

## Top Park, Ramsbottom, Bury

# Flood Risk Assessment and Outline Drainage Strategy Report

Date 3<sup>rd</sup> April 2024

### Notice

This report was produced by Lynas Engineers for Steve Wells Associates for the specific purpose of assessing the risk of flooding along with the outline strategy for draining the proposed development on Top Park, Bolton Road West, Ramsbottom, Bury.

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## Summary

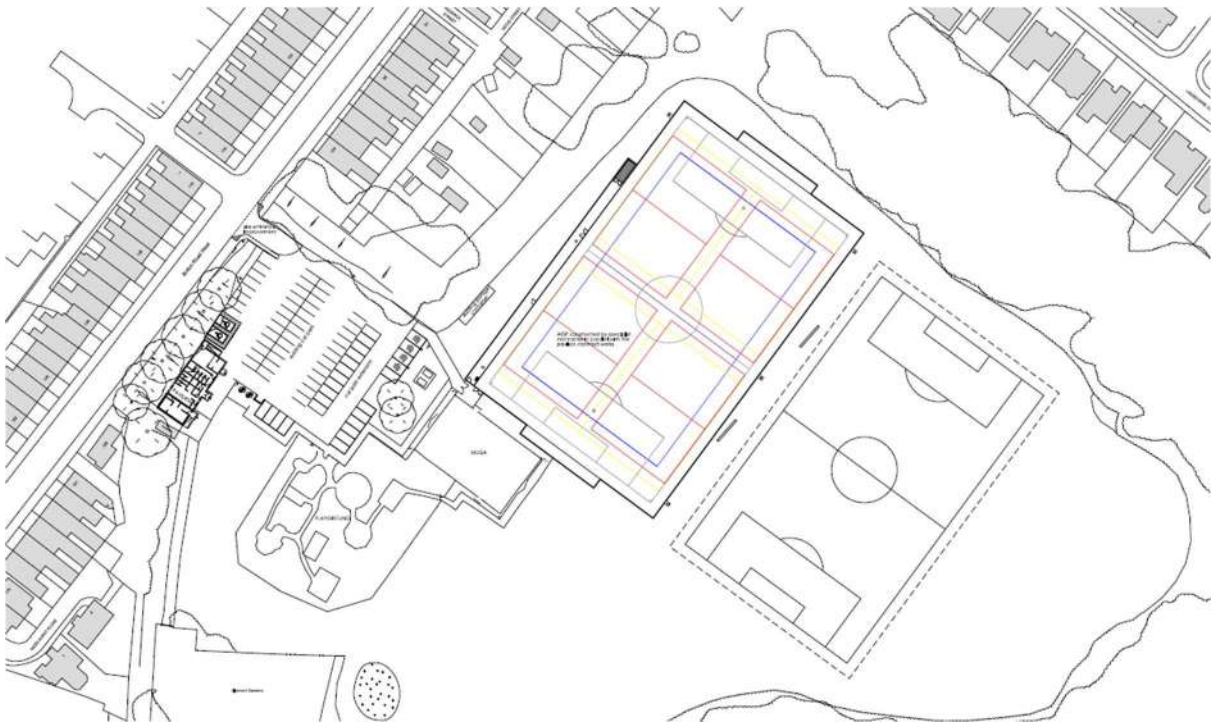
1. Lynas Engineers was commissioned by Steve Wells Associates to undertake a Flood Risk Assessment (FRA) and Drainage Strategy (DS) report in respect of the proposed development located east of Bolton Road West, Ramsbottom, Bury.
2. The proposed development plan increases the site impermeable area by a total of 0.712ha; 0.635ha from the proposed AGP, 0.071ha from the car park extension, and 0.006ha from the proposed pavilion extension.
3. A location plan of the area can be found in **Appendix A**.
4. The FRA has been produced in accordance with the National Planning Policy Framework (NPPF), standing advice and general requirements of the Environment Agency (EA), and Bury Council's Local Plan 2012 – 2029.
5. The document can be viewed through this link:  
<https://councildecisions.bury.gov.uk/Data/Council/201307031900/Agenda/att17935.pdf>
6. The FRA demonstrates the following:
  - The specific location designated for the surface water drainage system is located within Flood Zone 1 and is at a very low probability of fluvial flooding.
  - The proposed site is at a very low risk of flooding from surface water.
  - The proposed site is not at risk of flooding from a reservoir failure.
  - The risk of flooding elsewhere from all sources of flooding will not change from the existing situation.
7. The Outline DS demonstrates the following:
  - The potential solutions for the attenuation/disposal of surface water run-off from the proposed site.
  - The outline surface water drainage philosophy for the proposed development.
  - The foul water scenario has not changed and will therefore not be considered as part of this application.

