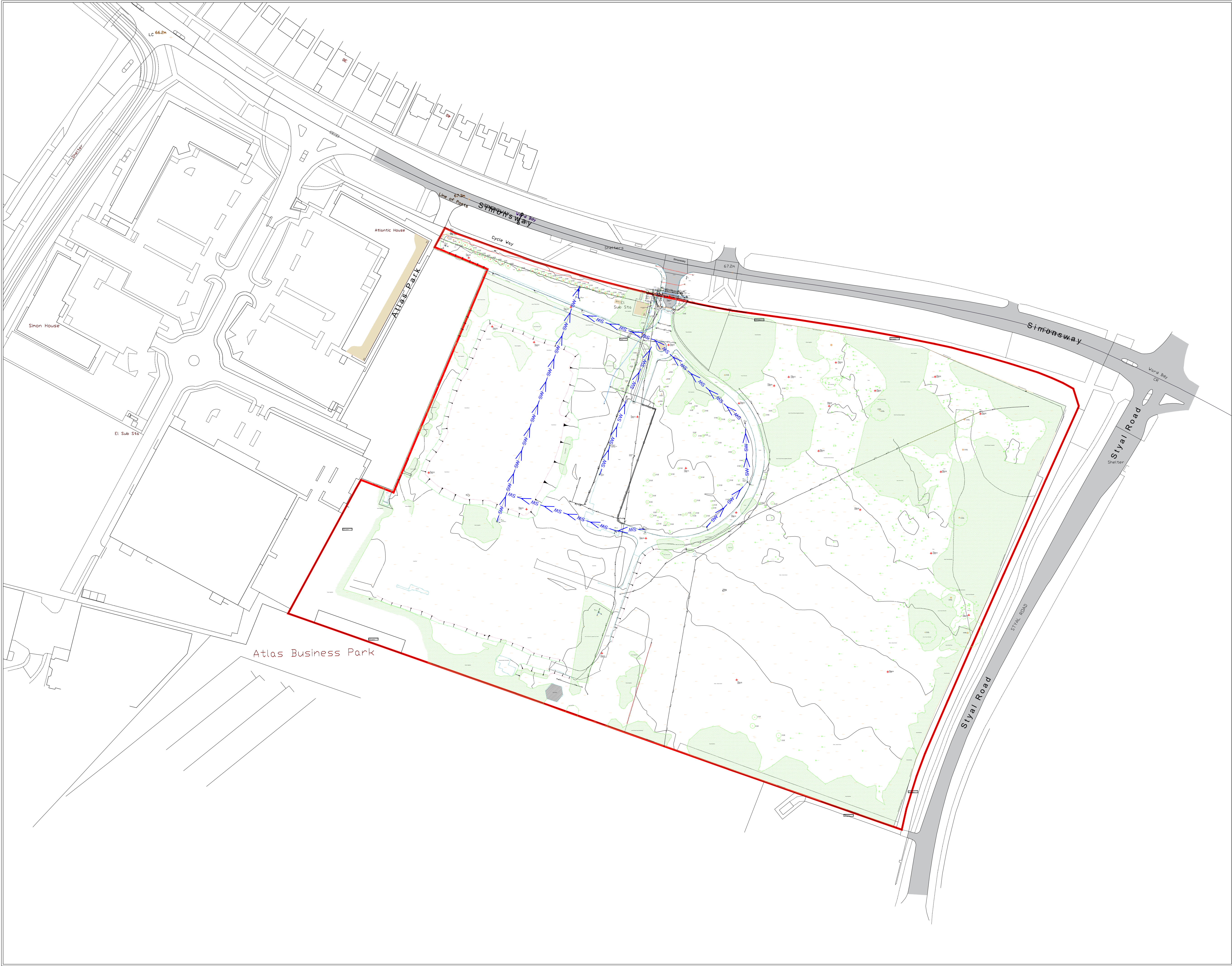
20071 PL 201

Revision:

A

DRAFT

APPENDIX B – TOPOGRAPHICAL SURVEY



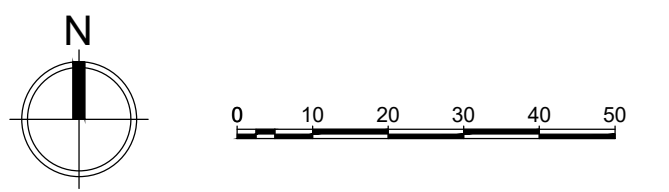
Disclaimer:
Subject to survey.

Notes:

KEY

— Approx Site Boundary
(93,044m² / 22.99 acres / 9.3 ha)

A	First Issue	01.08.2022	PL	HA
-	First Issue	01.08.2022	PL	HA



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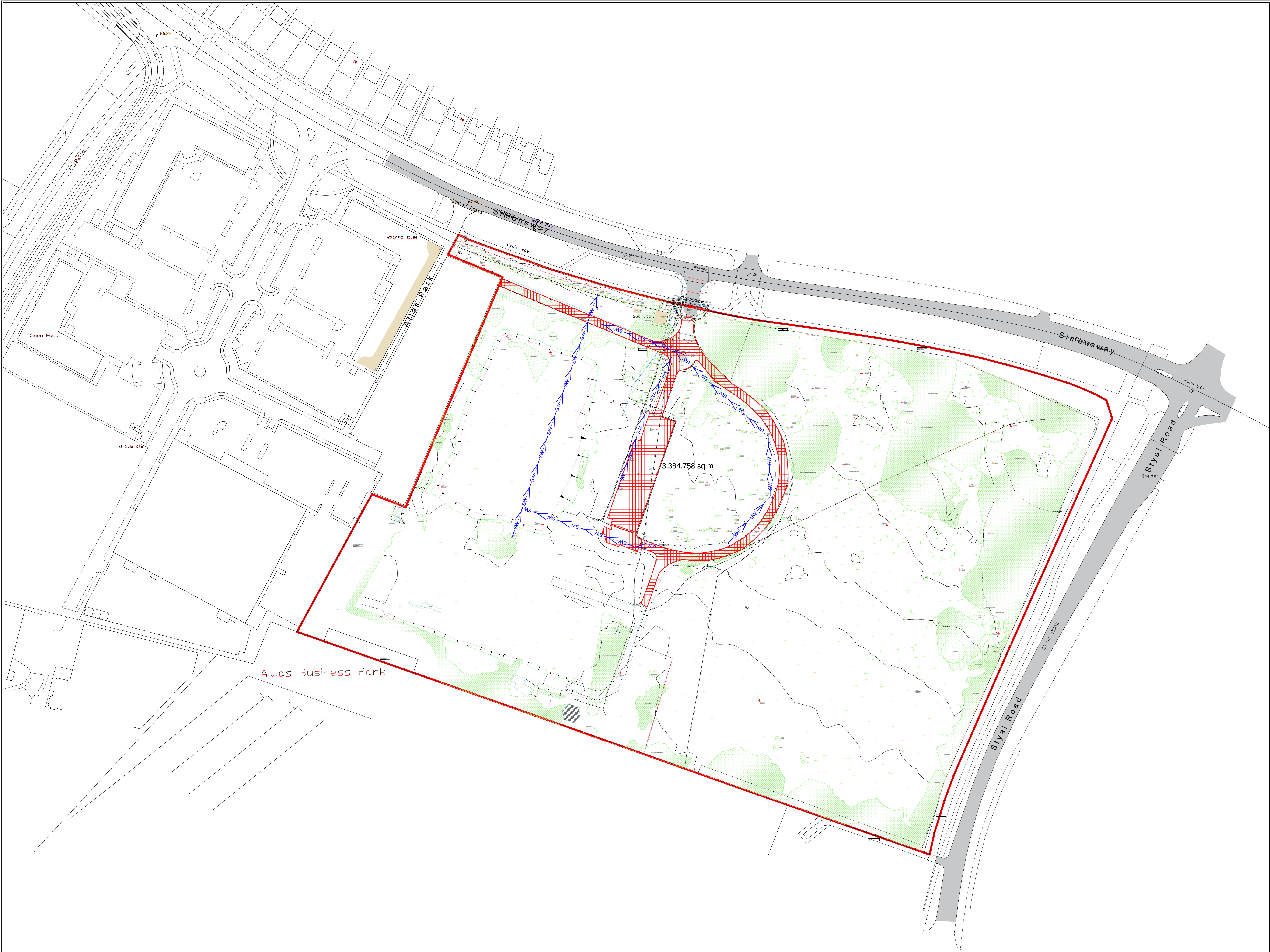
Project:
**Atlas Business Park
Manchester**

Drawing Title:
Existing Site Plan

Project No: 20071	Scale @ A1 1:1000	Revision: A
Drawing No: SK 115		

APPENDIX C – SITE INVESTIGATION INFORMATION

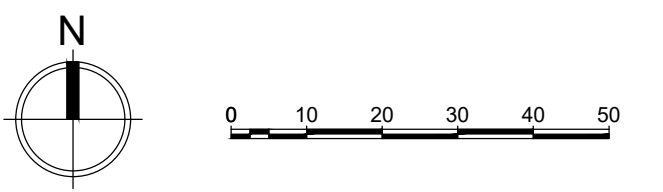
APPENDIX D – EXISTING DISCHARGE RATES AND GREENFIELD CALCULATIONS



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Notes:
KEY
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(93,044m² / 22.99 acres / 9.3 ha)

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Manchester**

Drawing Title:
Existing Site Plan

Project No: 20071	Scale @ A1 1:1000
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Drawing No: SK 115	Revision: A
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Scott Hughes Design Ltd		Page 1
The Flint Glass Works 64 Jersey Street Manchester M4 6JW		
Date 12/10/2022 12:24 File	Designed by pbarrett Checked by	
Micro Drainage Source Control 2018.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	9.512	Urban	0.000
SAAR (mm)	800	Region Number	Region 10

Results l/s

QBAR Rural	48.9
QBAR Urban	48.9
Q1 year	42.5
Q1 year	42.5
Q30 years	82.8
Q100 years	101.6

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The Flint Glass Works 64 Jersey Street Manchester M4 6JW		
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Micro Drainage Source Control 2018.1		

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.000
Ratio R	0.390
Areal Reduction Factor	1.00
Area (ha)	7.748
SAAR (mm)	800
CWI	117.339
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	48.45
Greenfield Runoff Volume (m³)	2166.696

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APPENDIX E – RIDGE DESIGN DRAWINGS



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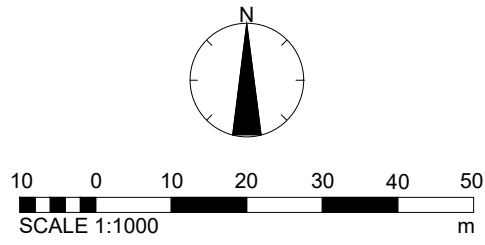
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- KEY
- EXISTING PUBLIC CWS
 - PROPOSED PRIVATE FW DRAIN
 - PROPOSED PRIVATE SW DRAIN
 - PROPOSED PPIC
 - PROPOSED PRECAST CONCRETE MH
 - PROPOSED LINEAR DRAINAGE
 - PROPOSED LAND DRAINAGE
 - FLOW CONTROL



P01	PLANNING ISSUE	19.10.22	PB	LMc
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ORIGINATOR:				



