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B&M KINGSWAY, BURNAGE

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

OCTOBER 2023

REPORT NO: 21894-FRADS-001

B&M KINGSWAY, BURNAGE

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

Triple Jersey Limited

Flood Risk Assessment & Drainage Strategy

CONFIDENTIAL

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1 INTRODUCTION

1.1.1 This Flood Risk Assessment (FRA) and Detailed Drainage Strategy (DS) has been provided at the request of Triple Jersey Limited, hereafter referred to as "the client", to assess the flood risks associated with the proposed development of B&M Kingsway, Burnage, hereafter referred to as "the site".

1.1.2 The purpose of this FRA is to:

- Identify the possible hazards posed from all major sources of flooding (fluvial, surface water, groundwater, infrastructural and coastal sources);
- Provide a qualitative assessment of the probability of each potential flood hazard representing a constraint on the proposed development, based on the proposed land use type for the development and likelihood of flood occurrence;
- Investigate and define any potential drainage impacts associated with the site;
- Conceptually determine and define necessary surface water management controls to ensure no exacerbation of flood risk on the site or to external receptors due to any increase in surface water runoff; and
- Recommend appropriate and necessary mitigation measures and additional assessments that may be required to progress the sustainable development of the site.

1.1.3 The FRA comprises the following:

- A desktop review of publicly available information, including information from the Environment Agency (EA) and Manchester City Council who are the Lead Local Flood Authority (LLFA) for the proposed development area; and
- An assessment and outline design of hydraulic controls and drainage requirements and drainage elements required to support the development of the site.

1.1.4 This report further details the methodologies employed within this study and provides recommendations as to any further work or investigations required to support the development of the site through the planning application process.

1.2 REGULATORY POLICY AND LEGISLATION

1.2.1 This assessment has been carried out in line with the current Government legislation, the National Planning Policy Framework (NPPF) 2021.

1.2.2 It has been assessed with reference to the following documents and legislative guidelines:

- CIRIA 753 The SUDS Manual V6 (2016);
- DEFRA "Flood Risk Assessment Guidance for New Developments" (2006);
- DEFRA "Surface Water Management Plan Technical Guidance" (2010);
- BS 8533 2011 Assessing & Managing Flood Risk in Development Code of Practice (2011);
- BS 8582:2013 Code of practice for surface water management for development Sites (2013);
- National Planning Practice Guidance (2012 – updated 2016);
- C624 Development and Flood Risk – Guidance for the Construction Industry' (2004);

- Design and Construction Guidance for Sewage Sector (DCGSS) (2020);
- Planning Policy Guidance – Flood Risk and Climate Change (2014 and as amended).

1.2.3 In addition to the above, this report has also been informed by the following documents:

- Manchester Core Strategy 2012 to 2027
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA Level 1 SFRA
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA Level 2 SFRA
- Manchester City Council Local Flood Risk Management Strategy

1.3 SCOPE OF FLOOD RISK ASSESSMENT

1.3.1 The objective of this analysis and report is to provide an FRA in accordance with local and national guidance.

1.3.2 The detail and complexity of the FRA will reflect the level of risk to the site and consider the appropriateness of the proposed development type. This will also include assessment of potential risk to property and livelihoods, consideration of climate change, and the definition of appropriate flood risk mitigations required to satisfy the planning process.

1.3.3 Based on the assessment of requirements for a site-specific FRA as defined within NPPF 2019 technical guidance, the majority of the site is located within Flood Zone 1, with a small section in the north being located within Flood Zone 2, therefore it is necessary to provide a site-specific FRA. Flood Zone 1 refers to an area as having less than 1 in 1,000 annual probability (<0.1%) of river or sea flooding in any one year.

1.3.4 Flood Zone 2 refers to an area as having between a 1 in 100 and 1 in 1,000 annual probability (1% - 0.1%) of river flooding, or between a 1 in 200 and 1 in 1,000 annual probability (0.5% - 0.1%) of sea flooding in any one year.

1.3.5 Similarly, as the site is indicatively located in an area that may be subject to other assessable sources of flooding, such as pluvial (surface water) flooding, it is necessary to undertake a further site-specific assessment to verify the proposals for development.

1.3.6 Policy EN14 of the Manchester Core Strategy states that all future development must ensure that:

- In line with the risk-based sequential approach contained within PPS25, development should be directed away from sites at the greatest risk of flooding, and towards sites with little or no risk of flooding; this should take account of all sources of flooding identified in the Manchester-Salford-Trafford Strategic Flood Risk Assessment (SFRA).
- In addition to the requirements for site-specific Flood Risk Assessments (FRAs) set out in PPS25, an appropriate FRA will also be required for all development proposals, including changes of use, on sites greater than 0.5ha within Critical Drainage Areas (CDAs) and Canal Hazard Zones identified in the SFRA.
- All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required.
- The City of Manchester contains many sections of rivers which are culverted or 'hidden'; where these are indicated in the SFRA beneath the proposed development site, further investigation

will be required and the development proposal should take this into account; where feasible and appropriate development should seek to open up culverted/hidden rivers to reduce the associated flood risk and danger of collapse, taking advantage of opportunities to enhance biodiversity and Green Infrastructure.

1.3.7 Potential flood risk at the site has been assessed against the site layout plan, which has been provided as Appendix A to this report. Significant changes to the site's developable area may necessitate a further review of this document to ensure that risk of flooding is not exacerbated and has been satisfactorily addressed within the development proposal.

1.4 SCOPE OF DRAINAGE STRATEGY

1.4.1 Surface water runoff must be effectively managed to ensure that there is no exacerbation of potential surface water flooding issues on the site, or at any external receptors, due to any potential increases in surface water runoff rates and volumes.

1.4.2 The drainage hierarchy will be applied in determining the most suitable type and point of discharge of surface waters runoff from impermeable areas on the site. This will ensure that surface water is sustainably managed on the site, and that there is no exacerbation of flood risk elsewhere as a result of undertaking the development. This will be undertaken in accordance with industry best practice principles and guidance, such as the C753 SUDS Manual (2016), Design and Construction Guidance for Sewage Sector (DCGSS) (2020) and applicable sections of the Planning Policy Guidance (PPG).

1.4.3 Any increase in surface water runoff rate associated with the development of the site must also be managed in accordance with the guidelines set by LPA, the LLFA for the area.

1.4.4 The DS will identify potential opportunities and locations for attenuation infrastructure, as well as potential connection points and provide calculations of permissible discharge rates for runoff generated on site.

1.4.5 The DS therefore aims to provide surety that any drainage provided as part of the project development can safely and appropriately convey all flows from the site to appropriate discharge locations. This is to ensure sustainable and safe operation within the site, as well as ensuring sustainable operation of any receiving infrastructure. These assessments have been undertaken in accordance with prescribed best practice and building codes, including prioritising the incorporation of SuDS, where appropriate and practicable for the management of surface water.

1.4.6 Following the completion of a final site masterplan the drainage scheme proposed within this report should be reassessed to ensure surface water runoff and foul water drainage can be appropriately managed in accordance with best practise and local and national standard requirements.

2 METHODOLOGY

2.1 INTRODUCTION

2.1.1 This report aims to demonstrate that the proposed development is sustainable and will not be impacted by or exacerbate flood risk elsewhere through the development of the site. This assessment will account for the effects of climate change, as well as identifying further opportunities to reduce the probability and consequences of flooding within the site locality.

2.1.2 This report aims to identify constraints and opportunities for the site based on the development proposals provided by the client (Appendix A) and provide recommendations for the sustainable provision of drainage and mitigation of any potential flood risk for the site.

2.1.3 The assessment methodology is as follows:

- Desktop review of the geology, hydrology, and other pertinent environmental characteristics of the site, and how these affect flood risk of the proposed development and site drainage.
- Obtain and review existing baseline flood risk and drainage guidance information from relevant environmental authorities (EA, LLFA, etc.) as to site specific flood risk from all applicable sources.
- Produce design calculations for the DS to determine the requirements for developing the site's surface water drainage and providing adequate storage in line with local planning policy and guidance. This will include the presentation of drawings with an indicative layout for any additional drainage and attenuation infrastructure located on the site.
- Review the findings from the above and advise on the suitability of developing the site for the proposed development in consideration of the applicable flood risk and drainage and comment on limitations and opportunities for the site, with recommendations of further mitigation where applicable and appropriate.

3 PROJECT BACKGROUND

3.1 DEVELOPMENT DESCRIPTION AND LOCATION

3.1.1 Andrew Moseley Associates (AMA) was appointed by Triple Jersey Limited to provide a Flood Risk Assessment and Drainage Strategy in support of a residential development, located at B&M Home Store and Garden Centre, Kingsway, Burnage, Manchester, M19 1BB at NGR: SJ 86305 93145.

3.1.2 The proposed development is located in the area of Burnage approximately 3.5 miles southeast of Manchester city centre. Proposals for the site are for residential use, consisting of 112 residential dwellings and 88 parking spaces with associated hardstanding, landscaping, and infrastructure.

3.1.3 The Local Planning Authority for this development is Manchester City Council, who are also the Lead Local Flood Authority for the area.

3.1.4 This report has been prepared in accordance with the National Planning Policy Framework (NPPF) and the accompanying technical guidance to assess all forms of flooding including the management of surface water on-site.

3.1.5 The site is referenced in Table 3-1 and Figure 1 below.

Table 3-1. Site Context

Site Name	B&M Kingsway, Burnage
Location	Manchester
NGR (approx.)	SJ 86305 93145
Application Site Area (ha)	1.65
General Locality	The site is located on previously developed brownfield land and borders undeveloped land to the north, the A34 to the east, commercial developments to the south and a railway line to the west. Pedestrian and vehicular access to the site is provided via the existing unnamed road running through the west of the site.
Development Type	Residential
EA Flood Zone	Flood Zone 1 and 2
EA Office	North West
Local Planning Authority	Manchester City Council

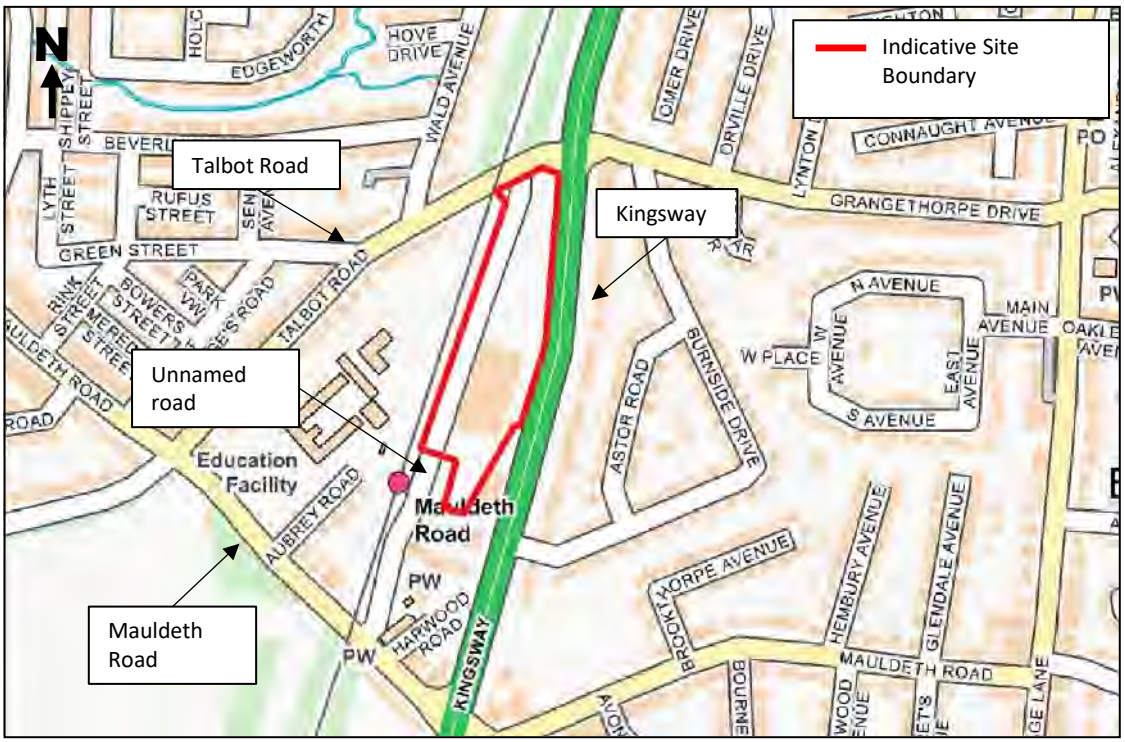

Figure 1. Site Location

3.2 CURRENT SITE CONDITIONS

Ground Cover and Topography

3.2.1 A topographic survey provided by Triple Jersey Limited and undertaken by Survey & Engineering Projects (Ref: S244643-3dT) shows ground levels at the site are shown to be in the region of 42.3 to 47.1 m Above Ordnance Datum (m AOD). The topographic survey can be found in Appendix B.

3.2.2 Further review of topographical data shows site levels to be lowest in the north of the site, while greatest levels are located in the south of the site. A general fall in gradient from south to north is observed across the site.

3.2.3 As indicated by aerial imagery, the previously developed site consists of areas of hardstanding which make up approximately 90% of the site, with areas of greenfield land located around the boundaries of the development.

3.3 GEOLOGY

3.3.1 British Geological Survey (BGS) Open Geoscience website[1] indicates that the entire site is underlain by Chester Formation – Sandstone, with overlying superficial deposits of Till, Devensian - Diamicton.

[1] Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html accessed on 08/06/2023

3.3.2 The BGS website information indicates that there are eight borehole records within the site boundary (borehole records ref: SJ89SE368, SJ89SE369, SJ89SE370, SJ89SE371, SJ89SE372, SJ89SE373, SJ89SE374 and SJ89SE375). The borehole records date back to 1988 and are confidential.

3.4 HYDROGEOLOGY

3.4.1 According to the Department for Environment, Food and Rural Affairs (DEFRA) MAGIC map[2], the site is indicated as not being located in a Groundwater Source Protection Zone (SPZ), as defined by the Environment Agency (EA) for the protection of a potable groundwater supply.

3.4.2 The site is located as being in an area of medium to low ground water vulnerability and located above a Principal bedrock aquifer as well as a Secondary undifferentiated superficial drift aquifer.

3.4.3 Information obtained from the Cranfield University's Soilscape website[3] indicates that the site is located in an area classified as being Soilscape 17, which is defined as having slowly permeable seasonally wet acid loamy and clayey soils.

3.5 HYDROLOGY

3.5.1 There are two watercourses within close proximity of the site: the Cringle Black Brook and the Shaw Brook.

3.5.2 The Cringle Black Brook is located approximately 115m to the northwest of the site and flows west into the Chorlton Brook. The Shaw Brook is located approximately 600m to the southeast of the site.