## Introduction

### Development Proposal

1. The proposal is to develop the site area, which is currently occupied by grass playing fields, a concrete basketball court, a playground, 45 space car park and a pavilion with changing facilities.
2. The nearest post code to the development site is BL0 9PE.
3. The proposed development will comprise of the installation of a new artificial grass pitch, an additional 26 parking spaces, an extension to the pavilion, new fencing, and improvements to the existing entrance off Bolton Road West.
4. The overall proposed development area equates to 0.712ha.
5. **Figure 1** illustrates the proposed layout for the development, with the red line boundary indicating the proposed site extents. A larger scale layout of the proposed development can be viewed in **Appendix B**.

Figure 1 – Proposed Layout



## Purpose

1. A preliminary review of the flood maps for the area indicates that the site is located wholly within Zone 1 of the Environment Agency Flood Map, which is defined as land assessed as having a less than 1 in 1000 years (<0.1% AEP) annual probability of river or sea flooding in any one year.
2. The report is intended to provide an understanding of the flood risk associated with the existing site, assess whether the proposed drainage would be susceptible to flood risk and, if so, consider whether and how that flood risk can be managed in an acceptable manner, whilst also allowing for any climate change.
3. To assess whether the proposed development would increase the risk of flooding elsewhere.
4. Assess how surface water run-off from the existing site is disposed.
5. Assess the potential solutions for the disposal of surface water run-off from the proposed development site against relevant standards.
6. Identify any constraints associated with the potential solutions and identify the preferred solution for the discharge of surface water run-off from the proposed development.
7. Outline the surface water drainage philosophy for the proposed development site.

## Legislation, Policy and Guidance

### National Planning Policy Framework

1. NPPF sets out the Government's national policies on different aspects of land use planning in England.
2. Section 14: Meeting the challenge of Climate Change, Flooding and Coastal Change, states that "Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development".
3. The NPPF provides the following guidance in respect of Planning and Flood Risk:
  - 3.1 Paragraph 159 states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.
  - 3.2 Paragraph 160 states that strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.
  - 3.3 Paragraph 161 states that all plans should apply a sequential, risk-based approach to the location of development – considering the current and future impacts of climate change – to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:
    - a) applying the sequential test and then, if necessary, the exception test as set out below;
    - b) safeguarding land from development that is required, or likely to be required, for current or future flood management;
    - c) using opportunities provided by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques); and
    - d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.
  - 3.4 Paragraph 162 states the aim of the sequential test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.
  - 3.5 Paragraph 163 states that if it is not possible for development to be in zones with a lower risk of flooding (considering wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend

on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in national planning guidance.

- 3.6 Paragraph 164 states the application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:
  - a) The development would provide wider sustainability benefits to the community that outweigh the flood risk; and
  - b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
- 3.7 Paragraph 165 states that both elements of the exception test should be satisfied for development to be allocated or permitted.
- 3.8 Paragraph 166 states where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the plan making stage, or if more recent information about existing or potential flood risk should be considered.
- 3.9 Paragraph 167 states when determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:
  - a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
  - b) the development is appropriately flood resistant and resilient;
  - c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
  - d) any residual risk can be safely managed; and
  - e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.
- 3.10 Paragraph 168 states that applications for some minor development and changes of use should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments.
- 3.11 Paragraph 169 states that major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:
  - a) take account of advice from the lead local flood authority;
  - b) have appropriate proposed minimum operational standards;
  - c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
  - d) where possible, provide multifunctional benefits.

4. Using NPPF Technical Guidance Table 3 (see Table 2), as a simple chart, it shows whether the development should or should not be permitted and whether further information will be required for the planning application.