5TH FLOOR
BELVEDERE HOUSE
12 BOOTH STREET
MANCHESTER, M2 4AW

TEL: 0161 833 9579
WWW.RIDGE.CO.UK

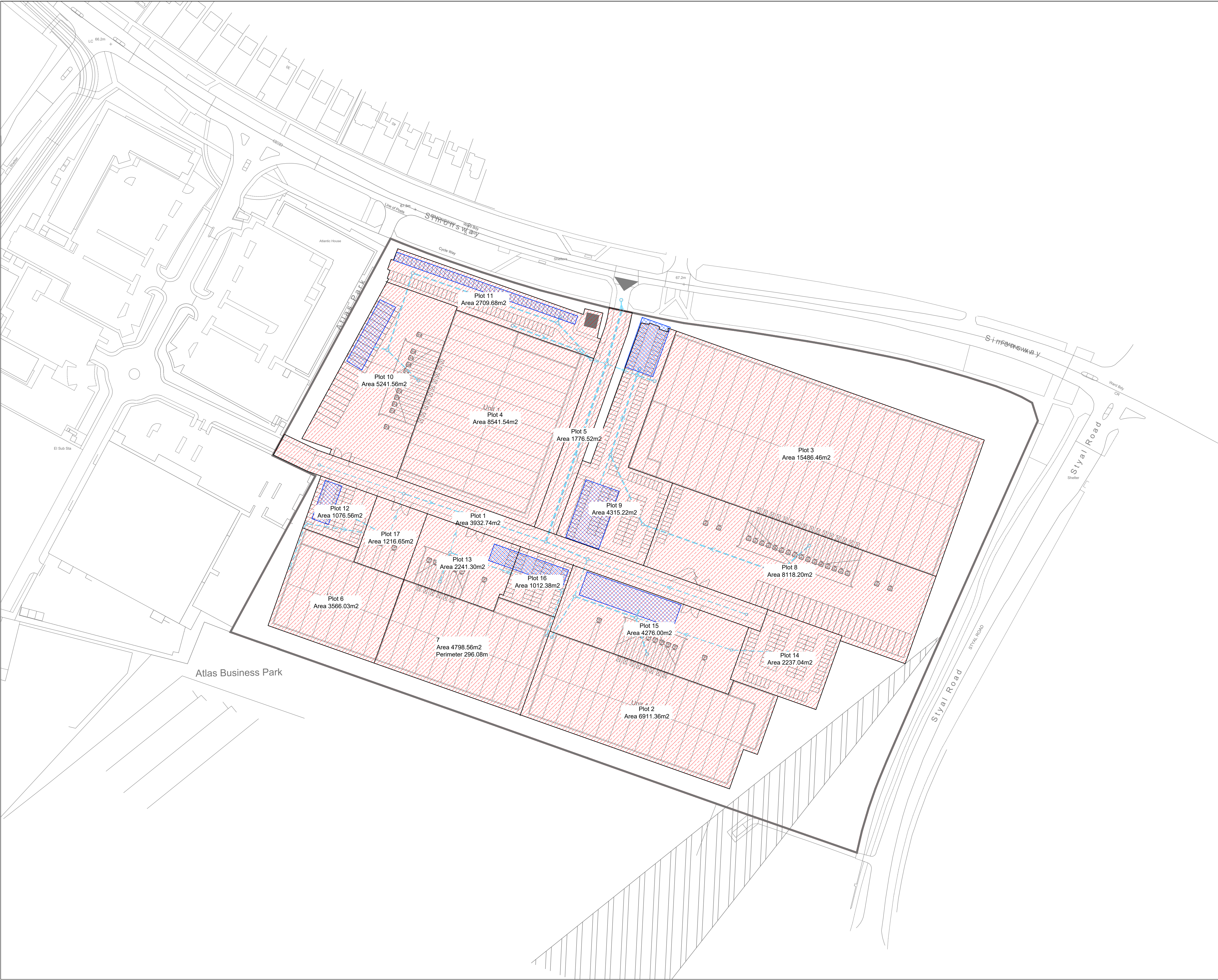
CLIENT:
AVIVA

IN ASSOCIATION WITH:

PROJECT:
ATLAS PARK

TITLE:
SURFACE WATER DRAINAGE
STRATEGY DRAWING

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AP	PB	PB	STATUS ISSUE:	S1		
STATUS: PRELIMINARY						
UNLESS ISSUED FOR CONSTRUCTION - WORKS AT CLIENT/CONTRACTORS RISK						
SUITABILITY: SO - Initial Status or WIP						
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						P01



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- PROPOSED PRIVATE FW DRAIN
- PROPOSED PRIVATE SW DRAIN
- PROPOSED PPIC
- PROPOSED PRECAST CONCRETE MH
- PROPOSED LINEAR DRAINAGE
- PROPOSED LAND DRAINAGE
- FLOW CONTROL (FC)

10 0 10 20 30 40 50
SCALE 1:1000
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REV	DESCRIPTION	DATE	BY	CHKD			
ORIGINATOR:							
RIDGE							
5TH FLOOR BELVEDERE HOUSE 12 BOOTH STREET MANCHESTER, M2 4AW			TEL: 0161 833 9579 WWW.RIDGE.CO.UK				
CLIENT: AVIVA							
IN ASSOCIATION WITH:							
PROJECT: ATLAS PARK							
TITLE: SUREFACE WATER DRAINAGE IMPERMEABLE AREAS PLAN							
ENG/TECH:	CSE:	ICSE:	SCALE:	1:1000 @ A1			
AP	PB	PB	STATUS ISSUE:	S1			
STATUS: PRELIMINARY							
UNLESS ISSUED FOR CONSTRUCTION - WORKS AT CLIENT/CONTRACTORS RISK							
SUITABILITY: S0 - Initial Status or WIP							
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KEY

- RISK OF FLOODING - SW 30 YEAR (HIGH) WITH DIRECTION OF FLOW
- RISK OF FLOODING - SW 100 YEAR (MED / DESIGN) WITH DIRECTION OF FLOW
- RISK OF FLOODING - SW 100 YEAR (LOW / RESIDUAL) WITH DIRECTION OF FLOW

10 0 10 20 30 40 50
SCALE 1:1000
m

12 10 22 AP PB
DATE BY CHKD

ORIGINATOR:

RIDGE

5TH FLOOR
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PROJECT: ATLAS PARK				
TITLE: SW FLOOD RISK INVESTIGATION PLAN				
ENG/TECH:	CSE:	ICSE:	SCALE:	1:1000 @ A1
AP	PB	PB	STATUS ISSUE:	S1
STATUS: PRELIMINARY				
UNLESS ISSUED FOR CONSTRUCTION - WORKS AT CLIENT/CONTRACTORS RISK				
SUITABILITY: S0 - Initial Status or WIP				
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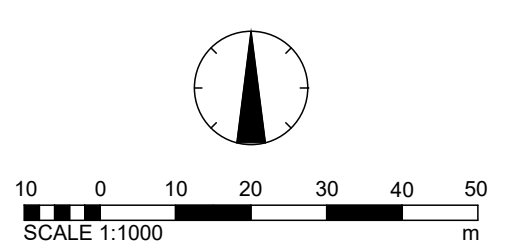
DRAWING NOTES:

CDM REGULATIONS 2015

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- KEY**
- RISK OF FLOODING - SW 30 YEAR (HIGH) WITH DIRECTION OF FLOW
 - RISK OF FLOODING - SW 100 YEAR (MED / DESIGN) WITH DIRECTION OF FLOW
 - RISK OF FLOODING - SW 100 YEAR (LOW / RESIDUAL) WITH DIRECTION OF FLOW
 - FLOOD RISK MITIGATED
 - ON SITE FLOOD MITIGATION AREA (RESIDUAL RISK ONLY)



P01	PRELIMINARY ISSUE	12.10.22	AP	PB
REV	DESCRIPTION	DATE	BY	CHKD

ORIGINATOR:

RIDGE

5TH FLOOR
BELVEDERE HOUSE
12 BOOTH STREET
MANCHESTER, M2 4AW

TEL: 0161 833 9579
WWW.RIDGE.CO.UK

CLIENT:
AVIVA

IN ASSOCIATION WITH:

PROJECT:
ATLAS PARK

TITLE:
SW FLOOD RISK
MITIGATION PLAN

ENG/TECH:	CSE:	ICSE:	SCALE:	1:1000	@	A1
AP	PB	PB	STATUS ISSUE:	S1		
STATUS: PRELIMINARY						
UNLESS ISSUED FOR CONSTRUCTION - WORKS AT CLIENT/CONTRACTORS RISK						
SUITABILITY: SO - Initial Status or WIP						
PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:
5017477	RDG	XX	XX	DR	C	0551
						REV:
						P01

APPENDIX F – SURFACE WATER CALCULATIONS

Atlas Park
Propsoed SW
Drainage Calculations

Designed by PB
Checked by lmc



Network 2020.1

Network Design Table for 1.000

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
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Atlas Park
Propsoed SW
Drainage Calculations

Designed by PB
Checked by lmC



Network 2020.1

Network Design Table for 1.000

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
1.000	23.475	0.401	58.5	0.000	15.00	0.0	0.600	o	600	Pipe/Conduit		
1.001	82.822	0.166	500.0	0.812	0.00	0.0	0.600	o	600	Pipe/Conduit		
1.002	47.421	0.095	500.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit		
1.003	48.150	0.096	500.0	0.432	0.00	0.0	0.600	o	675	Pipe/Conduit		
2.000	10.669	0.371	28.8	1.549	15.00	0.0	0.600	o	525	Pipe/Conduit		
3.000	15.820	0.190	83.3	0.000	15.00	0.0	0.600	o	675	Pipe/Conduit		
1.004	18.658#	0.037	504.3	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit		

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	86.74	15.12	66.068	0.000	0.0	0.0	0.0	3.19	901.1	0.0
1.001	82.88	16.40	65.667	0.812	0.0	0.0	82.0	1.08	306.0	264.2
1.002	80.84	17.13	65.501	0.812	0.0	0.0	82.0	1.08	306.0	264.2
1.003	79.03	17.82	65.407	1.244	0.0	0.0	119.8	1.17	417.0	386.1
2.000	87.00	15.04	66.799	1.549	0.0	0.0	164.2	4.19	906.7	529.1
3.000	86.84	15.09	65.500	0.000	0.0	0.0	0.0	2.87	1028.4	0.0
1.004	78.46	18.04	65.310	2.793	0.0	0.0	267.0	1.39	883.3	860.5

Atlas Park
Propsoed SW
Drainage Calculations

Designed by PB
Checked by lmC



Network 2020.1

Network Design Table for 1.000

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
4.000	31.446	0.105	300.0	0.000	15.00	0.0	0.600	o	300	Pipe/Conduit		🔒
4.001	57.352	0.248	231.7	0.224	0.00	0.0	0.600	o	300	Pipe/Conduit		🔓
5.000	23.529	0.402	58.5	0.000	15.00	0.0	0.600	o	525	Pipe/Conduit		🔒
4.002	37.717	0.077	490.6	0.426	0.00	0.0	0.600	o	525	Pipe/Conduit		🔓
6.000	26.746	0.838	31.9	0.691	15.00	0.0	0.600	o	375	Pipe/Conduit		🔓