3.5.3 The EA's Catchment Data Explorer website[4] indicates that the site resides within the Bollin Dean Mersey Upper operational catchment and the Fallowfield Brook sub catchment.

[2] Available at: https://magic.defra.gov.uk/MagicMap.aspx?startTopic, accessed on 08/06/2023
[3] Available at: http://www.landis.org.uk/soilscapes/, accessed on 08/06/2023
[4] Available at: https://environment.data.gov.uk/catchment-planning/ , accessed on 08/06/2023

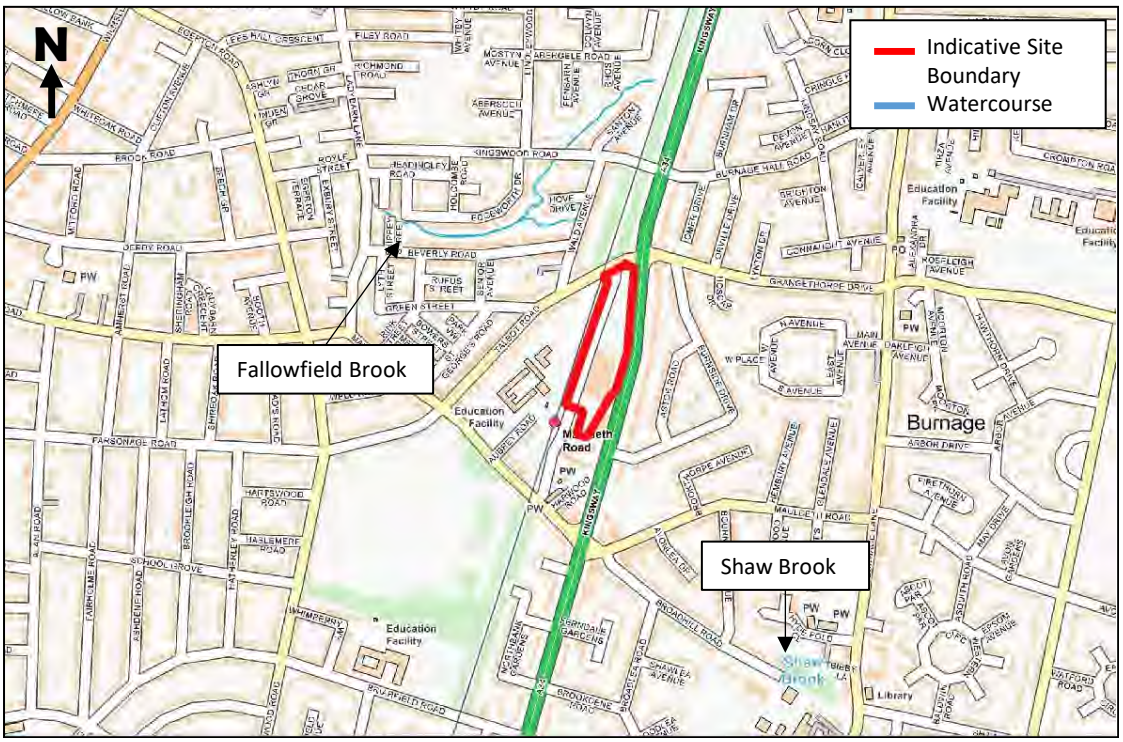

Figure 2. Watercourse Location

4 POTENTIAL FLOOD RISK

4.1 SOURCES OF FLOODING

4.1.1 This report is to consider flood risk from all potential sources. Section 5 then discusses in further detail the probability of flooding, any potential impacts and necessary mitigation, where required.

4.1.2 The NPPF (2021) also requires site developers to consider the impact of additional runoff generated by the proposed development on the receiving downstream catchment, and to assess the risk of runoff from the surrounding. This is further discussed in Section 6.

According to Flood Risk maps provided by the Environment Agency the majority of the site is located in Flood Zone 1, which is designated as land having less than a 1 in 1000 probability of river or sea flooding. However, there is a small area in the north of the site that is designated as being in Flood Zone 2, which is designated as land having between a 1 in 100 and 1 in 1000 probability of river flooding, or between a 1 in 200 and 1 in 1000 probability of sea flooding.

4.2 ENVIRONMENT AGENCY FLOOD ZONES

4.2.1 The EA Flood Map for Planning shows the site is located within Flood Zone 1, i.e. land assessed as having less than 1 in 1,000 annual probability (<0.1%) of river or sea flooding in any one year, and Flood Zone 2, i.e. land assessed as having between a 1 in 100 and 1 in 1,000 annual probability (1% - 0.1%) of river flooding, or between a 1 in 200 and 1 in 1,000 annual probability (0.5% - 0.1%) of sea flooding in any one year.

4.2.2 This potential fluvial/coastal flood risk to the site has been illustrated in Figure 3.

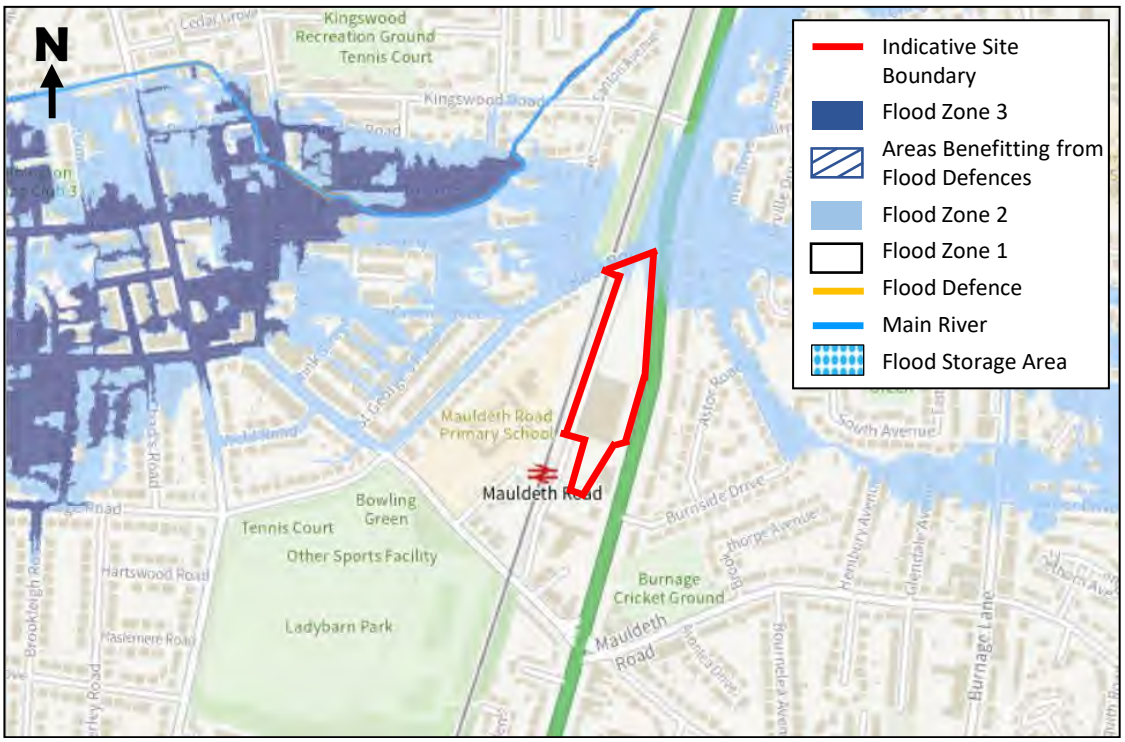

Figure 3. Environment Agency Long Term Flood Map for Planning

4.3 FLUVIAL AND COASTAL FLOODING

4.3.1 The EA Long Term Flood Risk Map for fluvial and coastal flooding shown in Figure 4 indicates that the site is at low risk of fluvial flooding. The risk of flooding posed to the proposed development is classed as low.

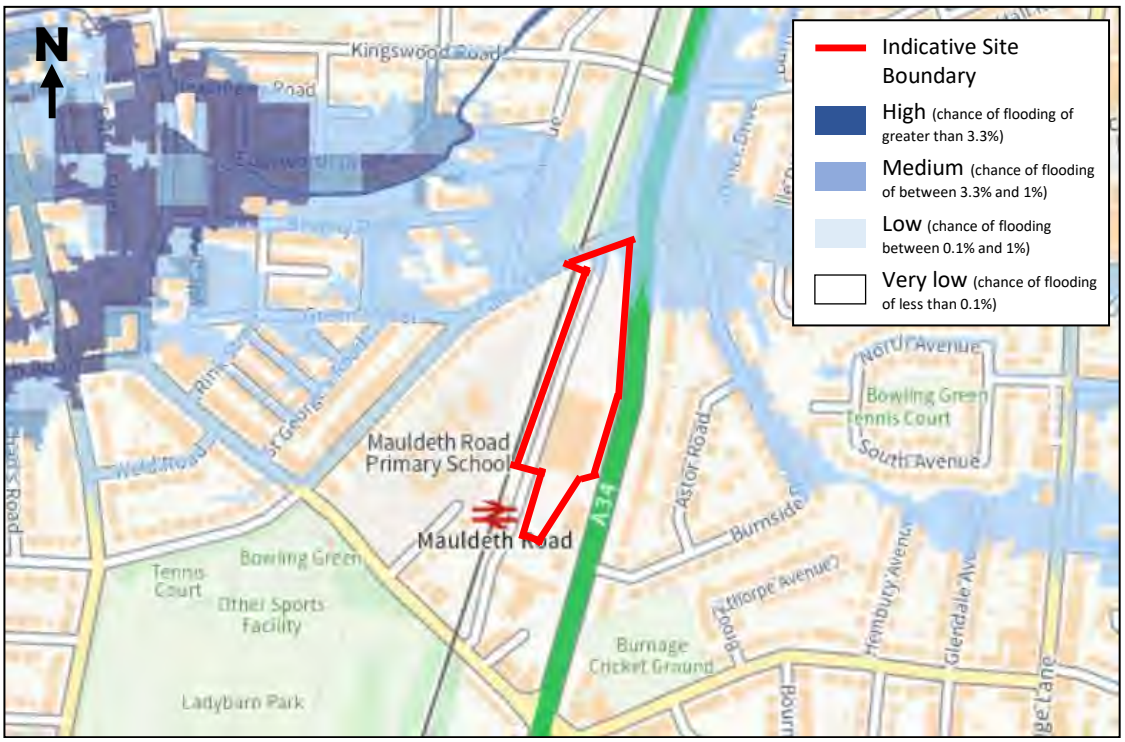

Figure 4. Environment Agency Long Term Flood Map – Rivers and Sea

4.3.2 As a small area of the site is situated in Flood Zone 2, additional fluvial flood data was requested from the EA on the 6th of June 2023 and was received on the 23rd of July 2023. This data has been provided in Appendix C.

Defences

4.3.3 The data provided by the EA shows a number of flood defences within the vicinity of the site, located along the Cringle Black Brook to the north of the site. The assets identified as being in the closest proximity of the site are labelled as assets 8871 and 9636.

4.3.4 Further information provided reveals that asset 8871 is natural high ground with a 100-year standard of protection. The EA provided the upstream crest level for the asset as being 41.17 m AOD and the downstream crest level of 39.56 m AOD.

4.3.5 Asset 9636 is identified as being engineered high ground with a 100-year standard of protection. The upstream crest level of this asset has been provided as 41.26 m AOD, and the downstream crest level is 43.83 m AOD.

4.3.6 As discussed, there are a number of fluvial flood defences acting to protect the site location from an increased risk of flooding and therefore, the flood risk at the site should be assessed against a defended scenario.

Fluvial

4.3.7 The EA provided data from the 2017 Cringle Brook Model within Appendix C. This data showed that for a 1in100year+CC (35%) defended fluvial flooding event, only the northern boundary will be affected by flood waters of depths up to 0.20 m, as shown in Figure 5. Based on information from

the topographic survey in Appendix B, the northern boundary of the site has an elevation of 42.30 mAOD meaning that in the scenario of a 1in100year+CC (35%) defended fluvial flood event, the flood level along the northern boundary of the site will be 42.50 mAOD.

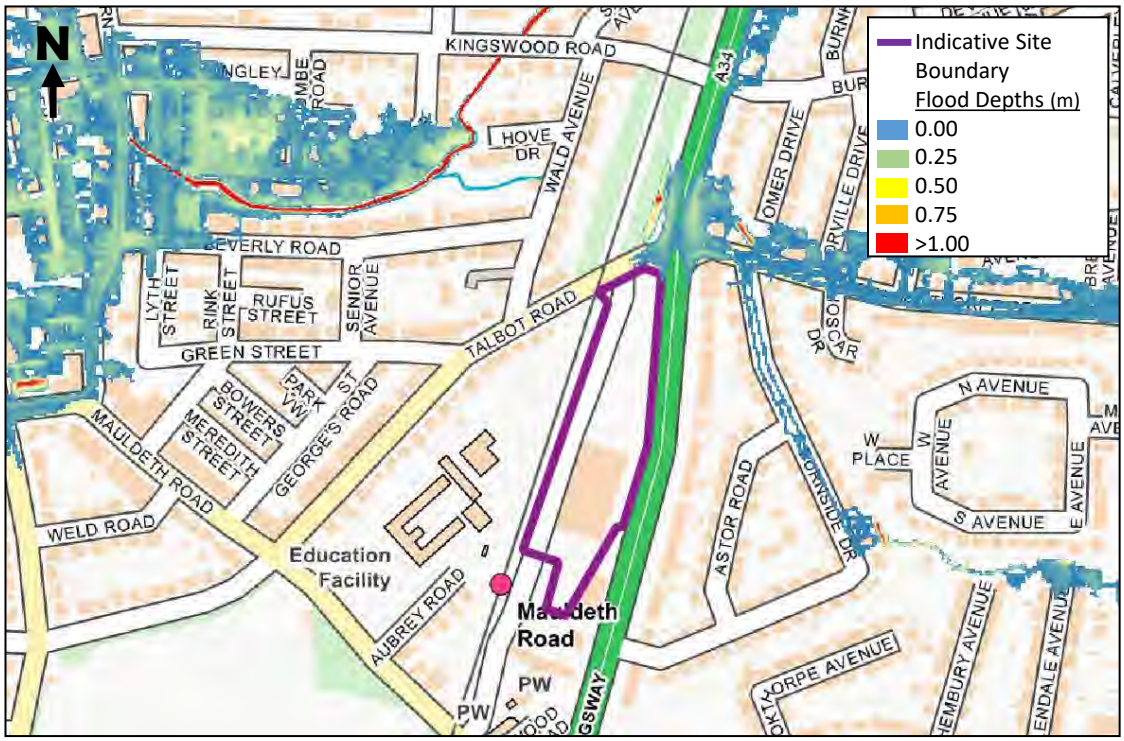

Figure 5. 1in100year + CC (35%) Defended Fluvial Flood Depth

4.3.8 Figure 6 shows that the area anticipated to be at risk of flooding in the 1in100year + CC (35%) defended fluvial flood event is projected to have flood velocities of below 0.1 m/s.