Table A: NPPF Technical Guidance Table 2

| Vulnerability Classification |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Less Vulnerable              | <ul style="list-style-type: none"> <li>Police, ambulance and fire stations which are not required to be operational during flooding.</li> <li>Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in “more vulnerable”, and assembly and leisure.</li> <li>Land and buildings used for agriculture and forestry.</li> <li>Waste treatment (except landfill and hazardous waste facilities).</li> <li>Minerals working and processing (except for sand and gravel working).</li> <li>Water treatment works which do not need to remain operational during times of flood.</li> <li>Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).</li> </ul> |

Table B: NPPF Technical Guidance Table 3

| Flood Zones | Flood Risk Vulnerability Classification |                         |                         |                 |                  |
|-------------|-----------------------------------------|-------------------------|-------------------------|-----------------|------------------|
|             | Essential Infrastructure                | Highly Vulnerable       | More Vulnerable         | Less Vulnerable | Water Compatible |
| Zone 1      | ✓                                       | ✓                       | ✓                       | ✓               | ✓                |
| Zone 2      | ✓                                       | Exception Test Required | ✓                       | ✓               | ✓                |
| Zone 3a     | Exception Test Required                 | x                       | Exception Test Required | ✓               | ✓                |
| Zone 3b     | Exception Test Required                 | x                       | x                       | x               | ✓                |

Key:

✓ Development is appropriate.

x Development should not be permitted.

## Local Plan – Bury Council

1. Bury Council's Local Plan 2012 - 2029 was formally adopted in 2013 and provides planning guidance for developers in the form of the core strategies and objectives.
2. The document can be viewed through this link:
3. <https://councildecisions.bury.gov.uk/Data/Council/201307031900/Agenda/att17935.pdf>
4. Sustainable development, adapting to climate change and reducing carbon emissions are central to the vision for the Borough, this vision is refined to a series of specific objectives. Figure 2 below shows the objective surrounding the environment and discusses climate change.

Figure 2 – Policy EN9 – Surface Water Management and Drainage

### Environment

#### The Key Issues to emerge in respect of the Borough's environmental assets and environmental quality are:

- The need to adapt to the impacts of climate change and reduce carbon emissions from all sources, especially the built environment and transport.
- A significant amount of the Borough's residents travel to work by private motor vehicle and use of public transport throughout the Borough is low, both of which contribute to the Borough's high carbon emissions.
- The need for Council activities to achieve targets for reducing carbon by 35% by 2014.
- The need to manage flood risk from all sources and address particular issues associated with high risk areas in Ramsbottom, to the west of Bury town centre and between Bury and Radcliffe.
- The need to create, maintain and enhance a network of multi-functional green infrastructure.
- The need to conserve ecological and geological assets.
- The need to retain and enhance the Borough's landscape character;
- The need to retain the Borough's best and most versatile agricultural land in north Radcliffe, Fairfield and Unsworth.
- Air quality in some areas of the Borough fails to meet recognised standards, particularly in East Bury and Whitefield and Unsworth.
- The need to strive towards improved waterbodies, particularly on the River Irwell, Whittle Brook and Kirklees Brook.
- The need to conserve the Borough's built heritage.
- The need to ensure the sustainable management of minerals resources, notably at Fletcher Bank in Ramsbottom and at Pilsworth.
- The need to ensure the sustainable management of waste.

5. Policy EN9, shown below in Figure 3, discusses how Bury Council set out to reduce flood risk on-site and elsewhere, as well as the installation of SuDS within developments.

Figure 3 – Policy EN9 Surface Water Management and Drainage

| SURFACE WATER MANAGEMENT AND DRAINAGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | DM Policy<br><b>EN9</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <p>The Council will ensure that all new development proposals minimise the impact of development on surface water run-off, and where possible, seek to reduce it.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |
| <p>The AGMA authorities are currently developing specific drainage standards for developments within Critical Drainage Areas (CDAs). In the interim the following allowable drainage rates will apply across the Borough:</p> <ul style="list-style-type: none"> <li>▪ Development should deliver Greenfield runoff on Greenfield sites up to a 1 in 100 year storm event, considering climate change.</li> <li>▪ Development should aim for a minimum reduction in surface water runoff rates of 30% (increasing to 50% within CDAs) for Brownfield sites up to a 1 in 100 year storm event, considering climate change.</li> <li>▪ Development should be designed so that there is no flooding to the development in a 1 in 30 year event and no property flooding in 1 in 100 year plus climate change event.</li> </ul> |                         |
| <p>Drainage from new developments should incorporate storage, and residual discharge of surface water should be directed to the following networks in order of preference:</p> <ol style="list-style-type: none"> <li>a) Discharge into infiltration systems located in porous sub soils</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                         |
| <ol style="list-style-type: none"> <li>b) Attenuate flows into green engineering solutions such as ponds; swales or other open water features for gradual release to a watercourse and/or porous sub soils</li> <li>c) Attenuate by storing in tanks or sealed systems for gradual release to a watercourse</li> <li>d) Direct discharge to a watercourse</li> <li>e) Direct discharge to a surface water sewer</li> <li>f) Controlled discharge into the combined sewerage network ~ this option is a last resort when all other options have been discounted.</li> </ol>                                                                                                                                                                                                                                                  |                         |
| <p>The choice of system will be determined by local ground conditions (including groundwater levels). Whilst infiltration SuDS may be the most suitable for new development, developers must consider the risk of contamination to underlying aquifers.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         |