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.000	85.30	15.58	67.323	0.000	0.0	0.0	0.0	0.90	63.8	0.0
4.001	82.56	16.51	67.218	0.224	0.0	0.0	22.5	1.03	72.7	72.5
5.000	86.70	15.13	67.326	0.000	0.0	0.0	0.0	2.93	634.7	0.0
4.002	80.82	17.14	66.924	0.650	0.0	0.0	64.0	1.00	217.4	206.3
6.000	86.69	15.14	68.210	0.691	0.0	0.0	73.0	3.22	355.3	235.3

Atlas Park
Propsoed SW
Drainage Calculations

Designed by PB
Checked by lmC



Network 2020.1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
4.003	22.623	0.046	491.8	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit		
7.000	96.321	0.574	167.7	0.162	15.00	0.0	0.600	o	300	Pipe/Conduit		
4.004	25.893	0.053	490.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit		
8.000	27.392	0.759	36.1	0.480	15.00	0.0	0.600	o	300	Pipe/Conduit		
8.001	67.693	0.510	132.9	0.101	0.00	0.0	0.600	o	450	Pipe/Conduit		
9.000	17.693	0.303	58.4	0.000	15.00	0.0	0.600	o	450	Pipe/Conduit		

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.003	80.02	17.44	66.847	1.341	0.0	0.0	130.8	1.26	554.5	421.4
7.000	83.09	16.33	67.790	0.162	0.0	0.0	16.4	1.21	85.6	52.7
4.004	79.13	17.78	66.801	1.503	0.0	0.0	144.9	1.26	555.2	466.9
8.000	86.58	15.17	68.227	0.480	0.0	0.0	50.6	2.63	185.6	163.1
8.001	84.59	15.81	67.468	0.581	0.0	0.0	59.9	1.76	280.3	193.0
9.000	86.78	15.11	66.832	0.000	0.0	0.0	0.0	2.66	423.8	0.0

Atlas Park
Propsoed SW
Drainage Calculations

Designed by PB
Checked by lmC



Network 2020.1

Network Design Table for 1.000

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
10.000	52.953	0.132	401.2	0.000	15.00	0.0	0.600	o	450	Pipe/Conduit		🔒
8.002	23.626	0.058	407.3	0.224	0.00	0.0	0.600	o	600	Pipe/Conduit		🔓
11.000	27.045	0.178	151.8	0.357	15.00	0.0	0.600	o	375	Pipe/Conduit		🔓
11.001	48.045	0.449	106.9	0.108	0.00	0.0	0.600	o	375	Pipe/Conduit		🔓
12.000	32.324	0.108	300.0	0.000	15.00	0.0	0.600	o	375	Pipe/Conduit		🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
10.000	84.41	15.87	66.661	0.000	0.0	0.0	0.0	1.01	160.5	0.0
8.002	83.44	16.20	66.529	0.805	0.0	0.0	81.9	1.20	339.4	263.9
11.000	86.15	15.31	67.743	0.357	0.0	0.0	37.4	1.47	162.1	120.6
11.001	84.75	15.76	67.565	0.464	0.0	0.0	47.9	1.75	193.5	154.5
12.000	85.50	15.52	66.965	0.000	0.0	0.0	0.0	1.04	115.0	0.0

Network Design Table for 1.000

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
11.002	26.114	0.082	318.5	0.122	0.00	0.0	0.600	o	525	Pipe/Conduit	
13.000	51.007	0.303	168.2	0.078	15.00	0.0	0.600	o	225	Pipe/Conduit	
11.003	35.033	0.110	319.9	0.078	0.00	0.0	0.600	o	525	Pipe/Conduit	
8.003	50.813	0.125	407.7	0.078	0.00	0.0	0.600	o	750	Pipe/Conduit	
4.005	107.668#	0.219	491.6	0.000	0.00	0.0	0.600	o	975	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
11.002	83.71	16.11	66.857	0.586	0.0	0.0	59.8	1.25	270.5	192.6
13.000	84.50	15.85	67.015	0.078	0.0	0.0	8.0	1.01	40.0	25.9
11.003	82.36	16.58	66.711	0.742	0.0	0.0	74.5	1.25	269.9	240.0
8.003	80.67	17.19	66.471	1.625	0.0	0.0	159.8	1.38	609.5	514.8
4.005	76.14	18.99	66.346	3.128	0.0	0.0	290.2	1.48	1103.5	935.2

Network Design Table for 1.000

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
14.000	24.757	0.423	58.5	0.000	15.00	0.0	0.600	o	450	Pipe/Conduit	
14.001	46.510	0.134	347.5	0.524	0.00	0.0	0.600	o	525	Pipe/Conduit	
14.002	87.588	0.252	347.5	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
15.000	45.346	0.100	453.5	0.000	15.00	0.0	0.600	o	600	Pipe/Conduit	
14.003	28.464	0.057	500.0	0.271	0.00	0.0	0.600	o	600	Pipe/Conduit	
16.000	40.186	0.161	249.4	0.854	15.00	0.0	0.600	o	525	Pipe/Conduit	
16.001	8.980	0.732	12.3	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
14.000	86.64	15.16	66.750	0.000		0.0	0.0	2.66	423.3	0.0
14.001	84.63	15.80	66.327	0.524		0.0	54.1	1.20	258.9	174.2
14.002	81.13	17.02	66.193	0.524		0.0	54.1	1.20	258.9	174.2
15.000	85.05	15.66	65.800	0.000		0.0	0.0	1.14	321.5	0.0
14.003	79.95	17.46	65.700	0.795		0.0	77.5	1.08	306.0	249.6
16.000	85.63	15.47	67.460	0.854		0.0	89.1	1.41	306.0	287.2
16.001	85.56	15.50	67.299	0.854		0.0	89.1	6.42	1389.9	287.2

Atlas Park
Propsoed SW
Drainage Calculations

Designed by PB
Checked by lmC



Network 2020.1

Network Design Table for 1.000

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
14.004	9.110#	0.018	506.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.005	31.744#	0.079	401.8	0.000	0.00	0.0	0.600	o	1275	Pipe/Conduit	
1.006	10.000#	0.033	303.0	0.178	0.00	0.0	0.600	o	1275	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
14.004	79.63	17.59	65.643	1.649	0.0	0.0	160.1	1.24	546.5	515.7
1.005	75.50	19.27	65.273	7.570	0.0	0.0	696.5	1.93	2465.3	2244.4
1.006	75.33	19.34	65.194	7.748	0.0	0.0	711.3	2.23	2841.3	2291.8

Manhole Schedules for 1.000

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	Pipe Out Invert Level (m) Diameter (mm)			Pipes In Invert Level (m) Diameter (mm)			Backdrop (mm)
SW01	67.368	1.300	Open Manhole	1500	1.000	66.068	600				
SW02	68.245	2.578	Open Manhole	1500	1.001	65.667	600	1.000	65.667	600	
SW03	68.336	2.834	Open Manhole	1500	1.002	65.501	600	1.001	65.501	600	
SW04	68.349	2.942	Open Manhole	1500	1.003	65.407	675	1.002	65.407	600	
SW08	68.449	1.650	Open Manhole	1500	2.000	66.799	525				
Unit 5 Storage	68.462	2.962	Junction		3.000	65.500	675				
SW05 (FC)	68.303	2.993	Open Manhole	1800	1.004	65.310	900	1.003	65.310	675	
								2.000	66.428	525	743
								3.000	65.310	675	
Unit 4 Storage	69.056	1.733	Junction		4.000	67.323	300				
SW19	69.142	1.924	Open Manhole	1200	4.001	67.218	300	4.000	67.218	300	
MH8	68.626	1.300	Open Manhole	1500	5.000	67.326	525				
SW20	69.034	2.110	Open Manhole	1500	4.002	66.924	525	4.001	66.971	300	
								5.000	66.924	525	
SW22	69.785	1.575	Open Manhole	1350	6.000	68.210	375				
SW21 (FC)	69.098	2.250	Open Manhole	1800	4.003	66.847	750	4.002	66.847	525	
								6.000	67.373	375	150
SW16	69.215	1.425	Open Manhole	1200	7.000	67.790	300				
SW17	68.957	2.156	Open Manhole	1800	4.004	66.801	750	4.003	66.801	750	

Atlas Park
Propsoed SW
Drainage Calculations

Designed by PB
Checked by lmC



Network 2020.1

Manhole Schedules for 1.000

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	Pipe Out			Pipes In			Backdrop (mm)	
					PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)	Diameter (mm)		
Unit 3 Storage	SW29	69.727	1.500	Open Manhole	1200	8.000	68.227	300	7.000	67.216	300	280
	SW30	69.118	1.650	Open Manhole	1350	8.001	67.468	450	8.000	67.468	300	
	SW32	68.132	1.300	Open Manhole	1350	9.000	66.832	450				
		68.945	2.284	Junction		10.000	66.661	450				
	SW31 (FC)	68.684	2.155	Open Manhole	1500	8.002	66.529	600	8.001	66.959	450	
Unit 2 Storage									9.000	66.529	450	108
									10.000	66.529	450	
	SW26	69.318	1.575	Open Manhole	1350	11.000	67.743	375				
	SW27	69.140	1.575	Open Manhole	1350	11.001	67.565	375	11.000	67.565	375	
		68.710	1.745	Junction		12.000	66.965	375				
	SW28 (FC)	68.765	1.908	Open Manhole	1500	11.002	66.857	525	11.001	67.115	375	64
									12.000	66.857	375	
	SW23	68.440	1.425	Open Manhole	1200	13.000	67.015	225				
	SW24	68.722	2.011	Open Manhole	1500	11.003	66.711	525	11.002	66.775	525	
									13.000	66.711	225	
	SW25	68.575	2.104	Open Manhole	1800	8.003	66.471	750	8.002	66.471	600	177
									11.003	66.602	525	
	SW18	69.277	2.931	Open Manhole	1875	4.005	66.346	975	4.004	66.748	750	

Atlas Park
Propsoed SW
Drainage Calculations

Designed by PB
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Network 2020.1

Manhole Schedules for 1.000

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam. ,L*W (mm)	Pipe Out			Pipes In			Backdrop (mm)
					PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)	Diameter (mm)	
								8.003	66.346	750	
SW09	68.050	1.300	Open Manhole	1350	14.000	66.750	450				
SW10	68.295	1.968	Open Manhole	1500	14.001	66.327	525	14.000	66.327	450	
SW11	68.144	1.951	Open Manhole	1500	14.002	66.193	525	14.001	66.193	525	
Unit 1 Storage	68.267	2.467	Junction		15.000	65.800	600				
SW12	68.581	2.881	Open Manhole	1500	14.003	65.700	600	14.002	65.941	525	166
								15.000	65.700	600	
SW14	69.185	1.725	Open Manhole	1500	16.000	67.460	525				
SW15	69.024	1.725	Open Manhole	1500	16.001	67.299	525	16.000	67.299	525	
SW13(FC)	68.367	2.724	Open Manhole	1800	14.004	65.643	750	14.003	65.643	600	
								16.001	66.567	525	699
SW06A	68.030	2.757	Open Manhole	2175	1.005	65.273	1275	1.004	65.273	900	
								4.005	66.127	975	554
								14.004	65.625	750	
SW06	67.366	2.172	Open Manhole	2400	1.006	65.194	1275	1.005	65.194	1275	
SW07	67.366	2.205	Open Manhole	2400		OUTFALL		1.006	65.161	1275	