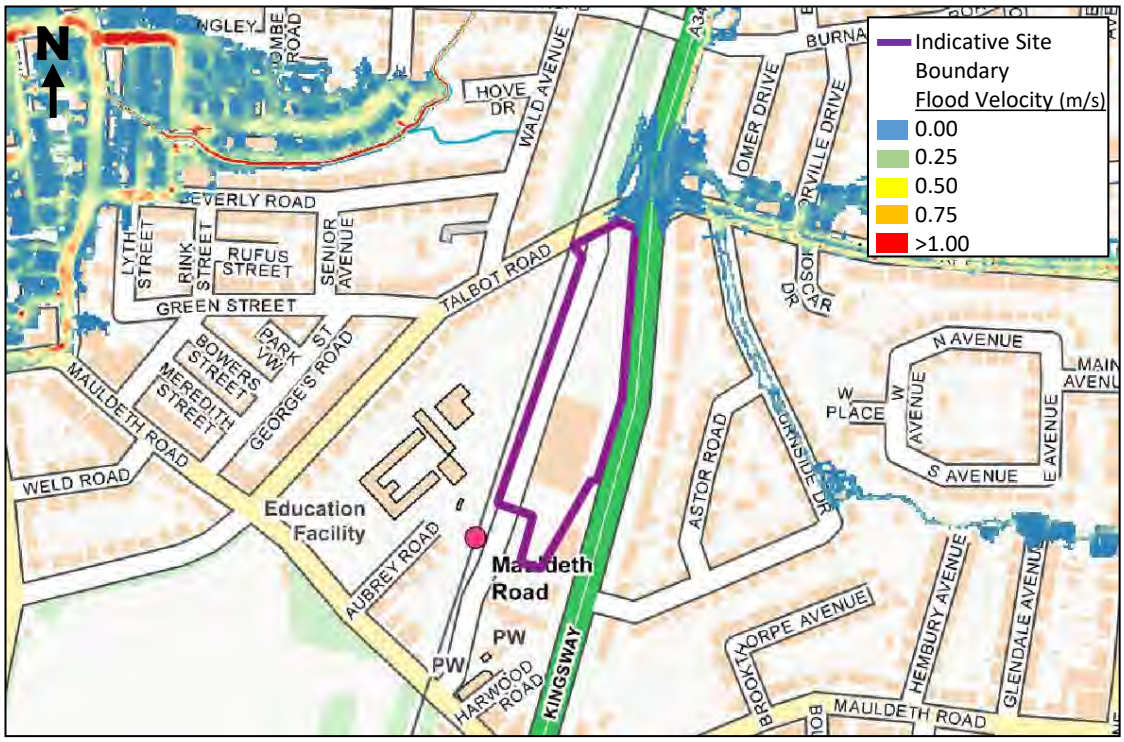

Figure 6. 1in100year + CC (35%) Defended Fluvial Flood Velocities

Coastal & Tidal

4.3.9 As the site is located approximately 30 miles inland, it is not considered to be at risk of either coastal or tidal flooding.

Conclusion

4.3.10 The maximum projected flood depth at the site is 0.20 m along the northern boundary of the site, and flood velocities in the region of 0.10 m/s can be anticipated.

4.3.11 As the areas at risk of flooding are restricted to the northern boundary of the site, none of the proposed dwellings will be affected by flooding.

4.4 PLUVIAL (SURFACE WATER) FLOODING

4.4.1 The EA Long Term Flood Risk Map (Figure 7) shows the majority of the site is located in an area at very low of surface water flooding, with a small area in the north and along the road within the site being at low risk of surface water flooding.

4.4.2 Areas at very low risk of surface water flooding have a chance of flooding of below 0.1% per year.

4.4.3 Areas at low risk of surface water flooding have a chance of flooding of between 0.1% and 1% per year. These areas have an anticipated flood depth of below 0.3m in the centre of the site and between 0.3m and 0.9m in the north of the site. The area in the centre of the site is at risk of experiencing flood velocities of less than 0.25 m/s, and the area in the north of the site is at risk of flood velocities of over 0.25 m/s in a northerly direction.

4.4.4 As the proposed development of the site may potentially reduce the overall site permeability and potentially increase surface water runoff rates and volumes, the surface water discharge controls must ensure that any proposal for drainage, or discharge, does not adversely impact upon downstream drainage infrastructure or offsite receptors.

4.4.5 The site is therefore considered to have low potential risk of flooding from pluvial sources.

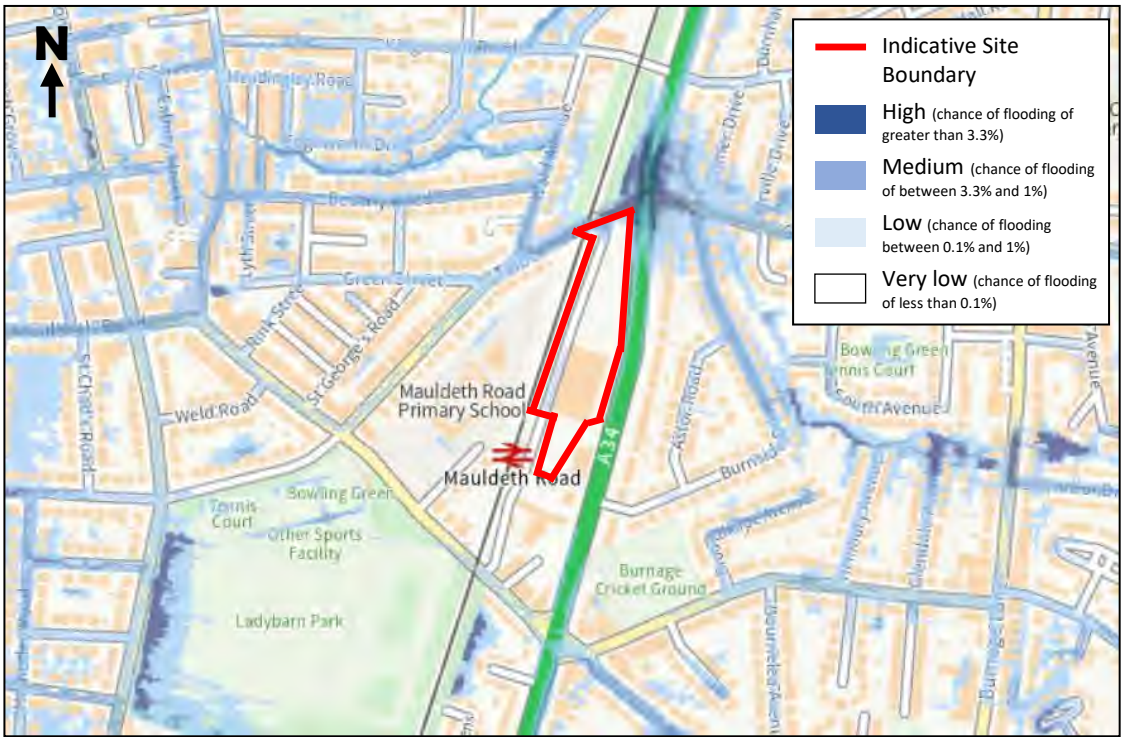

Figure 7. Environment Agency Long Term Flood Risk Map – Pluvial (Surface Water) Flooding

4.5 GROUNDWATER FLOODING

4.5.1 Ground conditions at the site consist of slowly permeable seasonally wet acid loamy and clayey soils, therefore the propensity for ground water emergence at the site is considered to be low, and the potential risk of groundwater emergence affecting the site development is considered to be low.

4.5.2 However, given the impermeable nature of the proposed site's hardstanding areas subsequent to development, potential elevation of groundwater or groundwater emergence within the superficial geology causing flooding within the site post-development will be largely eliminated.

4.5.3 According to the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA groundwater flooding map presented in Appendix D, the site is not identified as being at risk from groundwater flooding.

4.5.4 During long periods of heavy rainfall, the water table within an area can rise above the natural ground level, resulting in groundwater flooding. The site is located above a principal bedrock aquifer. This signifies permeable layers which would allow infiltration of water up through the soil.

4.5.5 Site specific investigations should be able to prove the presence of ground water and propose remedial mitigation where required. Flood risk to the proposed development due to groundwater emergence is therefore considered to be low.

4.5.6 Flood risk to the proposed development due to groundwater emergence is considered to be low provided that all reasonable and practicable mitigation measures for any subsurface construction associated with the development are adhered to.

4.6 FLOODING FROM ARTIFICIAL SOURCES

4.6.1 The EA Long Term Flood Risk Map of flood risk from reservoir and canal failure (Figure 8) indicates that there is a small area in the north of the site that is at risk of flooding from artificial sources. The figures provided within the EA mapping principally indicate the worst-case flooding extents. Therefore, the potential risk of flooding from reservoir and/or canal failure is considered to be negligible.

4.6.2 The site is therefore considered to have very low potential risk of flooding from artificial sources.

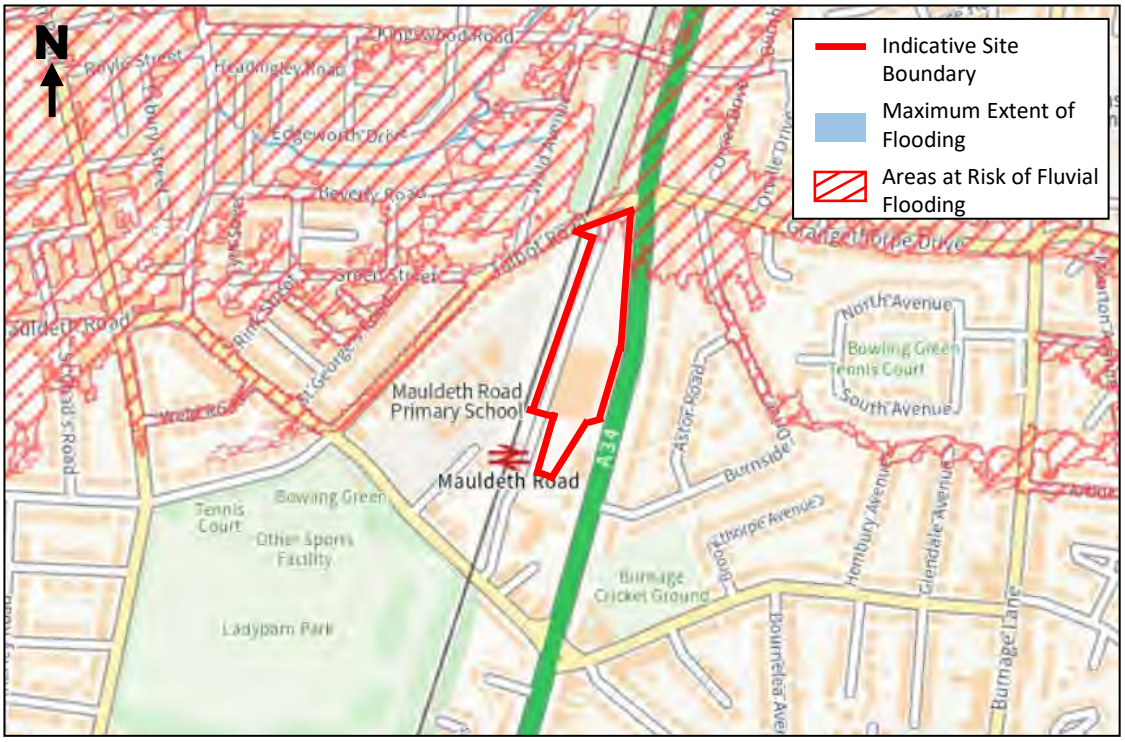

Figure 8. Environment Agency Long Term Flood Risk Map – Artificial Sources

4.7 FLOODING FROM SEWERS

4.7.1 The site currently consists of brownfield land and as such is identified as having existing drainage infrastructure located within the site boundary.

4.7.2 The area of Burnage is not identified as being a location that is at risk of sewer flooding within the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA.

4.8 HISTORIC FLOODING

4.8.1 The EA historic flood map shows the site to not have experienced historic flooding.

4.8.2 A review of the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA indicates no detail of historic flooding within the area of the site.

5 FLOOD RISK ASSESSMENT

5.1 FLOOD RISK PLANNING POLICY

National Planning Policy Framework

5.1.1 The NPPF sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. Planning Practice Guidance is also available online.

5.1.2 The Planning Practice Guidance sets out the vulnerability to flooding of different land uses. It encourages development to be located in areas of lower flood risk where possible and stresses the importance of preventing increases in flood risk off site to the wider catchment area.

5.1.3 The Planning Practice Guidance also states that alternative sources of flooding, other than fluvial (river flooding), should also be considered when preparing a Flood Risk Assessment.

5.1.4 This Flood Risk Assessment is written in accordance with the NPPF and the Planning Practice Guidance.

5.1.5 The EA Flood Map for Planning locates the majority of the site within Flood Zone 1, i.e., land assessed as having less than 1 in 1,000 annual probability (<0.1%) of river or sea flooding in any one year, and a small area in the north of the site in Flood Zone 2, i.e. land assessed as having between a 1 in 100 and 1 in 1,000 annual probability (1% - 0.1%) of river flooding, or between a 1 in 200 and 1 in 1,000 annual probability (0.5% - 0.1%) of sea flooding in any one year.

5.1.6 The flood map extents indicated on this map show the potential for flooding from fluvial and coastal sources, and although they are indicative, they are a key tool in defining the appropriateness of a development type or the requirement for further assessment.

5.1.7 Under the NPPF (2021), Flood Zones 1 and 2 is defined as having a low probability flood risk. The proposed development includes 112 residential dwellings and 88 parking spaces with associated hardstanding, landscaping, and infrastructure, which are defined within Table 2 of the NPPF technical guidance as being 'More Vulnerable'. Therefore, according to the criteria in Table 3 of the NPPF Technical Guidance (Flood Risk Vulnerability and Flood Zone 'Compatibility'), the proposed development may be deemed as 'Appropriate'.

5.2 SEQUENTIAL AND EXCEPTION TEST

5.2.1 Both the NPPG and the SFRA require the 'Sequential Test' to be applied to ensure that proposed developments are carried out in area that are at the least risk of flooding, before considering development in areas that are at risk of flooding. The proposed site falls within Flood Zones 1 and 2 and is considered to come under the 'More Vulnerable' category as a residential development.

5.2.2 Based on Table 3 in the National Planning Practice Guidance for Flood Risk and Coastal Change, the proposed use of the site is acceptable due to it being located in Flood Zones 1 and 2 and an Exception Test is not required.