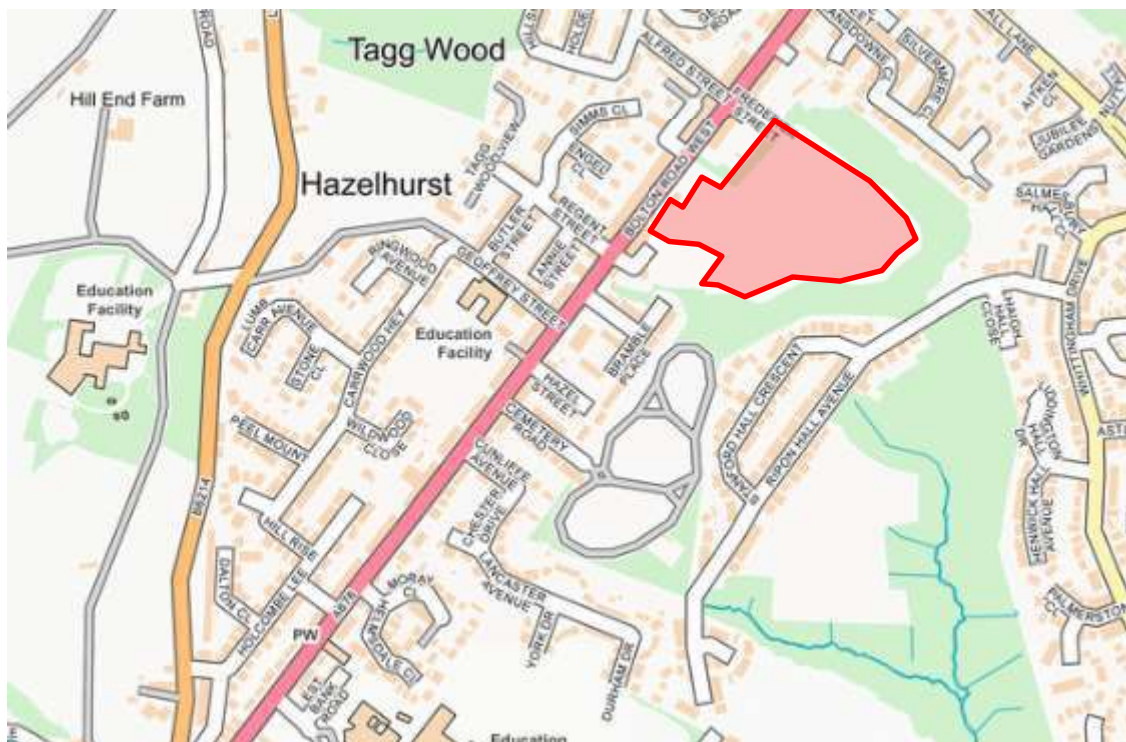
6. Local Planning Authorities are required to undertake a Strategic Flood Risk Assessment (SFRA). Such assessments will identify areas that are at risk from flooding and will also identify factors that influence both the current and future flood risk.
7. Where appropriate, evidence and recommendations from this report and the Local Plan have been incorporated into the FRA, prepared by Lynas Engineers, for the proposed development.

## Development Site

### General

1. The site lies to the east off Bolton Road West (A676), Ramsbottom, Bury.
2. The proposed site is currently occupied by grass playing fields, a concrete basketball court, a playground, 45 space car park and a pavilion with changing facilities.
3. The site is located at grid ref. SD783158 (co-ordinates X: 378318, Y: 415835) and the nearest postcode to the development site is BLO 9PE.
4. **Figure 4** below shows the approximate location of the proposed development, indicated by the red outline, in the context of the wider conurbation.

Figure 4 - Location Plan



5. The application site is 0.712hectares (ha) in area and will comprise of the installation of a new artificial grass pitch, an additional 26 parking spaces, an extension to the pavilion, new fencing, and improvements to the existing entrance off Bolton Road West.
6. In terms of the surrounding area, there are allotments bordering the southwest corner of the site, vegetation runs along the southeast, east, and northeast sides with residential units after those.