Ridge and Partners LLP		Page 18																																												
The Cowyards Blenheim Park, Oxford Road Woodstock OX20 1QR	Atlas Park Propsoed SW Drainage Calculations																																													
Date 19/12/2022 File ATLAS PARK.MDX	Designed by PB Checked by lmC																																													
Innovyze	Network 2020.1																																													
<u>Surcharged Outfall Details for 1.000</u> <table><thead><tr><th>Outfall Pipe Number</th><th>Outfall Name</th><th>C. Level (m)</th><th>I. Level (m)</th><th>Min I. Level (m)</th><th>D,L (mm)</th><th>W (mm)</th></tr></thead><tbody><tr><td>1.006</td><td>SW07</td><td>67.366</td><td>65.161</td><td>0.000</td><td>2400</td><td>0</td></tr></tbody></table> Datum (m) 0.000 Offset (mins) 0 <table><thead><tr><th>Time (mins)</th><th>Depth (m)</th><th>Time (mins)</th><th>Depth (m)</th><th>Time (mins)</th><th>Depth (m)</th><th>Time (mins)</th><th>Depth (m)</th><th>Time (mins)</th><th>Depth (m)</th></tr></thead><tbody><tr><td>2016</td><td>66.088</td><td>6048</td><td>66.088</td><td>10080</td><td>66.088</td><td>14112</td><td>66.088</td><td>18144</td><td>66.088</td></tr><tr><td>4032</td><td>66.088</td><td>8064</td><td>66.088</td><td>12096</td><td>66.088</td><td>16128</td><td>66.088</td><td>20160</td><td>66.088</td></tr></tbody></table>			Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	1.006	SW07	67.366	65.161	0.000	2400	0	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	2016	66.088	6048	66.088	10080	66.088	14112	66.088	18144	66.088	4032	66.088	8064	66.088	12096	66.088	16128	66.088	20160	66.088
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Online Controls for 1.000

Hydro-Brake® Optimum Manhole: SW05(FC), DS/PN: 1.004, Volume (m³): 31.5

Unit Reference	MD-CHE-0168-1900-2000-1900	Sump Available	No
Design Head (m)	2.000	Diameter (mm)	168
Design Flow (l/s)	19.0	Invert Level (m)	65.310
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	19.0	Kick-Flo®	0.577	10.5
Flush-Flo™	0.413	19.0	Mean Flow over Head Range	-	14.2

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)	Depth (m)	Flow (l/s)
0.100	4.9	0.600	10.5	1.600	17.0	2.600	21.6	5.000	29.8	7.500	36.3
0.200	11.8	0.800	12.1	1.800	18.0	3.000	23.2	5.500	31.2	8.000	37.5
0.300	16.1	1.000	13.5	2.000	19.0	3.500	25.0	6.000	32.6	8.500	38.7
0.400	18.9	1.200	14.8	2.200	19.9	4.000	26.7	6.500	33.9	9.000	39.8
0.500	13.1	1.400	16.0	2.400	20.8	4.500	28.3	7.000	35.1	9.500	40.8

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<u>Hydro-Brake® Optimum Manhole: SW21(FC), DS/PN: 4.003, Volume (m³): 16.3</u> <table><tr><td>Unit Reference</td><td>MD-CHE-0126-9100-1400-9100</td><td>Sump Available</td><td>No</td></tr><tr><td>Design Head (m)</td><td>1.400</td><td>Diameter (mm)</td><td>126</td></tr><tr><td>Design Flow (l/s)</td><td>9.1</td><td>Invert Level (m)</td><td>66.847</td></tr><tr><td>Flush-Flo™</td><td>Calculated</td><td>Minimum Outlet Pipe Diameter (mm)</td><td>150</td></tr><tr><td>Objective</td><td>Minimise upstream storage</td><td>Suggested Manhole Diameter (mm)</td><td>1200</td></tr><tr><td>Application</td><td>Surface</td><td></td><td></td></tr></table> <table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>1.400</td><td>9.1</td><td>Kick-Flo®</td><td>0.423</td><td>5.2</td></tr><tr><td>Flush-Flo™</td><td>0.302</td><td>9.1</td><td>Mean Flow over Head Range</td><td>-</td><td>6.8</td></tr></table> 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 <table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>3.7</td><td>0.600</td><td>6.0</td><td>1.600</td><td>9.7</td><td>2.600</td><td>12.3</td><td>5.000</td><td>17.0</td><td>7.500</td><td>20.7</td></tr><tr><td>0.200</td><td>7.2</td><td>0.800</td><td>6.9</td><td>1.800</td><td>10.3</td><td>3.000</td><td>13.2</td><td>5.500</td><td>17.8</td><td>8.000</td><td>21.4</td></tr><tr><td>0.300</td><td>9.1</td><td>1.000</td><td>7.7</td><td>2.000</td><td>10.8</td><td>3.500</td><td>14.2</td><td>6.000</td><td>18.6</td><td>8.500</td><td>22.0</td></tr><tr><td>0.400</td><td>5.3</td><td>1.200</td><td>8.4</td><td>2.200</td><td>11.3</td><td>4.000</td><td>15.2</td><td>6.500</td><td>19.3</td><td>9.000</td><td>22.6</td></tr><tr><td>0.500</td><td>5.5</td><td>1.400</td><td>9.1</td><td>2.400</td><td>11.8</td><td>4.500</td><td>16.1</td><td>7.000</td><td>20.0</td><td>9.500</td><td>23.3</td></tr></table> <u>Hydro-Brake® Optimum Manhole: SW31(FC), DS/PN: 8.002, Volume (m³): 25.2</u> <table><tr><td>Unit Reference</td><td>MD-CHE-0099-5500-1400-5500</td><td>Flush-Flo™</td><td>Calculated</td></tr><tr><td>Design Head (m)</td><td>1.400</td><td>Objective</td><td>Minimise upstream storage</td></tr><tr><td>Design Flow (l/s)</td><td>5.5</td><td>Application</td><td>Surface</td></tr></table>						Unit Reference	MD-CHE-0126-9100-1400-9100	Sump Available	No	Design Head (m)	1.400	Diameter (mm)	126	Design Flow (l/s)	9.1	Invert Level (m)	66.847	Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150	Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200	Application	Surface			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.400	9.1	Kick-Flo®	0.423	5.2	Flush-Flo™	0.302	9.1	Mean Flow over Head Range	-	6.8	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)	Depth (m)	Flow (l/s)	0.100	3.7	0.600	6.0	1.600	9.7	2.600	12.3	5.000	17.0	7.500	20.7	0.200	7.2	0.800	6.9	1.800	10.3	3.000	13.2	5.500	17.8	8.000	21.4	0.300	9.1	1.000	7.7	2.000	10.8	3.500	14.2	6.000	18.6	8.500	22.0	0.400	5.3	1.200	8.4	2.200	11.3	4.000	15.2	6.500	19.3	9.000	22.6	0.500	5.5	1.400	9.1	2.400	11.8	4.500	16.1	7.000	20.0	9.500	23.3	Unit Reference	MD-CHE-0099-5500-1400-5500	Flush-Flo™	Calculated	Design Head (m)	1.400	Objective	Minimise upstream storage	Design Flow (l/s)	5.5	Application	Surface
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<u>Hydro-Brake® Optimum Manhole: SW28(FC), DS/PN: 11.002, Volume (m³): 12.0</u>																																																																										
Unit Reference MD-CHE-0094-5000-1400-5000 Sump Available No Design Head (m) 1.400 Diameter (mm) 94 Design Flow (l/s) 5.0 Invert Level (m) 66.857 Flush-Flo™ Calculated Minimum Outlet Pipe Diameter (mm) 150 Objective Minimise upstream storage Suggested Manhole Diameter (mm) 1200 Application Surface																																																																										
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<u>Hydro-Brake® Optimum Manhole: SW28(FC), DS/PN: 11.002, Volume (m³): 12.0</u>															
Control Points				Head (m)		Flow (l/s)		Control Points				Head (m)		Flow (l/s)	
Design Point (Calculated)				1.400		5.0		Kick-Flo®				0.329		2.5	
Flush-Flo™				0.232		4.4		Mean Flow over Head Range				-		3.6	
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)	
0.100		2.5		0.600		3.3		1.600		5.3		2.600		6.8	
0.200		4.2		0.800		3.8		1.800		5.7		3.000		7.3	
0.300		2.7		1.000		4.2		2.000		6.0		3.500		7.8	
0.400		2.7		1.200		4.6		2.200		6.2		4.000		8.4	
0.500		3.0		1.400		5.0		2.400		6.5		4.500		8.9	

Hydro-Brake® Optimum Manhole: SW13(FC), DS/PN: 14.004, Volume (m³): 16.1

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)	Depth (m)	Flow (l/s)
0.100	4.0	0.600	6.5	1.600	10.6	2.600	13.4	5.000	18.5	7.500	22.6
0.200	7.9	0.800	7.5	1.800	11.2	3.000	14.4	5.500	19.4	8.000	23.3
0.300	10.3	1.000	8.4	2.000	11.8	3.500	15.5	6.000	20.2	8.500	24.0
0.400	7.4	1.200	9.2	2.200	12.4	4.000	16.6	6.500	21.0	9.000	24.7
0.500	6.0	1.400	9.9	2.400	12.9	4.500	17.6	7.000	21.8	9.500	25.3

Hydro-Brake® Optimum Manhole: SW06, DS/PN: 1.006, Volume (m³): 47.4

Unit Reference	MD-SHE-0314-6530-2200-6530
Design Head (m)	2.200
Design Flow (l/s)	65.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	314
Invert Level (m)	65.194
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.200	65.3	Flush-Flo SM	0.671	65.3