Table 5-1. Development Appropriateness Based on Vulnerability and Flood Zone

Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	✓	Exception test required	✓	✓
Flood Zone 3a	Exception test required	✓	x	Exception test required	✓
Flood Zone 3b	Exception test required	✓	x	x	x

5.3 CONCLUSION

5.3.1 In light of this assessment against the sites applicable flood zone (Flood Zones 1 and 2), further assessment against the Sequential or Exception Test is not required. This should be confirmed with (LPA) prior to development of the site.

5.3.2 Table 5-2 summarises the pre mitigation flood risk associated with the site as well as the impacts of the flood risk on the wider catchment prior to mitigation. The mitigation measures proposed to address flood risk issues and ensure the development is appropriate for its location are discussed within Section 3.0.

Table 5-2 Pre-Mitigation Flood Risk Summary

Sources	Probability of Flood Risk	Impacts	Description
Tidal	N/A	N/A	The site is located inland and therefore, is not tidally influenced.
Fluvial	Medium	Low	The northern boundary of the site is located in Flood Zone 2 and is shown to expect flood depths of up to 0.20 m and velocities of up to 0.10 m/s along the northern boundary of the site.
Surface Water (Pluvial)	Low	Low	Review of information from multiple sources (EA, LLFA) reveals evidence

			of surface water flooding along the centre and in the north of the site.
Groundwater	Very Low	Very Low	Ground water flood risk is considered to be low.
Artificial Sources	Low	Low	Review of information from multiple sources (EA, LLFA) reveals no evidence of flooding from reservoirs or canals.
Sewers	Low	Low	The risk of flooding from the surcharging of sewers is considered to be low.
Effect of development on wider catchment	Low	Low	The impermeable area of the site is being altered.

5.3.3 Based on the assessable information presented, the site is considered to meet the requirements of the NPPF, given the assessed potential flood risk posed from all applicable sources, the means of adopting suitable mitigation measures to prevent increase in the potential for flood risk and based on the vulnerability of the development type. Further consideration of necessary surface water runoff mitigation measures will be provided, so as to address the potential for increase of surface water arising from the proposed development of the site.

6 FLOOD RISK MITIGATION

6.1 FLOOD RISK MITIGATION

6.1.1 Section 2.0 has identified the sources of flooding which could potentially pose a risk to the site and the proposed development. This section of the FRA sets out the mitigation measures which are to be considered within the proposed development detail design to address and reduce the risk of flooding to within acceptable levels.

6.2 EFFECT OF DEVELOPMENT ON WIDER CATCHMENT

Development Drainage

6.2.1 The current site is considered to be brownfield. The amount of impermeable area will be altered. Therefore, the existing drainage systems will not be suitable to discharge the surface water from the site alongside the additional run off from the proposed development. A sufficient drainage strategy will be therefore provided by AMA.

6.3 SITE ARRANGEMENTS

Sequential Arrangement

6.3.1 The Flood Zone mapping shows the site to be located within Flood Zones 1 and 2. The area of the site identified as being located in Flood Zone 2 is located across the northern boundary and therefore, none of the proposed dwellings will be located within a flood zone.

Finished Floor Levels

6.3.2 As none of the proposed developments are located within Flood Zone 2, there are no specific requirements for finished floor levels with regard to flood risk. However, it is recommended that an FFL of 0.15 m is set for the proposed development.

7 FOUL WATER DRAINAGE

7.1 INTRODUCTION

7.1.1 It is proposed to install a new foul drainage system to serve the proposed residential development.

7.1.2 The foul water system will be designed and constructed in accordance with the current Building Regulations, BS EN:752 'Drainage and Sewer Systems Outside Buildings', the Local Authority Building Control specifications and requirements, Sewers for Adoption 7th Edition and the Civil Engineering Specification for the Water Industry.

7.2 EXISTING SEWERS

7.2.1 AMA attained a United Utilities predevelopment enquiry which can be seen in Appendix E. No information was provided regarding existing infrastructure on the site.

7.2.2 As there is an existing structure located on the site, it is expected that there is existing drainage infrastructure within the site boundary serving the development. There is evidence of existing drainage infrastructure within the site, shown in the topographic survey in Appendix B. The information provided included both cover and invert levels of manholes located within the site boundary.

7.3 FOUL WATER DISCHARGE RATES

7.3.1 The estimate design Dry Weather Flow (DWF) generated by the proposed development, based on a gravity system, has been calculated as 5.19 litres per second.

7.3.2 This figure is based on 112 dwellings at 4,000 litres per dwelling as prescribed in Sewers for Adoption.

7.4 FOUL WATER CAPACITY AND POINT OF CONNECTION

7.4.1 United Utilities have advised that foul water can discharge to the existing public combined sewer located to the south of the site, in Mauldeth Road. They have not advised of any known capacity issues with the public sewer network in the area which would hinder development at the site.

7.4.2 No depth/level information is available for these sewers and therefore further survey work in the form of a drainage CCTV and tracing survey will be required to confirm whether a gravity connection will be feasible.

7.4.3 Any proposed connection onto the public recorded sewers will require a S106 connection application.

8 SURFACE WATER DRAINAGE STRATEGY

8.1 INTRODUCTION

8.1.1 The National Planning Policy Framework (NPPF) and accompanying Technical Guidance indicate that surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management.

8.1.2 Consideration should therefore firstly be given to using sustainable drainage (SuDS) techniques including soakaways, infiltration trenches, permeable pavements, grassed swales, ponds and wetlands to reduce flood risk by attenuating the rate and quantity of surface water run-off from a site. This approach can also offer other benefits in terms of promoting groundwater recharge, water quality improvement and amenity enhancements. Approved document Part H of the Building Regulations (2015) sets out a hierarchy for the disposal of surface water which encourages a SuDS approach.

8.2 OVERVIEW AND CONCEPT

8.2.1 As detailed in Section 3.1, development proposals for the site consist of residential use, consisting of 112 residential dwellings and 88 parking spaces with associated hardstanding, landscaping, and infrastructure. The site plan shows the developable area of the site to be restricted to the red line boundary, as shown in Appendix A, with an approximate total developable area of 1.65 ha.

8.2.2 Review of the site plan shows proposals to consist of an approximate total impermeable area of 0.66 ha, which equates to approximately 40% of the total proposed developable area. The contributing areas have been identified within the Drainage Layout Drawing, in Appendix F.

8.2.3 It is considered that green open space and landscaped areas will not produce or contribute run-off to the surface water management infrastructure proposed as part of this strategy. This has been taken into account when deriving the impermeable area for the site.

8.3 PRE-DEVELOPMENT SURFACE WATER RUN-OFF

Brownfield

8.3.1 As the site is a previously developed, brownfield site, with an existing commercial structure pre-development surface water drainage will be based upon the Modified Rational Method (MRM). Based on the redevelopment to the existing structure, it is noted that there may be requirements to improve the surface water drainage to effectively drain the site.

8.3.2 As discussed previously in this report the total site area marked out by the red line boundary found in Appendix A is 1.65 ha with a total impermeable area of 0.66 ha. The pre-development surface water run-off will be based upon the existing impermeable area of 0.83 ha. Therefore:

- The total impermeable area (Pre-Development) of the site is 0.83 ha.
- The estimated peak flow rate for the site for a 50 mm / event is defined below using the Modified Rational Equation method.

$Q = C\ i\ A$

8.3.3 Where:

- Q = Flow rate in m^3/ sec
- C = site impermeablility or run-off coefficient = estimated as 100% or 1
- i = rainfall intensity = 50 mm/hr
- A = impermeable site area producing run-off = 0.83 ha or 8300 m^2

8.3.4 The peak run-off rate using the above defined equation would therefore be:

- Q = 1.00 x 50 x 0.83 (impermeable area in ha) x 2.78 = 116 l/s

8.3.5 As shown above the peak run off rate for the site using the modified rational method is estimated to be 116 l/s. Best practice requirements would be to provide a 50% betterment on this estimated run-off rate, giving a restricted discharge rate of 58 l/s.

8.3.6 Provision of suitable controls for the management of the on-site surface water run-off may be developed in conjunction with the future masterplan and existing site levels, especially if the footprints of development change meaning an increase in impermeable areas. Additional investigation would then need to be undertaken to determine if the site required betterment and attenuation.

8.4 GROUNDWATER PROTECTION

8.4.1 The proposed development site is not identified as being within a groundwater source protection zone (SPZ), as such no special measures are required to prevent risk to drinking water supplies.

8.5 METHODS OF SURFACE WATER MANAGEMENT

8.5.1 There are three methods that have been reviewed for the management and discharge of surface water which are detailed below; these may be applied individually or collectively to form a complete strategy. They should be applied in the order of priority as listed:

- Discharge via Infiltration
- Discharge to a Watercourse
- Discharge to Surface Water Sewer or Highway Drain
- Discharge to Public Sewer

8.6 INFILTRATION

8.6.1 Any impermeable areas that can drain to a soakaway or an alternative method of infiltration would significantly improve the sustainability of any surface water systems.

8.6.2 The British Geological Society (BGS) Geology of Britain Viewer indicates that the entire site is underlain by Chester Formation – Sandstone, with overlying superficial deposits of Till, Devensian - Diamicton.

8.6.3 Information obtained from the Cranfield University's Soilscape website indicates that the site is in an area classified as being Soilscape 17, which is defined as having slowly permeable seasonally wet acid loamy and clayey soils.

8.6.4 From a desktop review of the geology and soil at the site, it is believed that infiltration would not be an acceptable way of discharging surface water from the site.

8.7 WATERCOURSE

8.7.1 As discussed in Section 3.5 there are two watercourses within close proximity of the site: the Cringle Black Brook and the Shaw Brook.

8.7.2 The Cringle Black Brook is located approximately 115m to the northwest of the site and flows west into the Chorlton Brook. The distance and location of the Cringe Black Brook with a housing estate situated between the site and watercourse means it would be unviable to discharge surface water into the watercourse.

8.7.3 The Shaw Brook is located approximately 600m to the southeast of the site. The distance and location of the Cringle Black Brook with a housing estate situated between the site and watercourse means it would be unviable to discharge surface water into the watercourse.

8.8 PUBLIC SEWERS

8.8.1 As a last resort and following the hierarchy of surface water, disposal discharge to the public sewer system may need to be considered.

8.8.2 In the United Utilities predevelopment enquiry (Appendix E) they state that the drainage hierarchy should be followed for the disposal of surface water. As infiltration techniques and an outfall to a watercourse has been discounted, following the drainage hierarchy would mean that surface water should be disposed to the sewer system.

8.8.3 The topographic survey in Appendix B shows evidence of existing drainage infrastructure on site and as such it is proposed to maintain the existing connection into drainage infrastructure within the site boundary. It is presumed that the existing drainage from the site connects into the United Utilities public sewer system, which will need to be confirmed by CCTV drainage survey prior to work commencing on the site.

8.8.4 Therefore, it would be possible to discharge surface water from the site into the existing sewer system.

8.9 PROPOSED DISCHARGE RATES

Surface water from the site will be discharged via a connection into the existing drainage infrastructure located within the site boundary.

8.9.1 As the site will be drained by discharging surface water into the existing drainage system, surface water will be restricted to a 50% betterment of the existing brownfield run-off rate for the site. Therefore, surface water discharge will be restricted to a discharge rate of 58 l/s.

8.10 ATTENUATION REQUIREMENTS

8.10.1 As discussed earlier the site will be drained into the existing drainage system at a restricted discharge rate of 58 l/s. Therefore, attenuation will have to provided.

8.10.2 Causeway Flow drainage design software has been used to estimate the maximum storage volume required on-site for the 100-year storm event plus 40% allowance for climate change. The results of these calculations can be found in Appendix G.

8.10.3 The results below are based on an attenuation tank located in the north of the site.

8.10.4 A drainage layout drawing can be found in Appendix F.

Total Impermeable Area

8.10.5 This volume is based on using an attenuation tank with a discharge rate of 58 l/s. The details on the attenuation of the soakaway can be found in Table 5-3 below.

Table 8-1. Attenuation Volume

Attenuation Volume

Gross area (ha)	Max Discharge (l/s)	Imp. Area (ha)	Q100+40% Volume (m^3)
1.65	58	0.66	140

8.11 DRAINAGE NETWORK

8.11.1 A network hydraulic model has been developed so as to assess the conveyance requirements for the proposed drainage strategy. This includes a combination of surface water manholes, which will direct surface water runoff from impermeable areas to the attenuation basin located to the north of the site. This will ensure that surface water flows from the site are internally managed before they leave the site and further reduce the potential for impact elsewhere.

8.11.2 The final surface water drainage network servicing the site should ideally consist of permeable paving to limit the runoff from any paved areas, whilst extending time of concentration for discharge to the accompanying drainage network.

8.11.3 For any portion of the network crossing a highway or an area to be trafficked by heavy grade vehicles (HGV's), a minimum cover requirement of 1.20 m below cover level should be provided where practically possible for the internal drainage network to satisfy Sewers for Adoption standards.

8.11.4 Proposals for the drainage network are to discharge to the existing surface water drainage located on site. The suitability of discharging to this source, and any additional requirements will need to be confirmed by United Utilities.

9 SUSTAINABLE DRAINAGE SYSTEMS

9.1.1 Where possible, Sustainable drainage (SuDS) systems/techniques should be used to drain the site of surface water runoff. These could be in the form of permeable paving, rainwater harvesting, ponds, and other above ground green systems. Swales could also be incorporated into the layout to convey surface runoff rather than below ground pipes (which tend to have a higher velocity).

9.2 SUSTAINABLE DRAINAGE (OVERVIEW)

9.2.1 Drainage systems can contribute to sustainable development and improve urban design, by balancing the different issues that influence the development of communities. Approaches to manage surface water that take account of water quantity (flooding), water quality (pollution) and amenity issues are collectively referred to as Sustainable Drainage Systems (SuDS).

9.2.2 SuDS mimic nature and typically manage rainfall close to where it falls. SuDS can be designed to slow water down (attenuate) before it enters streams, rivers, and other watercourses, they provide areas to store water in natural contours and can be used to allow water to soak (infiltrate) into the ground or evaporated from surface water and lost or transpired from vegetation (known as evapotranspiration).

9.2.3 SUDS are technically regarded a sequence of management practices, control structures and strategies designed to efficiently and sustainably drain surface water, while minimising pollution and managing the impact on water quality of local water bodies.

9.2.4 SuDS are more sustainable than traditional drainage methods because they:

- Manage runoff volumes and flow rates from hard surfaces, reducing the impact of urbanisation on flooding,
- Protect or enhance water quality (reducing pollution from runoff),
- Protect natural flow regimes in watercourses,
- Are sympathetic to the environment and the needs of the local community,
- Provide an attractive habitat for wildlife in urban watercourses,
- Provide opportunities for evapotranspiration from vegetation and surface water,
- Encourage natural groundwater/aquifer recharge (where appropriate),
- Create better places to live, work and play.