## Topography

1. A topographical survey on the existing site was commissioned by Steve Wells Associates in July 2022 and is available to view in **Appendix C**.
2. All information relating to levels presented in this report have been taken from this topographical survey.
3. There is an access road into the proposed development that starts from a junction at the northwest of the site. There are several grassed areas, including trees, along most side boundaries of the site.
4. The general topography of the site falls from west to the east.
5. The highest point on the survey is 166.10m AOD along the northwestern boundary of the site and the lowest point is 159.29m AOD on the eastern border.

## Hydrological Setting and Historical Flooding

1. The nearest body of water to the site is the River Irwell which is located approximately 390m to the east of site. Kay Brow Lodge, a recreation and wildlife area sits approximately 600m northeast of site.
2. The Flood and Water Management Act 2010, Section 21 requires lead Local Flood Authorities such as Greater Manchester Council to maintain a register of structures and features, which are likely to have a significant effect on flood risk within their area. At the time of writing this report, using the Level 1 Strategic Flood Risk Assessment for Greater Manchester, Lynas Engineers are not aware of any of these assets on the site.
3. The Bury Local Flood Risk Management Strategy, produced in April 2018 aims to increase awareness of local flood risks, identify how its partners can best work together to reduce this risk and provide an overview of flood risk management. This strategy combined with the Level 1 SFRA for Greater Manchester (March 2019) sets out the flood risk history of Ramsbottom and the authorities plan and strategy going forward.
4. Both reports mentioned can be viewed through the following links:

Bury Local Flood Risk Management Strategy

<https://www.bury.gov.uk/asset-library/local-flood-risk-mangement-strategy-2018.pdf>

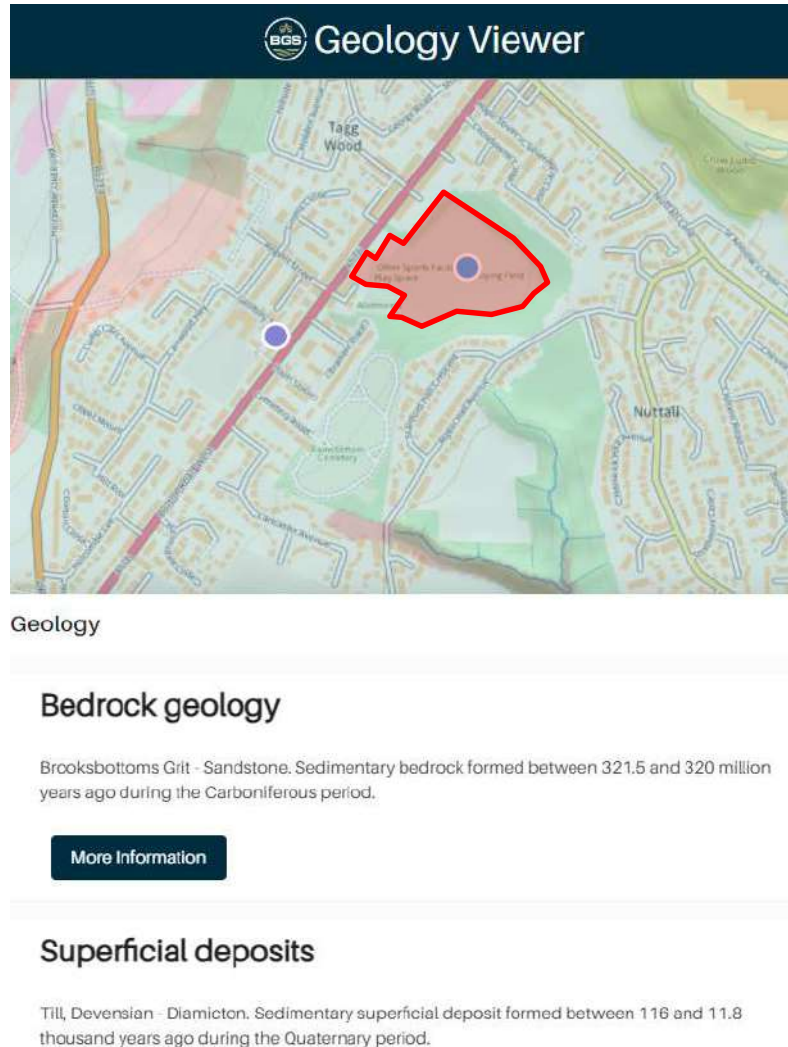
Level 1 SFRA for Greater Manchester

<https://www.greatermanchester-ca.gov.uk/GMCAFiles/PFE/Supporting%20documents/04%20Sustainable%20and%20Resilient%20Places/04.02.01%20GM%20Strategic%20Flood%20Risk%20Assessment%20Level%201%20Report.pdf>

## Hydrogeological Setting

1. Figure 5 is the record from the British Geological Survey's mapping system. The development site is represented by the red outline.