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<u>Hydro-Brake® Optimum Manhole: SW06, DS/PN: 1.006, Volume (m³): 47.4</u> <table><tr><th colspan="3">Control Points Head (m) Flow (l/s)</th><th colspan="3">Control Points Head (m) Flow (l/s)</th></tr><tr><td>Kick-Flo®</td><td>1.466</td><td>53.7</td><td>Mean Flow over Head Range</td><td>-</td><td>56.2</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>9.5</td><td>0.600</td><td>65.2</td><td>1.600</td><td>56.0</td><td>2.600</td><td>70.8</td><td>5.000</td><td>97.2</td><td>7.500</td><td>118.5</td></tr><tr><td>0.200</td><td>32.2</td><td>0.800</td><td>65.0</td><td>1.800</td><td>59.3</td><td>3.000</td><td>75.9</td><td>5.500</td><td>101.9</td><td>8.000</td><td>122.3</td></tr><tr><td>0.300</td><td>56.1</td><td>1.000</td><td>63.7</td><td>2.000</td><td>62.4</td><td>3.500</td><td>81.8</td><td>6.000</td><td>106.3</td><td>8.500</td><td>126.0</td></tr><tr><td>0.400</td><td>62.4</td><td>1.200</td><td>61.4</td><td>2.200</td><td>65.3</td><td>4.000</td><td>87.2</td><td>6.500</td><td>110.5</td><td>9.000</td><td>129.5</td></tr><tr><td>0.500</td><td>64.3</td><td>1.400</td><td>56.5</td><td>2.400</td><td>68.1</td><td>4.500</td><td>92.4</td><td>7.000</td><td>114.6</td><td>9.500</td><td>133.0</td></tr></table>						Control Points Head (m) Flow (l/s)			Control Points Head (m) Flow (l/s)			Kick-Flo®	1.466	53.7	Mean Flow over Head Range	-	56.2	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)	Depth (m)	Flow (l/s)	0.100	9.5	0.600	65.2	1.600	56.0	2.600	70.8	5.000	97.2	7.500	118.5	0.200	32.2	0.800	65.0	1.800	59.3	3.000	75.9	5.500	101.9	8.000	122.3	0.300	56.1	1.000	63.7	2.000	62.4	3.500	81.8	6.000	106.3	8.500	126.0	0.400	62.4	1.200	61.4	2.200	65.3	4.000	87.2	6.500	110.5	9.000	129.5	0.500	64.3	1.400	56.5	2.400	68.1	4.500	92.4	7.000	114.6	9.500	133.0
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Innovyze	Network 2020.1																			
<u>Storage Structures for 1.000</u>																				
<u>Cellular Storage Manhole: SW03, DS/PN: 1.002</u>																				
Invert Level (m) 65.501 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0																				
<table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td></tr><tr><td>0.000</td><td>720.0</td><td>0.0</td><td>1.600</td><td>720.0</td><td>0.0</td><td>1.601</td><td>0.0</td><td>0.0</td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	720.0	0.0	1.600	720.0	0.0	1.601	0.0	0.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)												
0.000	720.0	0.0	1.600	720.0	0.0	1.601	0.0	0.0												
<u>Cellular Storage Manhole: Unit 5 Storage, DS/PN: 3.000</u>																				
Invert Level (m) 66.054 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 1.0																				
<table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td></tr><tr><td>0.000</td><td>480.0</td><td>0.0</td><td>1.200</td><td>480.0</td><td>0.0</td><td>1.201</td><td>0.0</td><td>0.0</td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	480.0	0.0	1.200	480.0	0.0	1.201	0.0	0.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)												
0.000	480.0	0.0	1.200	480.0	0.0	1.201	0.0	0.0												
<u>Cellular Storage Manhole: SW20, DS/PN: 4.002</u>																				
Invert Level (m) 66.924 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 1.0																				
<table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td></tr><tr><td>0.000</td><td>770.0</td><td>0.0</td><td>1.200</td><td>770.0</td><td>0.0</td><td>1.201</td><td>0.0</td><td>0.0</td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	770.0	0.0	1.200	770.0	0.0	1.201	0.0	0.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)												
0.000	770.0	0.0	1.200	770.0	0.0	1.201	0.0	0.0												
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The Cowyards Blenheim Park, Oxford Road Woodstock OX20 1QR	Atlas Park Proposed SW Drainage Calculations																			
Date 19/12/2022 File ATLAS PARK.MDX	Designed by PB Checked by lmc																			
Innovyze	Network 2020.1																			
Cellular Storage Manhole: Unit 1 Storage, DS/PN: 15.000 Invert Level (m) 65.800 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 1.0 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>450.0</td><td>0.0</td><td>1.600</td><td>450.0</td><td>0.0</td><td>1.601</td><td>0.0</td><td>0.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	450.0	0.0	1.600	450.0	0.0	1.601	0.0	0.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)												
0.000	450.0	0.0	1.600	450.0	0.0	1.601	0.0	0.0												
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<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 1.000</u>																			
<table><thead><tr><th></th><th>US/MH</th><th></th><th>Level</th></tr><tr><th>PN</th><th>Name</th><th>Status</th><th>Exceeded</th></tr></thead><tbody><tr><td>1.000</td><td>SW01</td><td>OK</td><td></td></tr><tr><td>1.001</td><td>SW02</td><td>OK</td><td></td></tr></tbody></table>					US/MH		Level	PN	Name	Status	Exceeded	1.000	SW01	OK		1.001	SW02	OK	
	US/MH		Level																
PN	Name	Status	Exceeded																
1.000	SW01	OK																	
1.001	SW02	OK																	
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Atlas Park
Propsoed SW
Drainage Calculations

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 1.000

PN	US/MH Name	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
8.003	SW25		24.7	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 1.000

									Water	Surcharged	Flooded		
	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(l/s)
4.005		SW18	15 Winter	1	+0%				66.491	-0.831	0.000	0.05	
14.000		SW09	15 Summer	1	+0%	100/240	Winter		66.750	-0.450	0.000	0.00	
14.001		SW10	60 Winter	1	+0%	30/240	Winter		66.421	-0.431	0.000	0.07	
14.002		SW11	60 Winter	1	+0%	30/120	Winter		66.271	-0.447	0.000	0.05	
15.000	Unit 1 Storage	240	Winter	1	+0%	30/30	Winter		66.073	-0.327	0.000	0.04	
14.003		SW12	120 Winter	1	+0%	30/15	Summer		66.094	-0.206	0.000	0.04	
16.000		SW14	30 Winter	1	+0%	30/30	Winter		67.654	-0.331	0.000	0.29	
16.001		SW15	30 Winter	1	+0%				67.428	-0.396	0.000	0.14	
14.004	SW13(FC)	30	Winter	1	+0%	30/15	Summer		66.170	-0.223	0.000	0.03	
1.005		SW06A	30 Winter	1	+0%	30/30	Winter		65.745	-0.803	0.000	0.04	
1.006		SW06	30 Winter	1	+0%	100/15	Winter		65.710	-0.759	0.000	0.04	

PN	US/MH Name	Half Drain	Pipe	Status	Level Exceeded
		Time (mins)	Flow (l/s)		
4.005	SW18		41.4	OK	
14.000	SW09		0.0	OK	
14.001	SW10	53	12.9	OK	
14.002	SW11		12.9	OK	
15.000	Unit 1 Storage	167	8.5	OK*	
14.003	SW12		8.7	OK	
16.000	SW14		56.6	OK	
16.001	SW15		56.7	OK	

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Propsoed SW
Drainage Calculations

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Network 2020.1

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 1.000

PN	US/MH Name	Half Drain	Pipe	Status	Level Exceeded
		Time (mins)	Flow (l/s)		
14.004	SW13 (FC)		10.2	OK	
1.005	SW06A		62.4	OK	
1.006	SW06		62.8	OK	

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Date 19/12/2022 File ATLAS PARK.MDX	Designed by PB Checked by lmC																							
Innovyze	Network 2020.1																							
<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 1.000</u> <u>Simulation Criteria</u> <table><tr><td>Areal Reduction Factor 1.000</td><td>Manhole Headloss Coeff (Global) 0.000</td><td>MADD Factor * 10m³/ha Storage 0.000</td></tr><tr><td>Hot Start (mins) 0</td><td>Foul Sewage per hectare (l/s) 0.000</td><td>Inlet Coefficient 0.500</td></tr><tr><td>Hot Start Level (mm) 0</td><td>Additional Flow - % of Total Flow 0.000</td><td>Flow per Person per Day (l/per/day) 0.000</td></tr></table> Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 6 Number of Storage Structures 7 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> <table><tr><td>Rainfall Model</td><td>FSR M5-60 (mm) 18.000</td><td>Cv (Summer) 0.750</td></tr><tr><td>Region England and Wales</td><td>Ratio R 0.389</td><td>Cv (Winter) 0.840</td></tr></table> Margin for Flood Risk Warning (mm) 300.0 DVD Status ON Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON DTS Status OFF <table><tr><td>Profile(s)</td><td>Summer and Winter</td></tr><tr><td>Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440</td><td></td></tr><tr><td>Return Period(s) (years)</td><td>1, 30, 100</td></tr><tr><td>Climate Change (%)</td><td>0, 40, 45</td></tr></table> WARNING: Half Drain Time has not been calculated as the structure is too full.			Areal Reduction Factor 1.000	Manhole Headloss Coeff (Global) 0.000	MADD Factor * 10m³/ha Storage 0.000	Hot Start (mins) 0	Foul Sewage per hectare (l/s) 0.000	Inlet Coefficient 0.500	Hot Start Level (mm) 0	Additional Flow - % of Total Flow 0.000	Flow per Person per Day (l/per/day) 0.000	Rainfall Model	FSR M5-60 (mm) 18.000	Cv (Summer) 0.750	Region England and Wales	Ratio R 0.389	Cv (Winter) 0.840	Profile(s)	Summer and Winter	Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440		Return Period(s) (years)	1, 30, 100	Climate Change (%)
Areal Reduction Factor 1.000	Manhole Headloss Coeff (Global) 0.000	MADD Factor * 10m³/ha Storage 0.000																						
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Hot Start Level (mm) 0	Additional Flow - % of Total Flow 0.000	Flow per Person per Day (l/per/day) 0.000																						
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Return Period(s) (years)	1, 30, 100																							
Climate Change (%)	0, 40, 45																							
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<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 1.000</u>					

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<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 1.000</u>					
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<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 1.000</u>					
			Half Drain Pipe		
	US/MH	Time	Flow		Level
PN	Name	(mins)	(l/s)	Status	Exceeded
15.000	Unit 1 Storage		13.4	SURCHARGED*	
14.003	SW12		15.2	SURCHARGED	
16.000	SW14		192.4	SURCHARGED	
16.001	SW15		192.4	OK	
14.004	SW13 (FC)		10.1	SURCHARGED	
1.005	SW06A		71.5	SURCHARGED	
1.006	SW06		65.3	OK	

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The Cowyards Blenheim Park, Oxford Road Woodstock OX20 1QR	Atlas Park Proposed SW Drainage Calculations																							
Date 19/12/2022 File ATLAS PARK.MDX	Designed by PB Checked by lmC																							
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<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 1.000</u> <u>Simulation Criteria</u> <table><tr><td>Areal Reduction Factor 1.000</td><td>Manhole Headloss Coeff (Global) 0.000</td><td>MADD Factor * 10m³/ha Storage 0.000</td></tr><tr><td>Hot Start (mins) 0</td><td>Foul Sewage per hectare (l/s) 0.000</td><td>Inlet Coefficient 0.500</td></tr><tr><td>Hot Start Level (mm) 0</td><td>Additional Flow - % of Total Flow 0.000</td><td>Flow per Person per Day (l/per/day) 0.000</td></tr></table> Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 6 Number of Storage Structures 7 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> <table><tr><td>Rainfall Model</td><td>FSR M5-60 (mm) 18.000</td><td>Cv (Summer) 0.750</td></tr><tr><td>Region England and Wales</td><td>Ratio R 0.389</td><td>Cv (Winter) 0.840</td></tr></table> Margin for Flood Risk Warning (mm) 300.0 DVD Status ON Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON DTS Status OFF <table><tr><td>Profile(s)</td><td>Summer and Winter</td></tr><tr><td>Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440</td><td></td></tr><tr><td>Return Period(s) (years)</td><td>1, 30, 100</td></tr><tr><td>Climate Change (%)</td><td>0, 40, 45</td></tr></table> WARNING: Half Drain Time has not been calculated as the structure is too full.			Areal Reduction Factor 1.000	Manhole Headloss Coeff (Global) 0.000	MADD Factor * 10m³/ha Storage 0.000	Hot Start (mins) 0	Foul Sewage per hectare (l/s) 0.000	Inlet Coefficient 0.500	Hot Start Level (mm) 0	Additional Flow - % of Total Flow 0.000	Flow per Person per Day (l/per/day) 0.000	Rainfall Model	FSR M5-60 (mm) 18.000	Cv (Summer) 0.750	Region England and Wales	Ratio R 0.389	Cv (Winter) 0.840	Profile(s)	Summer and Winter	Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440		Return Period(s) (years)	1, 30, 100	Climate Change (%)
Areal Reduction Factor 1.000	Manhole Headloss Coeff (Global) 0.000	MADD Factor * 10m³/ha Storage 0.000																						
Hot Start (mins) 0	Foul Sewage per hectare (l/s) 0.000	Inlet Coefficient 0.500																						
Hot Start Level (mm) 0	Additional Flow - % of Total Flow 0.000	Flow per Person per Day (l/per/day) 0.000																						
Rainfall Model	FSR M5-60 (mm) 18.000	Cv (Summer) 0.750																						
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<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 1.000</u>		

APPENDIX G – NW SUDS PROFORMA

North West SuDS Pro-forma

Template for Supporting Guidance

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Document Change Log

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Version 5	May 2022	Pro-forma guidance updated to take account of the new climate change allowances published on 10 May 2022.