9.3 SUDS PRINCIPALS

9.3.1 Sustainable drainage is a departure from the traditional approach to draining sites. There are some key principles that influence the planning and design process enabling SuDS to mimic natural drainage by:

- Storing runoff and releasing it slowly (attenuation)
- Allowing water to soak into the ground (infiltration)
- Slowly transporting (conveying) water on the surface
- Filtering out pollutants
- Allowing sediments to settle out by controlling the flow of the water

9.3.2 The above was replicated from www.susdrain.org

9.4 SUDS TECHNIQUES

9.4.1 The following table is a list of SuDS features that may/may not be feasible for the proposed site.

Table 9-1. SuDS Feasibility Table

SUDS Technique	Can they be feasibly incorporated into the site?	Comments
Green Roofs	×	The sloping roofs of the proposed development would not permit a green-roof design
Basins and Ponds	×	The proposed development could not be designed to incorporate these elements due to site constraints such as the topography.
Filter Strips, Swales and Bio-Retention	×	The proposed development could not be designed to incorporate these elements due to site constraints.
Infiltration techniques	×	Desktop review of the available data indicate that infiltration would not be feasible at the site.
Permeable surfaces and tree pits	✓	Surfacing of the external areas could be in a permeable material, such as permeable paved access roads and driveways.
Rainwater Harvesting	✓	New roofs could be directed to rainwater harvesting tanks for reuse.
Tanked Systems	✓	Attenuation storage could be provided if a restricted discharge is required by the LLFA.

10 SUDS MAINTENANCE PLAN

10.1 SURFACE WATER DRAINAGE MAINTENANCE AND MANAGEMENT SCHEDULE

Table 10-1. Attenuation Tank Maintenance

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Inspect and identify areas that are not operating correctly. If required, take remedial action.	Monthly for the first 3 months of operation, then annually.
	Recover debris from catchment surface area where it may cause risk to performance.	Monthly
	Remove sediment and debris from pre-tank system.	Annually
Remedial Actions	Repair inlets/outlets/vents/overflows.	As necessary
Monitoring	Inspect all inlets/outlets and upstream drainage system to ensure they are in good condition and operating as designed.	Annually
	Survey inside of tank for sediment and build up and remove if necessary.	Every 5 years

Table 10-2. Hydrobrake Manhole Maintenance

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Remove sediment and debris from flow control chambers and upstream manholes.	Monthly for first 12 months, then 6 monthly.
Remedial Actions	Replace or clean hydrobrake if performance deteriorates or failure occurs.	As necessary
Monitoring	Check flow control to ensure emptying is occurring.	Quarterly and post high intensity storm event.

11 SUMMARY & CONCLUSION

11.1.1 The proposals for the site are for residential use, consisting of 112 residential dwellings and 88 parking spaces with associated hardstanding, landscaping and infrastructure.

11.1.2 The site is in an area identified as having a low to medium probability of flooding on the EA Flood Map and is located primarily in Flood Zone 1, with an area along the northern boundary being identified as being within Flood Zone 2.

11.1.3 The site is identified as not being at risk of tidal, groundwater, reservoir/canal or sewer flooding.

11.1.4 The data provided by the EA shows that there is an anticipated flood depth of approximately 0.20m, and a flood level of 42.50 mAOD along the northern boundary of the site.

11.1.5 There is evidence of a low risk of pluvial flooding along the centre and the north of the site.

11.1.6 None of the proposed dwellings are located within Flood Zone 2 and as such there is no risk of flooding to the properties. However, it is recommended that finished floor levels are set at 0.15m above the adjacent ground level.

11.1.7 As with any drainage system, blockages within the surface water sewer systems constructed to serve the development has the potential to cause flooding or disruption. Any drainage systems which are not to be offered for adoption to either the Water Company or the Local Authority will have a suitable maintenance regime scheduled and an appropriate management company appointed to carry out the works.

11.1.8 The primary option for surface water disposal is to form a connection into the existing drainage infrastructure on site.

11.1.9 Surface water disposal through infiltration will require an BRE 365 infiltration test on site to confirm the ground conditions could support infiltration.

11.1.10 There is not a suitable watercourse located within the vicinity of the site.

11.1.11 There is evidence of an existing drainage system located within the site boundary and as such it is proposed to form a connection into the system. Furthermore, there will be a restricted discharge limit of 58 l/s based on a 50% betterment of the existing brownfield site run-off and as such, attenuation is required.

11.1.12 Foul water from the proposed development will connect into the existing foul water sewer in the road to the west of the site, subject to a Section 106 agreement with United Utilities.

12 LIMITATIONS

12.1 LIMITATIONS

12.1.1 This report has been prepared for exclusive use by Triple Jersey Limited for the purpose of assisting them in evaluating the potential constraints imposed by flood risk and drainage in making a Planning Application.

12.1.2 AMA accepts no liability for any use of this document other than by its client and only for the purposes, stated in the document, for which it was prepared and provided. No person other than the client may copy (in whole or in part) use or rely on the contents of this document, without the prior written permission of AMA. Any advice, opinions or recommendations within this document should be read and relied upon only in the context of the document as a whole.

12.1.3 AMA has endeavoured to assess all information provided to them during this appraisal. The report summarises from several external sources and cannot offer any guarantees or warranties for the completeness or accuracy of information relied upon.

12.1.4 This report has been undertaken with the assumption that the site will be developed in accordance with the above proposals without significant change. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

12.1.5 A topographic survey has been completed for the site and was supplied to AMA by the client. AMA accepts no liability for the accuracy of this survey, and it is recommended that it is verified on-site prior to the commencement of any construction work.

12.1.6 Existing drainage information is based on third party survey data and record information which is considered to be incomplete. It is therefore recommended that a FULL drainage investigation survey is commissioned to establish the precise alignment, level, and condition of ALL existing drainage within the development site to inform the masterplan and future detailed design proposals.

APPENDICES

APPENDIX A – PROPOSED SITE LAYOUT

APPENDIX B – TOPOGRAPHIC SURVEY

APPENDIX C – ADDITIONAL EA DATA

APPENDIX D – MANCHESTER CITY, SALFORD CITY AND TRAFFORD COUNCILS LEVEL 2 HYBRID SFRA GROUNDWATER FLOOD MAP

APPENDIX E – UNITED UTILITIES PREDEVELOPMENT ENQUIRY

APPENDIX F – DRAINAGE LAYOUT DRAWING

APPENDIX G – CAUSEWAY FLOW CALCULATIONS

Appendix A

PROPOSED SITE LAYOUT

KINGSWAY, BURNAGE

Notes:

PLANNING LAYOUT LAYERS

Boundary treatments

- 1.8m High Brick wall
- 1.8m High Close boarded timber fe
- 1.2m High Metal railings
- Tree/vegetation to be retained.
- Root protection Zone.
- Tree/vegetation to be removed.
- Gate

N

REV:	DESCRIPTION:	BY:	DATE:
A	All apartments made 4 storey's to LPA meeting	SSH	Sept 23

Accommodation Schedule

Name	Floor Area Sq Ft	Beds	Persons	Storeys	Accom	No.	Total
Type 1	792	2	4	2	2B	6	4752
Type 2	906	2	4	3	2B	48	43488
Type 3	1128	3	4	2	3B	16	18048
Type 4	1305	4	6	3	4B	8	10440
Type 5 - Apt	537	1	2	3	1B	2	1074
	676	2	3	3	2B	21	14196
	666	2	3	4	2B	3	1998
	667	2	3	4	2B	8	5336
Sub Total						**112**	**99332**

Scaled @ 1:500

0 10m 20m 50m

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CLIENT: TRIPLE JERSEY LIMITED

SITE: KINGSWAY BURNAGE

TITLE: PLANNING LAYOUT

SCALE AT A0:	DATE:	DRAWN:	CHECKED:
1:500	AUG 23	SSH	-

PROJECT NO:	DRAWING NO:	REVISION:
2305	2305:01:PL	-

PLANNING LAYOUT

Appendix B

TOPOGRAPHIC SURVEY

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LEGEND

AV	AIR VALVE	L T	LIFE TY
B	B/J NR EA N	MH	MANH LE
C	CAP	MT	MOUNT
H	LE H LE	NT	NEUT E ND
IN	IN	W	W JN NT
W	TS H NR-K	WM	WATER M BELL
T	T N E T N VE L	N	TEL E T FIY E X
TV	TV GAS-K T		CL L M
V	V	Y	Y
V	W W ATS N VE L	Z	Z N EYE
PM	PARKING METER	BH	BOREHOLE
DO	DRAINAGE CHANNEL	RW	RAINWATER
DR	DRAIN PIPE	RTW	RETAINING WALL
GR	GRAIN	SAP	SAMPLING TAPS
EIC	ELEC INSPECTION COVER	SNP	NAME PLATE
EM	ELECTRIC MOTOR	SP	SUPPLY POLE
ELB	ELECTRIC BOX	SLP	SUPPT LEVEL
EB	EARTH ROD	SV	STOP VALVE
FL	FINISHED FLOOR	TB	TELEPHONE CLARD
FL	FINISHED FLOOR LEVEL	TCB	TELEPHONE CALL BOX
FH	FIRE HYDRANT	TE	TE WIRE
G	GULLY	TL	TRAFFIC LIGHT
G	GULLY	TLB	TRAFFIC LIGHT BOX
SL	STREET LIGHT	TP	TELEGRAPH POLE
GP	GATE POST	TP	TELEGRAPH POLE
GV	GAS VALVE	WC	WATER CK
GSV	GAS VALVE	MM	WATER METER
IC	INSPECTION COVER	WO	WASH OUT
IL	INVERT LEVEL	WSP	WATER STOP TAP
PO	AERIAL OUTLET	WSV	WATER STOP VALVE
LAD	LADDER	TCD.M	TREE GIRTH (DBL)
LD	LAND DRAIN	WS	TREE MULTI-GIRTH
LP	LAMP POST		

PAL	PALISADE		DRIP LINE
W.W	WIRE WATCH		ROAD EDGE
C.W	CHAIN LINK WIRE		KERB
C.P	CONC PANEL		FENCE
P.W	POST AND WIRE		SURFACE CHANGE
P.W	POST AND RAIL		TOP
S.W	IRON RAIL		TOP Bank
C.W	CHAIN LINK		BOTTOM Bank
D.L	DOUBLE DEGARDED		BUILDING
C.L	CHAIN LINK		BUILDING CANOPY
(98.88)	TOP OF FEATURE		OVER HEAD ELECTRICAL
TP	TEST PIT		OVER HEAD TELECOM
S	STATION		
	BOREHOLE		HEDGE
	BATTER		

NOTES:
All levels relate to O.S (Newlyn) Datum. Established using network RTK.
Survey plotted on a plane local grid, orientated to National Grid.

SURVEY STATIONS			
Name	Easting	Northing	Height
SEP2	386362.723	393322.128	42.304
SEP3	386353.342	393317.568	42.358

1
2
3
SHEET LAYOUT

0 2m 4m 8m 12m 16m
SCALE BAR

REV	DATE	DESCRIPTION

SURVEY & ENGINEERING PROJECTS

Client
J A Lewis
122 Waterloo Road
Southport
PR8 3AZ

Project Title
Topographical Survey of Land at:
B&M Home Store
Kingsway
Burnage
Manchester
M19 1BB

Surveyed	Drawn	Checked
D.Balmer	S.Flanagan	R.Critchley

Scale	Date	Drawing Ref.	No.	Size	Rev
1:200	Aug 23	524643-T	1	A0	--

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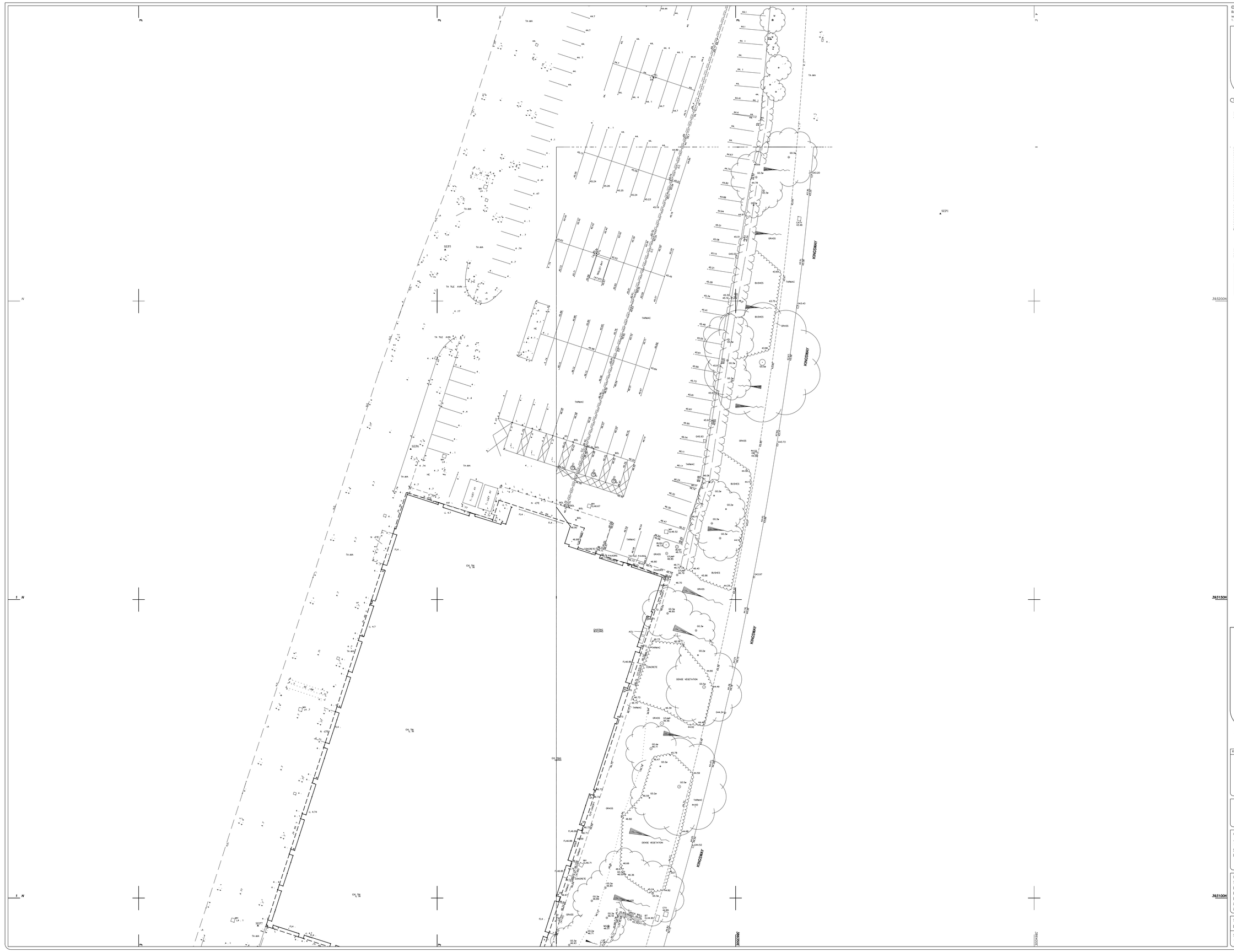


N

P AN GRID NOR H

File Name: 124645-3.01.dwg

LEGEND

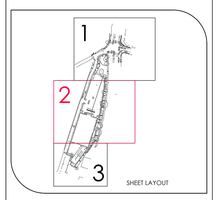
AV	A. VALVE
B	B.S.NA EA N
C	CAP
D	D.P. O LE
EN	EN
W	W.S.N MA.K
T	T.W. E T.N VE.L
TV	T.V. MA.K T
V	V.W.
W	W.M. ATI N W.
FM	FLOW METER
DO	DRAINAGE OUTLET
DC	DRAINAGE CHANNEL
DP	DOWN PIPE
GR	GRAIN
EIC	ELEC. INSPECTION COVER
EM	ELEC. METER
ELB	ELECTRIC BOX
EB	EARTH ROD
FL	FLOOR LEVEL
FL	FINISHED FLOOR LEVEL
FH	FIRE HYDRANT
G	GULLY
S	SOCKET
SL	STREET LIGHT
SP	GAS. POST
GV	GAS VALVE
GSV	GAS VALVE
IC	INSPECTION COVER
MH	MANHOLE
PO	AQ.PIPE OUTLET
LAD	LADDER
LD	LAND DRAIN
LP	LAMP POST
PAL	PALISADE
W.W	WELL WATER
C.W	CONC. WALL
P.W	CONC PANEL
P.W	PRECAST WALL
P.W	POST AND RAIL
I.W	IRON RAIL
W.W	WOOD. SCALLOPED
C.L	CHAIN LINK
(98.28)	TOP OF FEATURE
BH	B.H.
ST	STATION
B	BOREHOLE
BATTER	

L.T	LIFE T
MW	MARW LE
W	WELL W
W	WELL T NE
W	W .PR NE INT
WM	WATER METER BELL
	TEL.
	T FIY E X
N	N.
	O L M
	J
J	J. N EYE
BR	BRIDGE
RW	RETAINING WALL
TSP	TRAFFIC SIGN TIPS
SAP	SAPLING
SNP	NAME PLATE
SP	SIGN POST
SLV	SUPPT. LEVEL
SV	STOP VALVE
TCB	TELEPHONE CALLARD
TCB	TELEPHONE CALL BOX
TE	TE. WIRE
TL	TRAFFIC LIGHT
TLB	TRAFFIC LIGHT BOX
TP	TELEPHONE POLE
TP	TELEPHPN POLE
WB	WATER BOX
WM	WATER METER
WO	WASH OUT
WSV	WATER STOP VALVE
WSV	WATER STOP VALVE
TCD.M	TREE GIRTH (DIA.)
MS	TREE MULTI-GIRTH
	DRIP LINE
	WOOD FENCE
	HEDGE
	FENCE
	SURFACE CHANGE
	ROW
	TOP Bank
	BOTTOM BANK
	BUILDING
	BUILDING CANOPY
	OVER HEAD ELECTRICAL
	OVER HEAD TELECOM
	HEDGE

NOTES:
All levels relate to O.S (Newlyn) Datum. Established using network RTK.
Survey plotted on a plane local grid, orientated to National Grid.

SURVEY STATIONS

Name	Easting	Northing	Height
SEP1	386384.292	393214.624	43.384
SEP2	386464.723	393332.135	42.264
SEP3	386333.342	393317.566	42.259
SEP4	386321.944	393287.584	42.125
SEP5	386301.344	393208.086	46.125
SEP6	386265.565	393175.185	46.742
SEP7	386252.646	393175.185	46.742
SEP8	386252.646	393208.591	46.611



SHEET LAYOUT

0 2m 4m 8m 12m 16m
SCALE BAR

REV	DATE	DESCRIPTION

SURVEY & ENGINEERING PROJECTS

Client
J A Lewis
122 Waterloo Road
Southport
PR8 3AZ

Project Title
Topographical Survey of Land at:
B&M Home Store
Kingsway
Burnage
Manchester
M19 1BB

Surveyed	Drawn	Checked
D.Balmer	A.Worosz	R.Critchley

Scale	Date	Drawing Ref.	No.	Size	Rev
1:200	Nov 22	S23992-T	2	A0	--

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N

PLAN GRID NORTH

File Name: S24643-2dT.dwg

LEGEND

AV	AIR VALVE	LBY	LIFEBUOY
BB	BELISHA BEACON	MH	MANHOLE
BOL	BOLLARD	MKR	MARKER
BH	BORE HOLE	MS	MILE STONE
BIN	BIN	MP	MOORING POINT
BM	BENCH MARK	OF	OUTFALL FITTING
BS	BUS STOP	OP	OUTFALL PIPE
BT	BT INSPECTION COVER	PB	POST OFFICE BOX
CB	CONTROL BOX	PN	PYLON
CCTV	CCTV CAMERA POST	PP	PETROL PUMP
COL	COLUMN	PT	POST
COM	COMMUNICATIONS COVER	RE	RODDING EYE
CST	CAR CHARGING STATION	RL	RIDGE LEVEL
CV	CABLE TV COVER	RS	RAIN SENSOR
DCP	DOWN CAST PANNEL	RTW	RETAINING WALL
DP	DOWN PIPE	RWP	RAINWATER PIPE
DR	DRAIN	SAP	SAPLING
EIC	ELEC INSPECTION COVER	SNP	NAME PLATE
EL	EAVES LEVEL	SP	SIGN POST
ELB	ELECTRIC BOX	SOF	SOFFIT LEVEL
ER	EARTH ROD	SV	STOP VALVE
FB	FLAG POLE	TBL	TELEPHONE BOLLARD
FL	FINISHED FLOOR LEVEL	TCB	TELEPHONE CALL BOX
FH	FIRE HYDRANT	TIE	TIE WIRE
FP	FLAG POLE	TL	TRAFFIC LIGHT
G	GULLY	TLB	TRAFFIC LIGHT BOX
GLT	GROUND LIGHT	TM	TICKET MACHINE
GP	GATE POST	TP	TELEGRAPH POLE
GST	GAS TAP	VP	VENT PIPE
GSV	GAS VALVE	WM	WATER METER
IC	INSPECTION COVER	WT	WATER TAP
IL	INVERT LEVEL	WST	WATER STOP TAP
KO	KERB OUTLET	WSV	WATER STOP VALVE
LAD	LADDER	CO,BW	TREE GIRTH (Dia.)
LD	LAND DRAIN	MG	TREE MULTI-GIRTH
LP	LAMP POST		
PAL	PALISADE		DRIP LINE
W/M	WIRE MESH		BRICK COURSE
B/W	BARBED WIRE		KERB
C/P	CONC PANEL		FENCE
P/W	POST AND WIRE		SURFACE CHANGE
P/R	POST AND RAIL		WALL
I/R	IRON RAIL		TOP BANK
C/B	CLOSE BOARDED		BOTTOM BANK
CL	CHAIN LINK		BUILDING
(99.99)	EXTENT OF FEATURE		OVER HEAD CANOPY
	GATE		OVER HEAD ELECTRICAL
	STATION		OVER HEAD TELECOM
	BOREHOLE		HEDGE
	BATTER		

NOTES:

All levels relate to O.S (Newlyn) Datum, Established using network RTK.
Survey plotted on a plane local grid, orientated to National Grid.

SURVEY STATIONS

Name	Easting	Northing	Height
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SEP2	386364.723	393322.135	42.264
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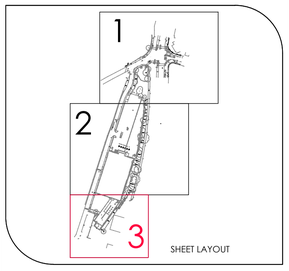
SEP4	386332.684	393278.077	43.157
SEP5	386301.344	393208.586	46.125
SEP6	386295.565	393175.195	46.742
SEP7	386269.977	393095.370	46.880
SEP8	386252.049	393039.591	48.611



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0 2m 4m 8m 12m 16m
SCALE BAR

REV	DATE	DESCRIPTION

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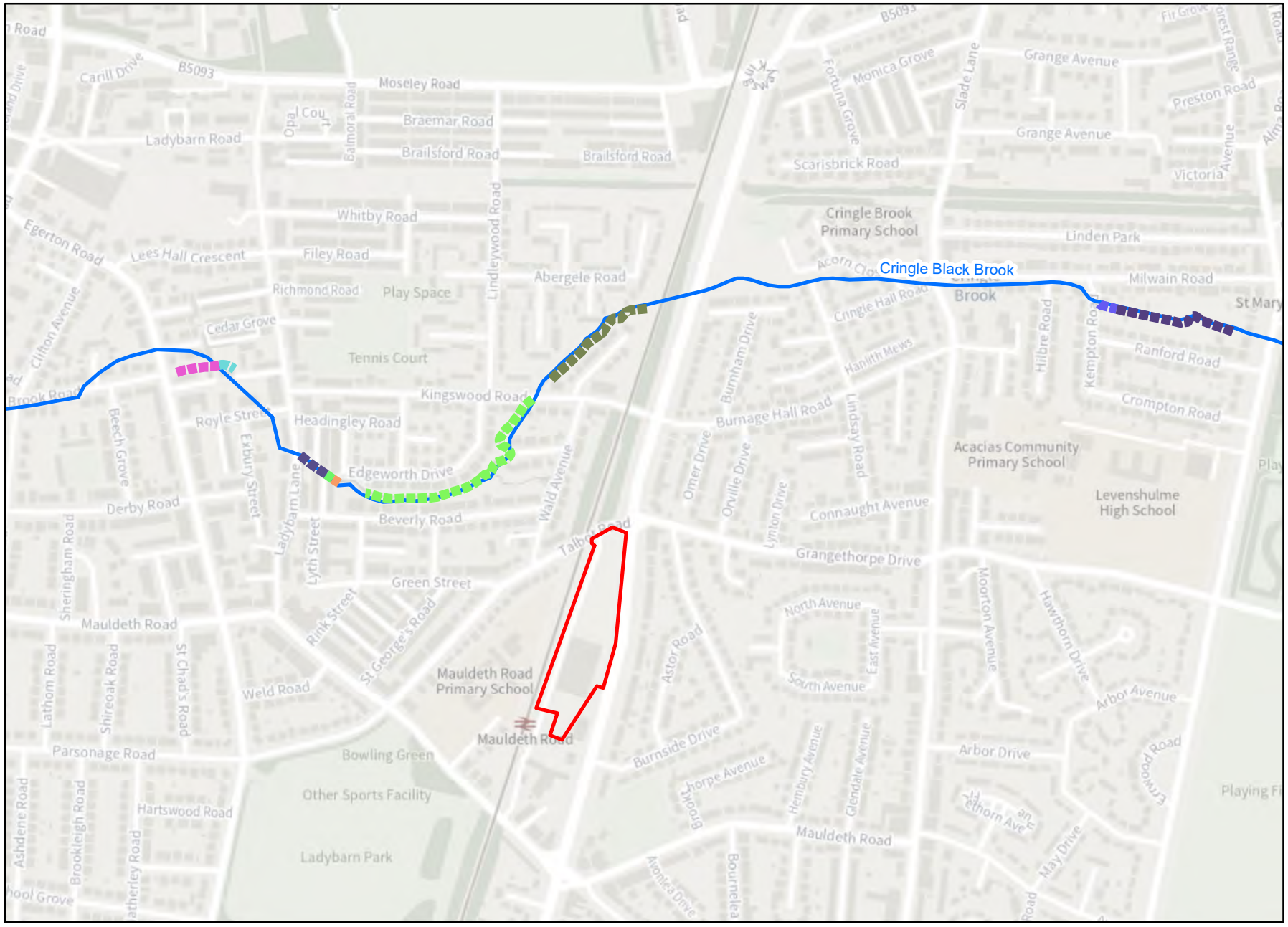
D.Balmer	A.Worosz	R.Critchley

Scale	Date	Drawing Ref.	No.	Size	Rev
1:200	Nov 22	S23992-T	3	A1	--

Appendix C

ADDITIONAL EA DATA

Flood Defence Map Centred on Kingsway, Manchester, M19 1BB.
Created 21/06/2023 [GMMC314396SW]



Environment Agency

1:7,500

N

Legend

Site Location

Main River

Defences

Asset ID

- 7430
- 8871
- 32270
- 32271
- 32357
- 32358
- 71686
- 8870
- 9636

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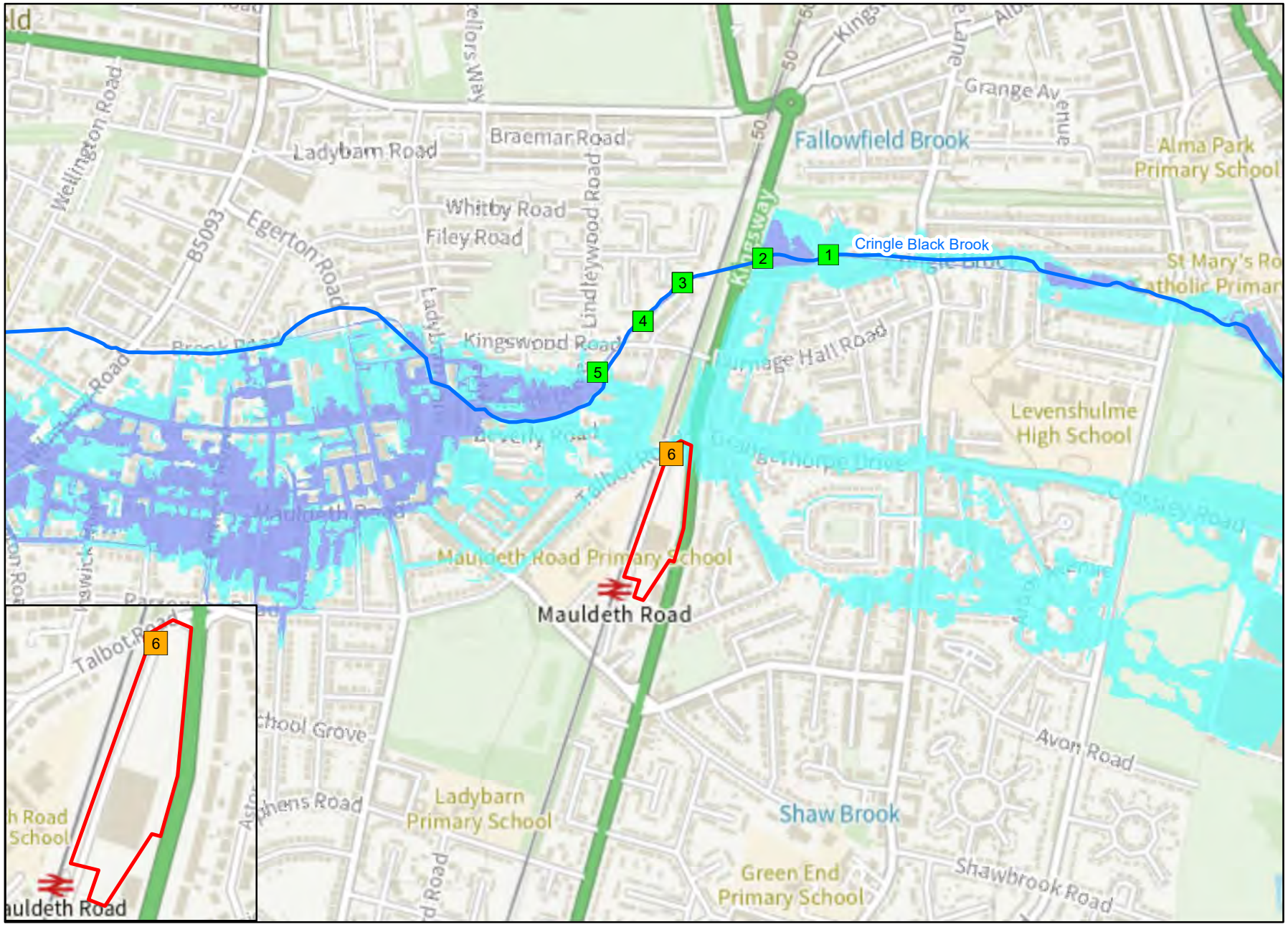
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Detailed Flood Map Centred on Kingsway, Manchester, M19 1BB.
Created 21/06/2023 [GMMC314396SW]