Website: [The Flood Hub](#)

This website is an online resource which has been funded by the North West Regional Flood and Coastal Committee as a one stop shop for flood advice and information across the North West.

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North West SuDS Pro-forma

Guidance for completing your pro-forma

[Add Local Authority branding/logo as required]

Endorsed by the Lead Local Flood Authority, Highways Authority, United Utilities and Environment Agency.

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WHAT DO I NEED TO SUBMIT WITH MY PLANNING APPLICATION?

It is important that your application can demonstrate the site can be sustainably drained; this is a principle of development. This should be demonstrated at the earliest opportunity.

If your development proposal is for major development¹, or in a Critical Drainage Area, regardless of your type of planning application, you must submit the following with your application for planning permission:

- 1. Site Specific Flood Risk Assessment (FRA)** - Where one is required under the [National Planning Policy Framework](#) and applicable Local Plan policies. In some cases, these also require you to submit a Sequential Test and/or Exception Test.
- 2. Sustainable Drainage Strategy** – This will include your overall approach and is where you will evidence your approach to surface water management. E.g. plans, drawings, calculations etc. It will also take account of any requirements identified in the FRA.
- 3. Sustainable Drainage Strategy: Pro-forma** – The pro-forma summarises and confirms the details contained within your Sustainable Drainage Strategy and Site Specific Flood Risk Assessment. It is intended to ensure all aspects of sustainable drainage have been considered. The information supplied should be appropriate and proportionate to the planning stage, further information can be gained from contacting your Local Planning Authority or Lead Local Flood Authority.

This document may form part of the Local Planning Authority's 'Planning Validation Checklist.' Planning applications for major development and for sites in Critical Drainage Areas that are not submitted with the above information will not be regarded as a 'valid' application.

This document contains information and guidance about what you need to submit in support of your major planning application.

¹ Major development is defined in Section 2 of [Statutory Instrument 2015 No. 595](#).

COMPLETING YOUR SUSTAINABLE DRAINAGE STRATEGY AND SUDS PRO-FORMA

What is a Sustainable Drainage Strategy?

The purpose of a Sustainable Drainage Strategy is to set out how surface water from a development site will be managed sustainably under both current and future conditions, and to support your proposed approach with appropriate evidence, such as drainage calculations and relevant plans and drawings.

The Sustainable Drainage Strategy must also set out how all sustainable drainage components are intended to be managed and maintained over the lifetime of the development to ensure that the sustainable drainage system will continue to perform throughout its design life.

How is a Sustainable Drainage Strategy different to a Site-Specific Flood Risk Assessment (FRA)?

A Site-Specific FRA assesses all sources of flood risk to and from the site and elsewhere, as a result of the development.

A Sustainable Drainage Strategy demonstrates how surface water from the development will be managed in line with national and local requirements for sustainable drainage systems and should incorporate the findings and address risks identified in the site specific FRA.

What is the purpose of the Pro-forma?

The pro-forma will support your planning application by ensuring that your sustainable drainage design, contained within your Sustainable Drainage Strategy, has considered and appropriately evidenced everything it needs to, reducing the risk of delays or refusal of your application as a result of a lack of information about sustainable drainage proposals.

What if I don't submit the pro-forma with my application?

The pro-forma may be a requirement of the planning validation checklist in the Local Planning Authority area your development proposal is in. This means if you do not submit a completed pro-forma your application will not be 'valid' and therefore will not be processed by the Local Planning Authority until a completed SuDS pro-forma has been received.

Where this pro-forma is not a requirement of the planning validation checklist it is strongly advised that a completed pro-forma is submitted as this will help to ensure that the minimum required information regarding your drainage proposals has been provided.

How do I complete the pro-forma?

You must fill in all white boxes in the pro-forma for the document to be accepted as complete. This guidance note will support you in completing the pro-forma.

FURTHER HELP AND ADVICE

It is advised that you employ an appropriately qualified drainage engineer to design all aspects of your site drainage, including taking account of in perpetuity maintenance of the system.

We would also encourage your drainage engineer to work with the landscape architect for the site.

Online tools and information

The [UK SuDS](#) and [Susdrain](#) websites are helpful in answering common questions on sustainable drainage design and also provide a range of tools, guidance and examples.

[UK Sustainable Drainage Guidance & Tools website](#), supported by HR Wallingford Ltd, provides a comprehensive list of frequently asked questions (FAQs).

The pro-forma can be completed using freely available tools such as [Tools for Sustainable Drainage Systems](#) or appropriate Industry Standard surface water management design software.

Pre-application service

Many Local Authorities offer a 'pre-application' service which enables applicants to obtain guidance and feedback from planning and other specialist officers before submitting their planning application, including from the Lead Local Flood Authority.

This service provides an opportunity for applicants to identify and discuss potential issues before submitting planning applications reducing the risk of applications being refused or delayed. There may be a charge for this service.

SECTION 1. APPLICATION AND DEVELOPMENT DETAILS

What is meant by 'Drained Area' of Development'?

Any area that may contribute to flows within the proposed drainage system. They may be either from permeable or impermeable areas and can also include areas from outside the proposed development area.

Do I need to submit a Site-Specific Flood Risk Assessment (FRA)?

Under **Footnote 50 of Paragraph 163 of the [National Planning Policy Framework](#)** a Site-Specific FRA is required if your development is:

- in Flood Zones 2 and 3 (this applies to all development types)
- in Flood Zone 1, for proposals involving: sites of 1 hectare or more
- on land which has been identified by the Environment Agency as having critical drainage problems
- on land identified in a strategic flood risk assessment as being at increased flood risk in future
- on land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use

If your development proposal meets any of these criteria, there are no exemptions to a Site-Specific FRA and you must submit one in order for your planning application to be validated by the Local Planning Authority.

What information does my Flood Risk Assessment need to include?

The information your Site-Specific FRA needs to include is contained within '[Flood risk assessment for planning applications](#)' and the [Planning Practice Guidance](#).

Reference should also be made to the Local Planning Authority's Strategic Flood Risk Assessment for locally specific guidance and information.

The detail and technical complexity of any Site-Specific FRA will reflect the scale, nature and location of your development proposal.

What if I am unable to complete a Site-Specific Flood Risk Assessment?

It is recommended that someone appropriately qualified is employed to undertake an FRA. If you meet the requirements for a Site-Specific FRA and you must submit one for your planning application to be validated by the Local Planning Authority.

How do I work out the expected lifetime of the development?

The [Planning Practice Guidance](#) states all residential developments have an expected minimum lifetime of 100 years, unless there is specific justification for considering a shorter period.

For non-residential development, you need to specify how long you expect the development to last taking account of the advice given in the [Planning Practice Guidance](#).

Development Type - What is classified as 'Greenfield' and 'Previously Developed'?

It is important that you are clear on the difference between 'Greenfield' and 'Previously Developed' sites in the context of drainage – not planning – and therefore the surface water drainage design standard expected for your development site.

Previously Developed / Brownfield

If you are proposing to use an existing drainage system for surface water management on your development site, your drainage system can be designed to 'previously developed' standards. For sites covered by buildings or impermeable hard surfaces this may require a reduction to existing rates to be applied in order to satisfy local planning policies – please check with your Local Planning Authority (LPA).

For the avoidance of doubt, 'use of an existing drainage system' means utilising the **entirety** of the existing drainage system on site and does not refer to simply the point of discharge.

- **Example:** If you are proposing to demolish an existing building and replace it with a new building but will use the existing means of surface water removal in entirety, this would be classified as 'previously developed.'

Greenfield

If you are proposing to install a new drainage system for surface water management on your development site then your drainage system must be designed to 'greenfield' standards, even if the land has been previously developed. It may be worth checking your Local Planning Authority's Local Plan for a local policy position.

- **Example 1:** If you are proposing to construct buildings on land which has been previously developed (i.e. brownfield) but are installing a new surface water drainage system connecting to the existing outfall, this would be classified as 'greenfield.'
- **Example 2:** If you are proposing to construct buildings on unbuilt 'green' land and will be installing a new surface water drainage system connecting to a new or existing outfall, this would be classified as 'greenfield.'

SECTION 2: IMPERMEABLE AREA AND EXISTING DRAINAGE

How do I work out the impermeable area?

Anything that has, or will have, impermeable surfaces within the curtilage of your development site must be included here. This includes impermeable roads, footpaths and buildings.

What should be considered as existing flow routes and flood risks?

Any flows that will enter and cross the development site. The catchment area above the site should also be considered and details of how these existing flow routes will be managed through the site so that flooding is not increased either within or outside the site.

Do I need to consider flows coming onto the site?

Yes, any flows that are likely to flow onto the site need to be considered as part of the planning submission. Details on how the flows enter the site and how they will be managed once the development is complete should be included.

For example, surface water from adjacent land may run overland across the development site. You must assess how best to deal with this runoff and ensure you do not block its path with the new development. You may need to mitigate against this potential flood risk by creating a flow path through the site or diverting the flow around the site.

What areas should be considered for the contributing areas in hydraulic models?

Any areas flowing into the drainage system should be considered as part of the contributing areas. These can be either permeable or impermeable areas. You should consider how you will achieve this if your software package only assumes runoff from impermeable areas.

SECTION 3: PEAK RUNOFF RATES

Why is this information required?

[Defra's Technical Standards for Sustainable Drainage Systems](#) require peak runoff rates from development sites to be restricted in line with Technical Standards S2, S3 and S6, unless S1 applies.

What is the 'peak runoff rate'?

This is the maximum flow rate at which surface water runoff leaves the site during the critical storm event.

How do I calculate Existing Runoff Rates from Previously Developed / Brownfield sites?

The available methods of calculating runoff rates from previously developed sites are outline in **Chapter 24.5 of [The SuDS Manual \(C753\)](#)**. Discuss with the LLFA if you are unsure.

How do I calculate Greenfield Runoff Rates?

The available methods of calculating Greenfield runoff rates are outline in **Chapter 24.3 of [The SuDS Manual \(C753\)](#)**. Discuss with the LLFA if you are unsure.

What about watercourses discharging to estuarial waters that are tidally affected?

Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface water body (e.g. the sea or a large estuary) the peak flow control standards and volume control technical standards need not apply.