Environment Agency

1:10,001

N

Legend

- Site Location
- Model Measurements
- 2D Measurements
- Main River
- Flood Zone 3
- Flood Zone 2

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					Undefended												Defended													
Map Reference	Model Node Reference	Easting	Northing	Data	50 % AEP (1 in 2 year)	20 % AEP (1 in 5 year)	10 % AEP (1 in 10 year)	5 % AEP (1 in 20 year)	4 % AEP (1 in 25 year)	2 % AEP (1 in 50 year)	1.33 % AEP (1 in 75 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + 30% increase in flow	1 % AEP (1 in 100 year) + 35% increase in flow	1 % AEP (1 in 100 year) + 70% increase in flow	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% increase in flow	50 % AEP (1 in 2 year)	20 % AEP (1 in 5 year)	10 % AEP (1 in 10 year)	5 % AEP (1 in 20 year)	4 % AEP (1 in 25 year)	2 % AEP (1 in 50 year)	1.33 % AEP (1 in 75 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + 30% increase in flow	1 % AEP (1 in 100 year) + 35% increase in flow	1 % AEP (1 in 100 year) + 70% increase in flow	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% increase in flow
1	ea013_0238_CRINS1_2672d	386624	393662	Modelled Water Level (m aodN)	43.05	43.17	43.44	43.64	43.69	43.94	44.09	44.18	44.59	44.65	44.87	44.42	45.00	45.13	43.05	43.17	43.44	43.64	43.69	43.94	44.09	44.18	44.59	44.65	44.87	44.42	45.00	45.13
				Modelled Flow (cumecs)	1.87	2.41	3.01	3.41	3.49	3.91	4.18	4.34	4.81	4.85	5.03	4.68	5.12	5.16	1.87	2.41	3.01	3.41	3.49	3.91	4.18	4.34	4.81	4.85	5.03	4.68	5.12	5.16
2	ea013_0238_CRINS1_2549	386502	393656	Modelled Water Level (m aodN)	42.53	42.78	43.29	43.56	43.63	43.92	44.08	44.18	44.59	44.64	44.86	44.41	44.98	45.10	42.53	42.78	43.29	43.56	43.63	43.92	44.08	44.18	44.59	44.64	44.86	44.41	44.98	45.10
				Modelled Flow (cumecs)	2.01	2.56	3.17	3.20	3.20	3.22	3.20	3.19	3.86	3.95	4.73	3.74	5.56	6.55	2.01	2.56	3.17	3.20	3.20	3.22	3.20	3.19	3.86	3.95	4.73	3.74	5.56	6.55
3	ea013_0238_CRINS1_2387	386354	393611	Modelled Water Level (m aodN)	41.47	41.57	41.68	41.73	41.74	41.79	41.81	41.82	41.87	41.87	41.90	41.85	41.91	41.92	41.47	41.57	41.68	41.73	41.74	41.79	41.81	41.82	41.87	41.87	41.90	41.85	41.91	41.92
				Modelled Flow (cumecs)	2.01	2.56	3.23	3.54	3.62	3.91	4.07	4.16	4.53	4.58	4.77	4.37	4.87	4.96	2.01	2.56	3.23	3.54	3.62	3.91	4.07	4.16	4.53	4.58	4.77	4.37	4.87	4.96
4	ea013_0238_CRINS1_2264	386281	393540	Modelled Water Level (m aodN)	40.73	40.82	40.92	40.97	40.98	41.03	41.06	41.07	41.14	41.15	41.21	41.11	41.33	41.39	40.73	40.82	40.92	40.97	40.98	41.03	41.06	41.07	41.14	41.15	41.21	41.11	41.33	41.39
				Modelled Flow (cumecs)	2.01	2.56	3.23	3.55	3.62	3.91	4.07	4.16	4.53	4.58	4.77	4.37	4.87	4.96	2.01	2.56	3.23	3.55	3.62	3.91	4.07	4.16	4.53	4.58	4.77	4.37	4.87	4.96
5	ea013_0238_CRINS1_2156	386197	393446	Modelled Water Level (m aodN)	40.21	40.34	40.49	40.55	40.57	40.60	40.62	40.63	40.67	40.68	40.70	40.66	40.75	40.79	40.21	40.34	40.49	40.55	40.57	40.60	40.62	40.63	40.67	40.68	40.70	40.66	40.75	40.79
				Modelled Flow (cumecs)	2.15	2.72	3.47	3.80	3.86	4.12	4.30	4.37	4.73	4.79	5.06	4.57	5.54	5.79	2.15	2.72	3.47	3.80	3.86	4.12	4.30	4.37	4.73	4.79	5.06	4.57	5.54	5.79

					Undefended			Defended		
Map Reference	Model Node Reference	Easting	Northing	Data	1 % AEP (1 in 100 year) + 70% increase in flow	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% increase in flow	1 % AEP (1 in 100 year) + 70% increase in flow	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% increase in flow
6	2D Levels	386334	393295	Modelled Water Level (m aodN)	42.59	42.92	43.10	42.59	42.92	43.10

Model data taken from Cringle Brook 2017

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

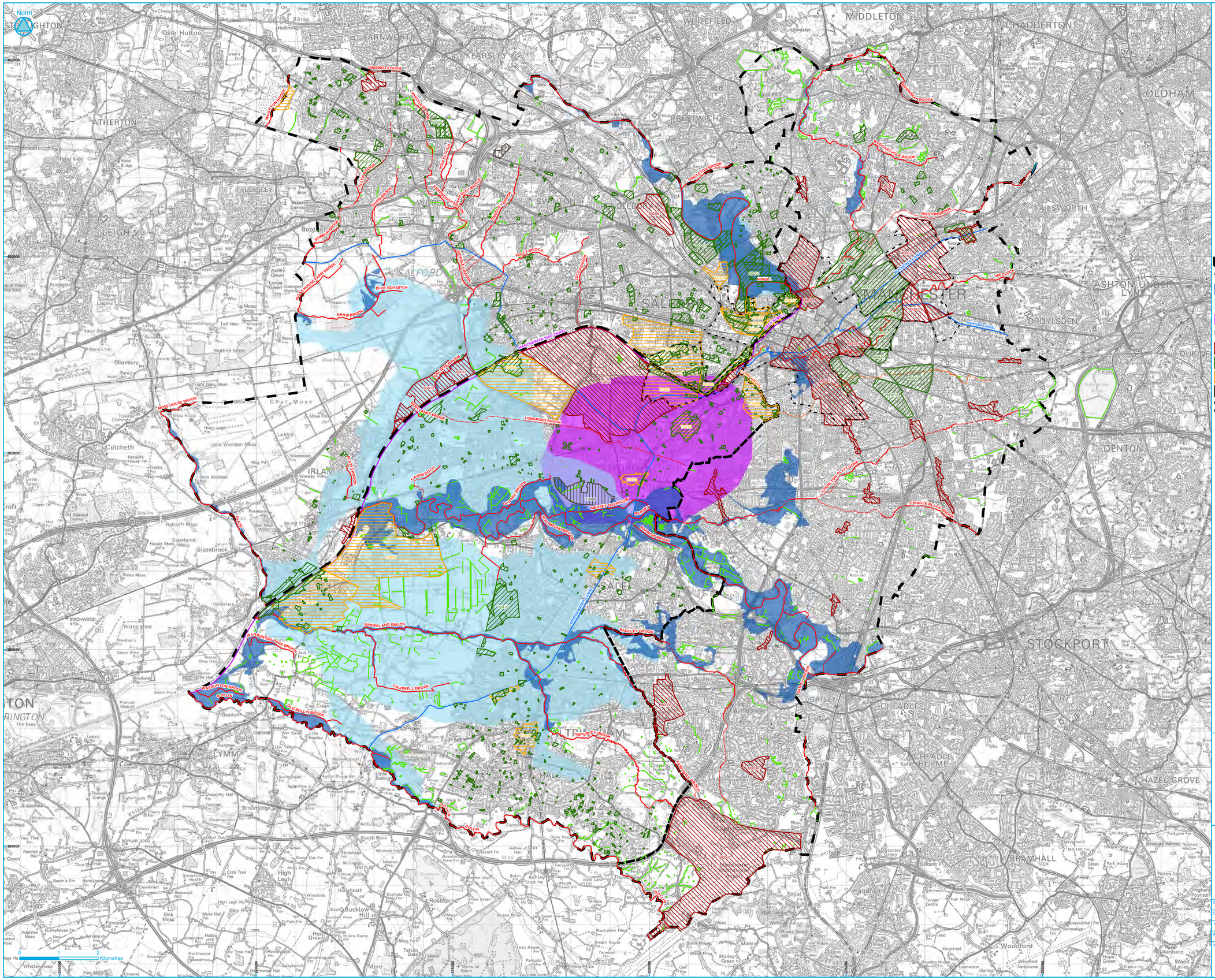
Notes: *Climate Change Scenario -30%, 35% and 70% increases in flow calculated for the 2080's (2070 - 2115). Please see https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances for more information regarding the new climate change guidance. The location of the site and the type (vulnerability) of development determine the climate change allowances to consider in any flood risk assessment.

Rivel Defences

Start Date	Asset Type	Asset ID	Standard of Protection	Upstream Actual Crest Level (m aod)	Downstream Actual Crest Level (m aod)
01/01/2004	Wall	32270	100	39.28	39.21
01/01/2004	Wall	32271	100	39.73	39.40
01/01/2004	Wall	32267	100	40.87	40.67
01/01/2004	Wall	32268	100	40.71	40.72
01/01/2004	Engineered High Ground	71686	100	48.71	47.89
01/01/2004	Wall	8870	100	39.83	39.84
01/01/2004	Engineered High Ground	9636	100	41.26	43.83
01/01/2004	Natural High Ground	7430	100	47.83	50.40
01/01/2004	Natural High Ground	8871	100	41.17	39.56

Appendix D

MANCHESTER CITY, SALFORD CITY AND TRAFFORD COUNCILS LEVEL 2 HYBRID SFRA GROUNDWATER FLOOD MAP



Council Boundary

Groundwater Issue

- Areas at risk of GW Flooding
- Areas of shallow GW
- Areas at risk of GW rebound

Potential Development Sites / Locations

- Employment
- Housing
- Mixed Use
- Other
- Regional Centre Boundary

- Ashton, Bridgewater and Rochdale Canals
- Manchester Ship Canal / Grey Irwell
- Other Waterbodies

Main Rivers (V8.0)

- Culverted
- Open

Digitised River Lines

- Culverted
- Open

The map has been produced in accordance with PPS25: Development and Flood Risk and its Practice Guide. This map shows areas that are potentially at risk from groundwater flooding and should be used to scope suitable mitigation measures in a site specific Flood Risk Assessment.

The Main River information shown in the SFRA is provided by the Environment Agency; the centreline data may deviate from that shown on basemapping due to inherent differences in data resolution. Further information on Main Rivers is provided on the Environment Agency's website. The mapping of culverted sections of watercourse is a strategic screening only based upon Ordnance Survey 1:10,000 mapping and should be confirmed for more detailed studies such as site specific Flood Risk Assessment. The canals layer does not necessarily cover all the canal arms, but the modelled overtopping/breaching and hydraulic interactions with rivers and other waterbodies is complete and accurate as appropriate for a Strategic Flood Risk Assessment.

The information on the map is based on Environment Agency potential groundwater rebound areas, data from the Coal Authority, BGS drift geology mapping and Defra Groundwater Emergence Maps.

The River Irwell between Victoria Station and Pomona Island is not shown as a Main River on the Environment Agency's Flood Map although Flood Zones related to the river are. The same approach has been taken in this SFRA.

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f 0845 8627772
e info@jbaconsulting.co.uk

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Warrington
WA1 1NN
United Kingdom

Other offices at Atherstone, Doncaster, Edinburgh, Haywards Heath, Limerick, Newcastle upon Tyne, Newport, Northallerton, Saltaire, Skipton, Tadcaster & Wallingford

for

Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA

Groundwater Flooding

Drawn by:	J Cheetham	Date:	08/03/2011
Checked by:	J Dimelow	Date:	01/02/2011
Approved by:	J Cooper	Date:	01/02/2011
File Name:	..ArcView\Mapping\Level 1\MST_GroundwaterFlooding_V1.3.mxd		
Drawing Number:	GW_2.1	Status:	FINAL
Scale:	1:45,000		

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Original @ A1

Appendix E

UNITED UTILITIES PREDEVELOPMENT ENQUIRY

From: seweradoptions@uuplc.co.uk
To: Jasmine Ellenor
Subject: RE: 04151928 - B&M Bargains, Burnage, M19 1BB
Date: 08 June 2023 11:27:18

Good Morning Jasmine,

Thank you for your Pre Development Enquiry, please see our response below:

Kingsway Burnage

Foul Water:

Foul flow from this site will be allowed to drain into the combined sewer system. Our preferred point of discharge would be to the large diameter public combined sewer within Middleton Road

Surface Water:

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

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.

For guidance, The North West SuDS Pro-Forma provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Regards

Anthony

Anthony Laithwaite
Ww Lead - ICS / Portal Project
Ww Engineer
Developer Services & Metering
Customer Services

M: 07880 298897
unitedutilities.com

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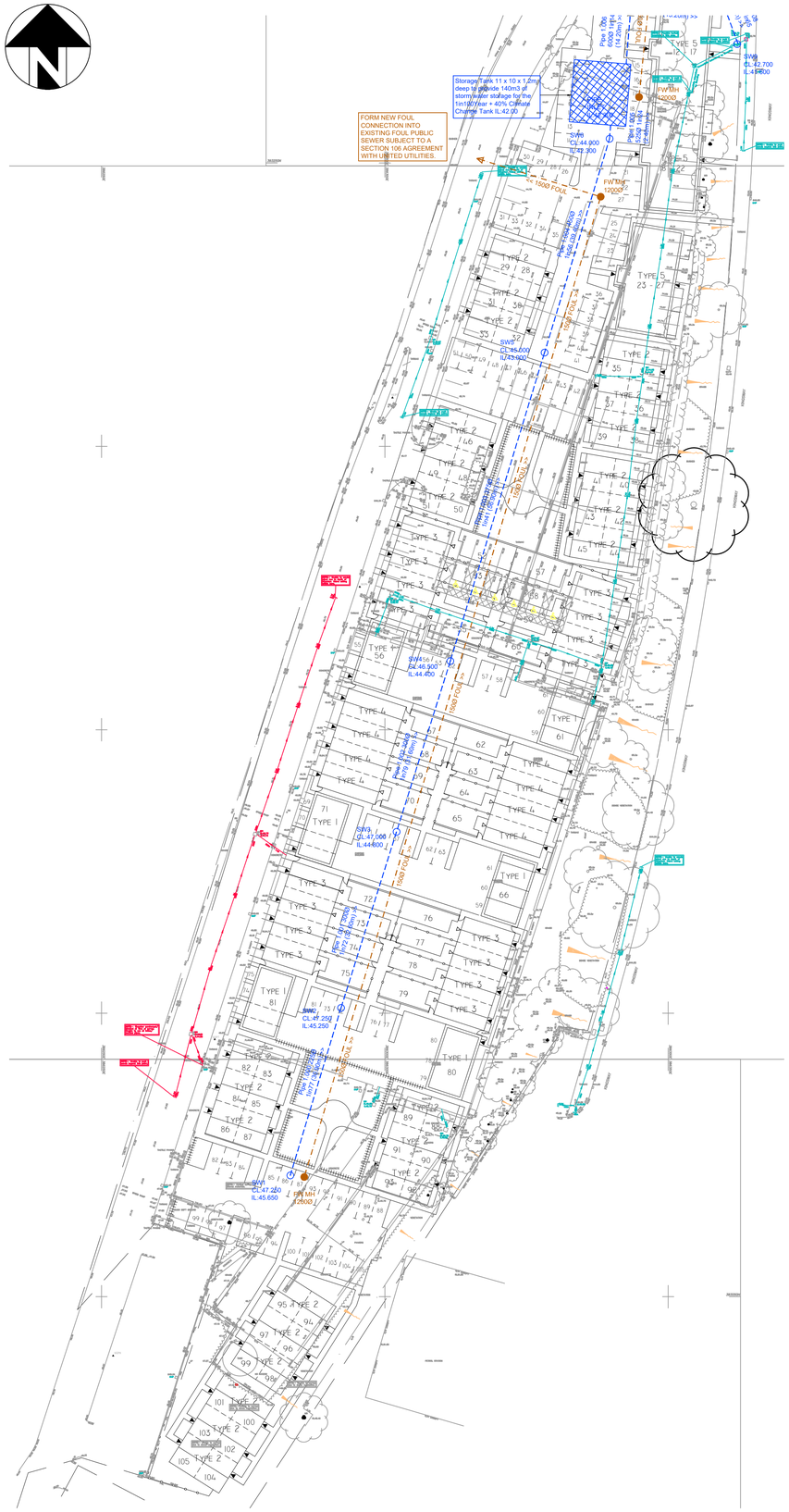
Appendix F

DRAINAGE LAYOUT DRAWING


Storage Tank 11 x 10 x 1.2m deep to provide 140m3 of storm water storage for the 1in100Year + 40% Climate Change Tank IL 42.00
FORM NEW FOUL CONNECTION INTO EXISTING FOUL PUBLIC SEWER SUBJECT TO A SECTION 106 AGREEMENT WITH UNITED UTILITIES.
Pipe 1.006 (175x3.1in10 L (14.25m) >>
Pipe 1.005 (175x3.1in10 L (14.25m) >>
Pipe 1.004 (175x3.1in10 L (14.25m) >>
Pipe 1.003 (175x3.1in10 L (14.25m) >>
Pipe 1.002 (175x3.1in10 L (14.25m) >>
Pipe 1.001 (175x3.1in10 L (14.25m) >>
Pipe 1.007 (175x3.1in10 L (15.20m) >>
Pipe 1.008 (175x3.1in10 L (15.20m) >>
Pipe 1.009 (175x3.1in10 L (15.20m) >>
Pipe 1.010 (175x3.1in10 L (15.20m) >>
Pipe 1.011 (175x3.1in10 L (15.20m) >>
Pipe 1.012 (175x3.1in10 L (15.20m) >>
Pipe

Appendix G

CAUSEWAY FLOW CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Inverts
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SW1	0.100	5.00	47.250	1200	1.600
SW2	0.100	5.00	47.250	1200	2.000
SW3	0.100	5.00	47.000	1200	2.200
SW4	0.100	5.00	46.500	1200	2.100
SW5	0.100	5.00	45.000	1200	2.000
SW6	0.100	5.00	44.000	1200	1.700
Tank	0.060	5.00	44.000	1200	2.000
SW7			43.250	2100	1.350
SW8			42.800	1200	1.050

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SW1	SW2	30.900	0.600	45.650	45.250	0.400	77.3	225	5.35	50.0
1.001	SW2	SW3	32.600	0.600	45.250	44.800	0.450	72.4	300	5.64	50.0
1.002	SW3	SW4	31.600	0.600	44.800	44.400	0.400	79.0	300	5.94	50.0
1.003	SW4	SW5	56.900	0.600	44.400	43.000	1.400	40.6	375	6.27	50.0
1.004	SW5	SW6	39.400	0.600	43.000	42.300	0.700	56.3	450	6.51	50.0
1.005	SW6	Tank	2.400	0.600	42.300	42.200	0.100	24.0	525	6.52	50.0
1.006	Tank	SW7	14.200	0.600	42.000	41.900	0.100	142.0	600	6.64	50.0
1.007	SW7	SW8	15.200	0.600	41.900	41.750	0.150	101.3	375	6.78	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.489	59.2	13.6	1.375	1.775	0.100	0.0	73	1.217
1.001	1.849	130.7	27.1	1.700	1.900	0.200	0.0	92	1.468
1.002	1.770	125.1	40.7	1.900	1.800	0.300	0.0	117	1.588
1.003	2.849	314.7	54.2	1.725	1.625	0.400	0.0	104	2.150
1.004	2.714	431.6	67.8	1.550	1.250	0.500	0.0	120	2.004
1.005	4.585	992.6	81.3	1.175	1.275	0.600	0.0	100	2.817
1.006	2.041	577.2	89.4	1.400	0.750	0.660	0.0	158	1.502
1.007	1.800	198.8	89.4	0.975	0.675	0.660	0.0	176	1.754

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	30.900	77.3	225	Circular	47.250	45.650	1.375	47.250	45.250	1.775
1.001	32.600	72.4	300	Circular	47.250	45.250	1.700	47.000	44.800	1.900
1.002	31.600	79.0	300	Circular	47.000	44.800	1.900	46.500	44.400	1.800
1.003	56.900	40.6	375	Circular	46.500	44.400	1.725	45.000	43.000	1.625
1.004	39.400	56.3	450	Circular	45.000	43.000	1.550	44.000	42.300	1.250
1.005	2.400	24.0	525	Circular	44.000	42.300	1.175	44.000	42.200	1.275
1.006	14.200	142.0	600	Circular	44.000	42.000	1.400	43.250	41.900	0.750
1.007	15.200	101.3	375	Circular	43.250	41.900	0.975	42.800	41.750	0.675

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SW1	1200	Manhole	Adoptable	SW2	1200	Manhole	Adoptable
1.001	SW2	1200	Manhole	Adoptable	SW3	1200	Manhole	Adoptable
1.002	SW3	1200	Manhole	Adoptable	SW4	1200	Manhole	Adoptable
1.003	SW4	1200	Manhole	Adoptable	SW5	1200	Manhole	Adoptable
1.004	SW5	1200	Manhole	Adoptable	SW6	1200	Manhole	Adoptable
1.005	SW6	1200	Manhole	Adoptable	Tank	1200	Manhole	Adoptable
1.006	Tank	1200	Manhole	Adoptable	SW7	2100	Manhole	Adoptable
1.007	SW7	2100	Manhole	Adoptable	SW8	1200	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SW1	47.250	1.600	1200					
					0	1.000	45.650	225
SW2	47.250	2.000	1200		1	1.000	45.250	225
					0	1.001	45.250	300
SW3	47.000	2.200	1200		1	1.001	44.800	300
					0	1.002	44.800	300
SW4	46.500	2.100	1200		1	1.002	44.400	300
					0	1.003	44.400	375
SW5	45.000	2.000	1200		1	1.003	43.000	375
					0	1.004	43.000	450
SW6	44.000	1.700	1200		1	1.004	42.300	450
					0	1.005	42.300	525
Tank	44.000	2.000	1200		1	1.005	42.200	525
					0	1.006	42.000	600

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Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SW7	43.250	1.350	2100		1	1.006	41.900	600
					0	1.007	41.900	375
SW8	42.800	1.050	1200		1	1.007	41.750	375

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	17.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Node SW7 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	41.900	Product Number	CTL-SHE-0311-5800-1200-5800
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.375
Design Flow (l/s)	58.0	Min Node Diameter (mm)	2100

Node Tank Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	42.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	23

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	110.0	0.0	1.200	110.0	0.0	1.201	0.0	0.0

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW1	10	45.717	0.067	11.9	0.1605	0.0000	OK
15 minute winter	SW2	10	45.335	0.085	23.6	0.1803	0.0000	OK
15 minute winter	SW3	11	44.913	0.113	35.0	0.2306	0.0000	OK
15 minute winter	SW4	11	44.496	0.096	46.0	0.1999	0.0000	OK
15 minute winter	SW5	11	43.111	0.111	57.4	0.2370	0.0000	OK
15 minute winter	SW6	11	42.426	0.126	68.9	0.2900	0.0000	OK
15 minute winter	Tank	14	42.144	0.144	75.6	16.0842	0.0000	OK
15 minute winter	SW7	14	42.148	0.248	44.6	0.8588	0.0000	OK
15 minute summer	SW8	1	41.750	0.000	41.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW1	1.000	SW2	11.7	0.993	0.198	0.3649	
15 minute winter	SW2	1.001	SW3	23.1	1.144	0.177	0.6603	
15 minute winter	SW3	1.002	SW4	34.7	1.590	0.277	0.6899	
15 minute winter	SW4	1.003	SW5	46.2	1.867	0.147	1.4091	
15 minute winter	SW5	1.004	SW6	57.7	1.734	0.134	1.3117	
15 minute winter	SW6	1.005	Tank	68.9	2.131	0.069	0.0780	
15 minute winter	Tank	1.006	SW7	44.6	0.682	0.077	1.1482	
15 minute winter	SW7	Hydro-Brake®	SW8	44.0				35.8

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW1	10	45.762	0.112	29.1	0.2666	0.0000	OK
15 minute winter	SW2	10	45.391	0.141	57.8	0.3008	0.0000	OK
15 minute winter	SW3	10	44.996	0.196	86.1	0.3994	0.0000	OK
15 minute winter	SW4	11	44.555	0.155	113.5	0.3226	0.0000	OK
15 minute winter	SW5	11	43.182	0.182	141.0	0.3872	0.0000	OK
15 minute winter	SW6	11	42.516	0.216	169.7	0.4985	0.0000	OK
30 minute winter	Tank	25	42.443	0.443	146.7	49.4543	0.0000	OK
15 minute winter	SW7	16	42.444	0.544	77.4	1.8834	0.0000	SURCHARGED
15 minute summer	SW8	1	41.750	0.000	58.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW1	1.000	SW2	28.7	1.249	0.485	0.7096	
15 minute winter	SW2	1.001	SW3	57.0	1.399	0.436	1.3246	
15 minute winter	SW3	1.002	SW4	85.1	1.996	0.680	1.3470	
15 minute winter	SW4	1.003	SW5	113.6	2.374	0.361	2.7256	
15 minute winter	SW5	1.004	SW6	142.3	2.107	0.330	2.6624	
15 minute winter	SW6	1.005	Tank	170.2	2.597	0.171	0.1728	
15 minute winter	Tank	1.006	SW7	77.4	0.727	0.134	3.4370	
30 minute winter	SW7	Hydro-Brake®	SW8	58.0				115.3

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW1	11	45.860	0.210	52.6	0.5002	0.0000	OK
15 minute winter	SW2	11	45.615	0.365	104.9	0.7773	0.0000	SURCHARGED
15 minute winter	SW3	11	45.322	0.522	146.5	1.0643	0.0000	SURCHARGED
15 minute winter	SW4	11	44.615	0.215	193.7	0.4473	0.0000	OK
15 minute winter	SW5	11	43.255	0.255	242.8	0.5431	0.0000	OK
30 minute winter	SW6	28	43.071	0.771	243.9	1.7777	0.0000	SURCHARGED
30 minute winter	Tank	28	43.069	1.069	259.9	119.4252	0.0000	SURCHARGED
30 minute winter	SW7	28	43.067	1.167	69.5	4.0420	0.0000	FLOOD RISK
15 minute summer	SW8	1	41.750	0.000	58.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW1	1.000	SW2	52.3	1.388	0.884	1.2109	
15 minute winter	SW2	1.001	SW3	96.3	1.472	0.737	2.2957	
15 minute winter	SW3	1.002	SW4	144.2	2.146	1.153	1.9653	
15 minute winter	SW4	1.003	SW5	193.3	2.700	0.614	4.1247	
15 minute winter	SW5	1.004	SW6	244.6	2.319	0.567	4.6591	
15 minute winter	SW6	1.005	Tank	283.7	2.834	0.286	0.5185	
240 minute winter	Tank	1.006	SW7	136.5	0.879	0.237	2.4949	
60 minute winter	SW7	Hydro-Brake®	SW8	58.0				265.0

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