Confirm with your LLFA prior to planning application submission.

Which methodologies should be used to calculate discharge rates?

Methodologies listed in **Chapter 24 of [The SuDS Manual \(C753\)](#)** are considered appropriate.

What values do I use for Qbar?

Qbar is the peak rate of flow from a catchment for the mean annual flood, a return period of approximately 1:2.3 years. Qbar_{rural} should be used for this value.

What must I limit proposed post-development surface water discharge rates to?

That depends on the approach you take to limiting the amount of surface water discharged from the site.

Approach 1 (Long Term Storage) controls discharge rate and discharge volume by providing long-term storage, allowing an attenuated volume equivalent to the 1:100 year 6 hour greenfield event to be discharged at the greenfield 1:100 year rate for the 1 in 100 year 6 hour event (plus an allowance for climate change). Additional post-development runoff volume should be infiltrated into the ground or released at a rate no greater than 2 l/s/ha.

Therefore, in accordance with Standard S2 and S3 of [Defra's Technical Standards for Sustainable Drainage Systems](#) the following discharge rates from the development to any highway drain, sewer or surface water body must be achieved:

Greenfield Site: For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event **and** the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

Previously Developed Site:

For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event **and** the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

Approach 1 is the preferred approach but is only appropriate when the volume of surface water discharged from the site for the 1 in 100 (plus climate change) 6 hour event is limited to the greenfield equivalent. This is achieved through the use of long-term storage (if the actual greenfield volume cannot be achieved) which will either be infiltrated into the ground or released at a rate no greater than 2 l/s/ha.

Approach 2 (Attenuation Only) provides an alternative where the greenfield runoff volume cannot be achieved/it can be demonstrated that long term storage is unachievable. In accordance with S6 of [Defra's Technical Standards for Sustainable Drainage Systems](#), which requires runoff volume to be discharged at a rate that does not adversely affect flood risk, rainfall events up to and including the 1:100 year (plus climate change) event should be attenuated and released at the greenfield Qbar rate.

For more information you can refer to the following:

- **Chapter 3.3 of [The SuDS Manual \(C753\)](#)**
- **[Rainfall runoff management for developments](#)** (Environment Agency)
- **[Assessing attenuation storage volumes for SuDS](#)** (CIRIA)

To mitigate for climate change the proposed 1 in 100 year (plus climate change allowance) rainfall event must be no greater than the existing 1 in 100 year rainfall event runoff rate. If this cannot be achieved, surface water flood risk increases under climate change.

To avoid delays or refusal it is advisable to confirm with your LLFA that your proposed discharge rate is acceptable prior to submission if the rate of discharge is higher than the greenfield equivalent. The proposed rate must be justified and appropriately evidenced as there is a presumption that greenfield rates are achievable for the majority of sites.

What volumetric and routing coefficients should I use?

You should not assume software package default values will be acceptable – you must be able to justify the parameters you have used. Refer to **Chapter 24 of [The SuDS Manual \(C753\)](#)** for more information

How can I restrict flow rates?

It is recommended that you refer to [The SuDS Manual \(C753\)](#) for options of how to restrict your flow rate(s), essentially the options available are:

- vortex control systems
- inlets, outlets and flow control systems

SECTION 4: DISCHARGE VOLUME

What is 'discharge volume' and why must I consider it?

Discharge volume is the total volume of water leaving the development site for a particular rainfall event.

Introducing new impermeable surfaces increases surface water runoff and therefore can increase flood risk within and outside the development. By understanding the increase in surface water runoff volume measures can be taken to attenuate flows and mitigate any potential flood risk outside of the development.

[Defra's Technical Standards for Sustainable Drainage Systems](#) require runoff volume from development sites to be restricted in line with Technical Standards S4, S5 and/or S6, unless S1 applies.

What must proposed post-development surface water discharge volume be limited to?

In line with Standard S4 and S5 of [Defra's Technical Standards for Sustainable Drainage Systems](#) the following discharge volumes from the development to any highway drain, sewer or surface water body must be achieved:

Greenfield Site: For greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.

Previously Developed Site: For developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with the above, the runoff volume must be discharged at a rate that does not adversely affect flood risk (usually Q_{bar}). Discuss with your LLFA pre-application if this is not achievable.

Why do I need to calculate the runoff volume for the 100 year 6 hour storm event?

This is a simple method of calculating the volume of surface water discharging from a development site to determine whether there will be an increase in runoff volume discharging to the downstream catchment and subsequently whether there will be an increase in flood risk

By using a single specific storm event such as the 100 year 6 hour storm event, we are able to compare the volumetric runoff response from the existing site and the developed site.

The greenfield runoff volume generated by the 100 year 6 hour storm is the maximum volume that can be attenuated and discharged at the 1:100 year greenfield discharge rate. Additional volume generated as a result

of development for the 1:100 (plus climate change event) 6 hour storm should utilise long-term storage and either infiltrate into the ground or discharge at a rate of 2 l/s/ha.

For more information, refer to the FAQ section on uksuds.com.

How can I demonstrate that the proposed post-development surface water discharge volume has taken account of climate change?

To mitigate for climate change, the volume discharge from site during the 1:100 year + climate change event should be no greater than the greenfield_1 in 100 year event.

The appropriate climate change allowance must be applied. **See guidance under Section 5** for what climate change allowance you need to apply.

SECTION 5: STORAGE

Why is this information required?

[Defra's Technical Standards for SuDS](#) requires flood risk within the development to be considered and the sustainable drainage system designed to ensure flooding doesn't occur on-site or elsewhere during certain rainfall events in line with Technical Standards S7, S8 and S9.

How can I provide storage for surface water?

To slowly release surface water at a restricted (attenuated) rate you will need to provide storage where excess flows can be held.

Paragraph 165 of the [National Planning Policy Framework](#) encourages multifunctional benefits of sustainable drainage systems and opportunities to achieve this are encouraged, for example through the use of detention basins, ponds, wetlands and swales.

It can be more cost effective to store volumes of water across a site in sub-catchments as part of the SuDS management train rather than storing at one location prior to discharge ([Assessing attenuation storage volumes for SuDS, CIRIA fact sheet](#)).

Please note that regardless of the approach used, it is important to run a range of duration events to ensure the worst case condition is found for each drainage element on the site.

What climate change allowance do I need to provide?

The capacity of SuDS must provide effective drainage for the development, taking account of the likely impacts of climate change and the likely changes in impermeable area within the site over the lifetime of the development.

New [climate change allowances](#) were published on 10 May 2022. You will need to ensure you incorporate the new allowances into your flood risk assessment and sustainable drainage design.

When determining what climate change allowance to apply, two variables must be considered:

1. Location and size of the drainage catchment

- o **Urban/Small (flashy) Catchments:** Use the [peak rainfall allowances map](#) for small catchments (less than 5 sq km), or urbanised drainage catchments. A drainage catchment is urban if the land use is a town or city.
- o **Rural/Large Catchments:** For large rural drainage catchments use the [peak river flow allowances](#).

2. [Lifetime of the development](#)

- o For all residential development, the development lifetime is 100 years.

- o For all other development types, a 100-year lifetime is to be applied unless the development has a time limited planning condition OR a shorter development lifetime is agreed in writing with the Local Planning Authority.

For flood risk assessments and strategic flood risk assessments the upper end allowance must be assessed for **both** the 1% and 3.3% annual exceedance probability events for the 2070s epoch (2061 to 2125).

Discuss with the Lead Local Flood Authority if you are unsure what climate change allowance to apply.

What rates should I use for Urban Creep?

Urban creep is the conversion of permeable surfaces to impermeable over time e.g. surfacing of front gardens to provide additional parking spaces, extensions to existing buildings, creation of large patio areas.

The appropriate allowance for urban creep should be included in the design of the drainage system over the lifetime of the proposed development.

In accordance with Section 24.7.2 of [The SuDS Manual \(C753\)](#) and Section 8.3 of [BS 8582:2013 Code of practice for surface water management for development sites](#), to allow for future urban expansion within the development an increase in paved surface area of 10% is to be applied if there is no specified value stipulated by the Lead Local Flood Authority or Local Planning Authority.

SECTION 6: WATER QUALITY PROTECTION

Why do I need to consider water quality in my proposal?

All surface water runoff is, to some degree, contaminated. You are asked to identify the pollution hazard level associated with the proposed development. This is the first stage in identifying an appropriate surface water SuDS treatment train as part of your drainage design to consider the risks of pollution to controlled waters.

This information is required to satisfy **Paragraph 170 of the [National Planning Policy Framework](#)** and is therefore necessary to consider before a surface water drainage strategy can be agreed.

Why do I need to consider if the ground is contaminated?

The previous use of the site will also influence the type of sustainable drainage system proposed. For example, if the ground is contaminated the use of infiltration would not be appropriate.

This is acknowledged within Section 7b of the pro-forma as a reason why infiltration has been discounted '*Evidence to confirm that infiltration to ground would result in a risk of deterioration to ground water quality*'.

How can I demonstrate that I have considered water quality?

You can take measures to reduce contamination and therefore negative impacts on the water quality of receiving water bodies by including an appropriate treatment train as part of your sustainable drainage system in accordance with [The SuDS Manual \(C753\)](#).

The level of treatment required in the surface water drainage system will be dependent on the nature and scale of the proposed development. This is called the 'pollution hazard level' and once this is known [The SuDS Manual \(C753\)](#) provides detailed technical guidance on how to quantify which SuDS features will provide an appropriate level of treatment for a given land use.

What if my development poses a medium or high pollution hazard level?

For all high pollution hazard level developments, a more detailed assessment of the pollution risks from surface waters will be required as an appropriate surface water SuDS treatment train cannot be established without it. This information will be required before a surface water drainage strategy can be agreed.

For some medium pollution hazard level developments, further detailed assessment will be required to consider the risks of pollution to controlled waters and determine what SuDS features would be most appropriate. This information will be required before a surface water drainage strategy can be agreed.

Developments with a High and / or Medium pollution hazard potential may also require an [Environmental Permit from the Environment Agency](#). For proposals of this nature, it is advisable to undertake pre-application discussions with the Environment Agency. The Environment Agency charge for providing detailed planning guidance through their discretionary advice service. More information is available [here](#).

On contaminated sites, sufficient information should be submitted to demonstrate that the SuDS components proposed will not increase the risk of pollution to controlled waters through the mobilisation of contaminants and/or the creation of new pollution pathways.

What if my development poses a low pollution hazard level?

For low pollution hazard level developments, you should incorporate an appropriate surface water SuDS treatment train into the design of your sustainable drainage system. [The SuDS Manual \(C753\)](#) provides detailed technical guidance on how to quantify which SuDS features will provide an appropriate level of treatment for your given land use.

SECTION 7: DETAILS OF YOUR SUSTAINABLE DRAINAGE SYSTEM

Functions of your Sustainable Drainage System

Development often alters natural drainage by replacing free draining and/or vegetated ground with impermeable surfaces, gullies, pipes and channels. These changes result in an increase in the total volume and flow of runoff from a site.

For this reason, it is encouraged for applicants to consider how they can first utilise rainwater as a resource within their proposals, and to promote source control (managing rainfall close to where it falls) which promotes natural losses through soakage, infiltration and evapotranspiration.

This will help to reduce discharges of surface water from site in the smaller rainfall events, helping to retain it onsite similar to the pre-developed condition.

What is the SuDS Hierarchy?

The hierarchy of drainage options is outlined in the [Planning Practice Guidance](#).

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

This is outlined as follows, in order of priority:

- 1. into the ground (infiltration);**
- 2. to a surface waterbody;**
- 3. to a surface water sewer or highway drain;**
- 4. to a combined sewer.**

Applicants must submit robust justification and appropriate evidence, to demonstrate how each level has been discounted. The evidence required at each stage of the hierarchy is specified in the 'Evidence Required' column of the pro-forma.

When can infiltration be used in drainage design?

Infiltration allows surface water runoff to infiltrate into the ground and should be used wherever possible. Infiltration is encouraged to be used alongside and in addition to other SuDS techniques, for example, to deliver interception for the upstream hardstanding areas, and can help reduce the amount of attenuation required for a site and replicate greenfield conditions for frequent rainfall events. Where ground conditions allow, discharge to ground via infiltration can be used as the effective outfall for surface water disposal (as per the above hierarchy).

Maximising infiltration, for example through source control measures, reduces the volume of runoff and can therefore reduce the volume of attenuation you need to provide as part of your sustainable drainage system.

Infiltration can also:

- be effective at pollutant removal via filtering through the soils
- be simple and cost-effective to construct and maintain

Why do I need to submit a 'Plan B' sustainable drainage design?

For proposals, particularly outline applications, where the effective outfall is to ground (via infiltration) the applicant should consider an alternative 'Plan B' sustainable drainage design utilising an alternative discharge method, for the event that infiltration proposals are not feasible upon site specific ground investigation.

What minimum evidence do I need to provide in this section for an outline application?

For both your Plan A and Plan B SuDS designs, the minimum information you should provide is a desktop study of the ground conditions on your development site.

If you have also undertaken ground investigations e.g. a geotechnical survey and/or infiltration testing you should also submit these in support of your application, in accordance with the 'evidence checklist'.

Where can I find information on indicative ground conditions?

British Geological Survey offers a 'SuDS Infiltration Map' service which will provide a comprehensive indication on whether infiltration will be feasible on your development site. This information can be submitted in support of your application and will support you in designing your sustainable drainage system:

<https://www.bgs.ac.uk/products/hydrogeology/infiltrationSuds.html>

Your Local Planning Authority may also have more local information on ground conditions in the area.

What level of detail do I need to provide in my Plan B SuDS design?

As this is an alternative SuDS design, the design should be based on assumptions that key variables (e.g. ground conditions) of your 'Plan A' design are unfeasible and provide:

- a description of how and where you intend to store and discharge surface water.
- a map showing where you intend to store and discharge surface water.

NOTE: The volume of storage and rate of surface water discharge for your Plan B design will remain unchanged.

What is a Watercourse Survey Report?

This survey and report details the condition of the watercourse to which the site drains including cross-sections of any adjacent watercourses for appropriate distance upstream and downstream of the discharge point (as agreed with the Lead Local Flood Authority and/or Environment Agency).

In cases of culverted watercourses a CCTV survey may be required to demonstrate its structural condition.

Under what circumstances will I need watercourse permission?

If your development proposals are within 8 metres of the top of the banks of a watercourse (16 metres of a main river if it involves quarrying or excavation or if it is a tidal main river) or make changes to a watercourse, you may need a Consent or Permit **in addition to** planning permission.

The requirement for a Consent or Permit is **separate to and independent of** any planning permission given by the Local Planning Authority. This means that the grant of planning permission does not guarantee that Consent or a Permit will be given.

What type of watercourse permission do I need and how do I apply?

Watercourses have two classifications – ‘ordinary’ and ‘main river’ – and this determines what type of permission you require.

- **Main Rivers** are watercourses which **have** been designated as a ‘Main River’ on the Environment Agency's ‘Main River’ map. Works near to or on these watercourses may require a [Permit](#) from the Environment Agency.
- **Ordinary Watercourses** are watercourses which **have not** been designated as a ‘Main River’ on the Environment Agency's ‘Main River’ map. Works to these watercourses require consent from the LLFA.

You can identify whether a watercourse is classified as a ‘main river’ or ‘ordinary watercourse’, by viewing the Environment Agency's [‘Main River Map’](#).

When do I need to apply for watercourse permission?

It is strongly advised that you obtain any required Consent or Permit **before or concurrently** as you apply for planning permission to avoid delays. This is supported by **Paragraph 42 of the [National Planning Policy Framework](#)** which encourages parallel processing of other required consents.

You **must** obtain your Consent or Permit before undertaking any work on site. You are breaking the law if you carry out activity without one and may be subject to enforcement action if you do not obtain the necessary permission.

How can I obtain agreement to discharge to the sewer from the Water and Sewerage Company?

You must have written approval from the Water and Sewerage Company before you can connect to a public sewer.

United Utilities will advise a maximum rate of discharge. However, the final discharge rate is to be agreed with the Lead Local Flood Authority and is unlikely to be greater than greenfield runoff rates. Any discharge to the public sewer is on the condition that the other options, as outlined within the surface water hierarchy of discharge options (in order of priority) have been discounted.

Proposed SuDS component types

In this section, the applicant should identify the SuDS components proposed as part of their sustainable drainage system design that are:

- Within the property boundary
- Within the development site boundary
- Not within the boundary of the proposed development (off site).

[Susdrain website](#) provides a useful overview of different SuDS components.

What if part of the proposed SuDS is outside the curtilage of the development site?

If any part of your proposed sustainable drainage system is outside of the curtilage of the development site **AND** the applicant owns the land, you must submit a plan showing the amended curtilage of the development site to the Local Planning Authority.

If your point of discharge for your sustainable drainage system is through/via land that is **NOT** owned by the applicant, you must secure an appropriate legal agreement with the land owner for construction works, access, ownership and in perpetuity maintenance of the asset. Evidence of this must be supplied to the LLFA.

When would I need a Third Party Landowner Agreement?

If you are constructing any part of your sustainable drainage system on land that is **NOT** owned by the applicant i.e. 'off site' as indicated in Section 7c of the pro-forma.

You must secure an appropriate agreement with the landowner for construction works, access, ownership and in perpetuity maintenance of the asset. Evidence that this has been secured must be provided **before** the approval of your final confirmed sustainable drainage design.

What are the 'types' of pervious pavements?

You can find details of this in **Chapter 20 of [The SuDS Manual C753](#)**.

Where can I find guidance on designing for exceedance?

[CIRIA Designing for exceedance in urban drainage - good practice \(C635\)](#).

SECTION 8: OPERATION AND MAINTENANCE

Why do I need to consider operation and maintenance of the sustainable drainage system?

Operation and maintenance of the SuDS system should be considered at an early stage. The Designer has an obligation to design for maintenance under The Construction (Design and Management) Regulations 2015.

Paragraph 165 of the [National Planning Policy Framework](#) requires maintenance arrangements to be put in place to ensure an acceptable standard of operation for the lifetime of the development.

[Sustainable Drainage Systems: Written Statement - HCWS161](#) states that ‘in considering planning applications, local planning authorities should consult the relevant lead local flood authority on the management of surface water; satisfy themselves that the proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development’.

[Defra's Technical Standards for Sustainable Drainage Systems](#) state:

***S10** Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.*

***S11** The materials, including products, components, fittings or naturally occurring materials, which are specified by the designer must be of a suitable nature and quality for their intended use.*

What do I need to provide to demonstrate maintenance arrangements are or can be put in place?

Applicants must provide the information listed within the ‘Evidence Required’ columns of the pro-forma to demonstrate to the Local Planning Authority (LPA) that clear arrangements will be in place for on-going management and maintenance over the lifetime of the development.

What are the maintenance options for sustainable drainage systems?

There are a range of viable maintenance options for the ownership and adoption of sustainable drainage systems, therefore the applicant should clearly state their proposed maintenance and management arrangements.

The applicant should identify any of the adopting bodies that you will be offering your sustainable drainage components for adoption.

What about SuDS components that are within a property boundary (e.g. roof garden)?

The applicant may be required to enter into a Section 106 agreement prior to the grant of planning permission, requiring that any sustainable drainage components on private property (e.g. individual houses) are maintained in perpetuity by the landowner enforced by a Deed of Grant and applied to the freehold title.

For any SuDS components proposed within the curtilage of a private property (e.g. individual houses) the developer should clearly set out any maintenance responsibilities for those SuDS components and potential implications of non-maintenance, and ensure this is communicated to the purchaser of such properties.

Developers are encouraged to provide details of SuDS components on the development site, both communal and private (property level), for inclusion within the Home Information Pack.

GLOSSARY

Combined Sewer	A sewer that drains both rainwater and foul water.
Curtilage	Land area within property boundaries
Culvert	A covered structure under a road, embankment etc, to direct the flow of water.
Evapotranspiration	The process by which the Earth's surface or soil loses moisture by evaporation of water and by uptake and then transpiration from plants.
Exceedance design	Designing a system to manage effectively events that exceed (i.e. are bigger and rarer than) the drainage system's required level of service.
Exceedance event	A rainfall or flow event that exceeds (i.e. is bigger and rarer than) the design event, not to be confused with an extreme event.
Exceedance flows	Flows in excess of those for which a system is designed
Four pillars of SuDS	The types of benefits that can be achieved by SuDS will be dependent on the site, but fit broadly into four categories: water quantity, water quality, amenity and biodiversity. These are also referred to as the four pillars of SuDS design.
Flood routing	Design and consideration of above-ground areas that act as pathways permitting water to run safely overland to minimise the adverse effect of flooding. This is required when the design capacity of the drainage system has been exceeded
Geohazard	A geologic hazard. In the case SuDS, this is particularly relevant for infiltration. See Chapter 25.2.3 of The SuDS Manual (C753) for more information.
Greenfield runoff	The surface water runoff regime from a site before development.
Home-zone	As a residential street where people and vehicles share the whole of the street space safely, and on equal terms, where quality of life takes precedence over the ease of traffic movement.
Infiltration	The passage of surface water through the surface of the ground / the entry of groundwater to a sewer.
Interception	The capture and retention on site of the first 5mm (or other specified depth) of the majority of all rainfall events
Management train	The sequence of drainage components that collect, convey, store and treat runoff as it drains through the site.

Modified flow routes	Flow routes that have been modified as a result of the development.
Ordinary Watercourse	Any watercourse that does not form part of a main river and is not classified as a main river.
Peak flow	The point at which the flow of water from a given event is at its highest.
Riparian landowner	A riparian landowner is the owner of land that is next to a watercourse or has a watercourse running through or beneath it. Riparian landowners have discrete legal rights and responsibilities in relation to the watercourse and its banks.
Source control	The control of runoff at or near its source, so that it does not enter the drainage system or is delayed and attenuated before it enters the drainage system.
SuDS component	An individual element of the drainage system that conveys, stores and/or treats surface water runoff. Susdrain website provides an overview of different SuDS components.
Treatment	Improving the quality of water by physical, chemical or biological means
Treatment train	Improving the quality of water by physical, chemical or biological means via a sequence of drainage components (see management train).
Urban creep	The increasing density of development, due to extensions, paving over of gardens and other permeable areas, and the addition or extension of roads or buildings, which increases the impermeability of developed areas and causes rates and volumes of runoff to rise.



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