Figure 5 – Combined Site Geology

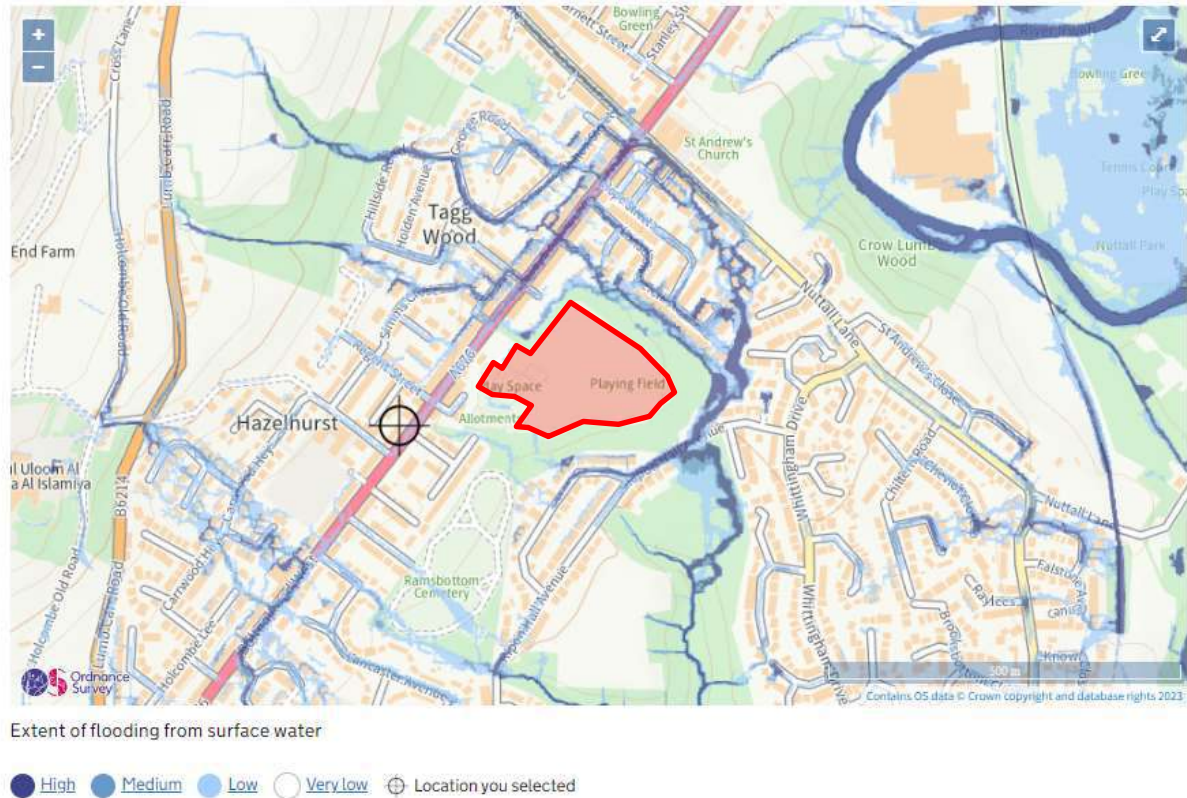


2. A review of the BGS mapping data identified that the development site is in an area which is underlain by superficial deposits of Devensian Till - Diamicton. The bedrock geology comprises of Brooksbottom Grit - Sandstone
3. Diamicton Till deposits are usually made up of a mixture of clay, sand, gravel and boulders varying in size and shape, these deposits have a slow permeability and are therefore, unlikely to be suitable for the use of infiltration as a drainage method.
4. According to the DEFRA Groundwater Vulnerability Map, the proposed development is not at risk of ground water flooding. This site has been classified as having a medium - low risk of groundwater vulnerability.

## Surface Water Flooding

1. Figure 6 shows the proposed site, outlined in red, in relation to the Environment Agency's surface water flooding records.
2. The site is in a very low risk area of surface water flooding.

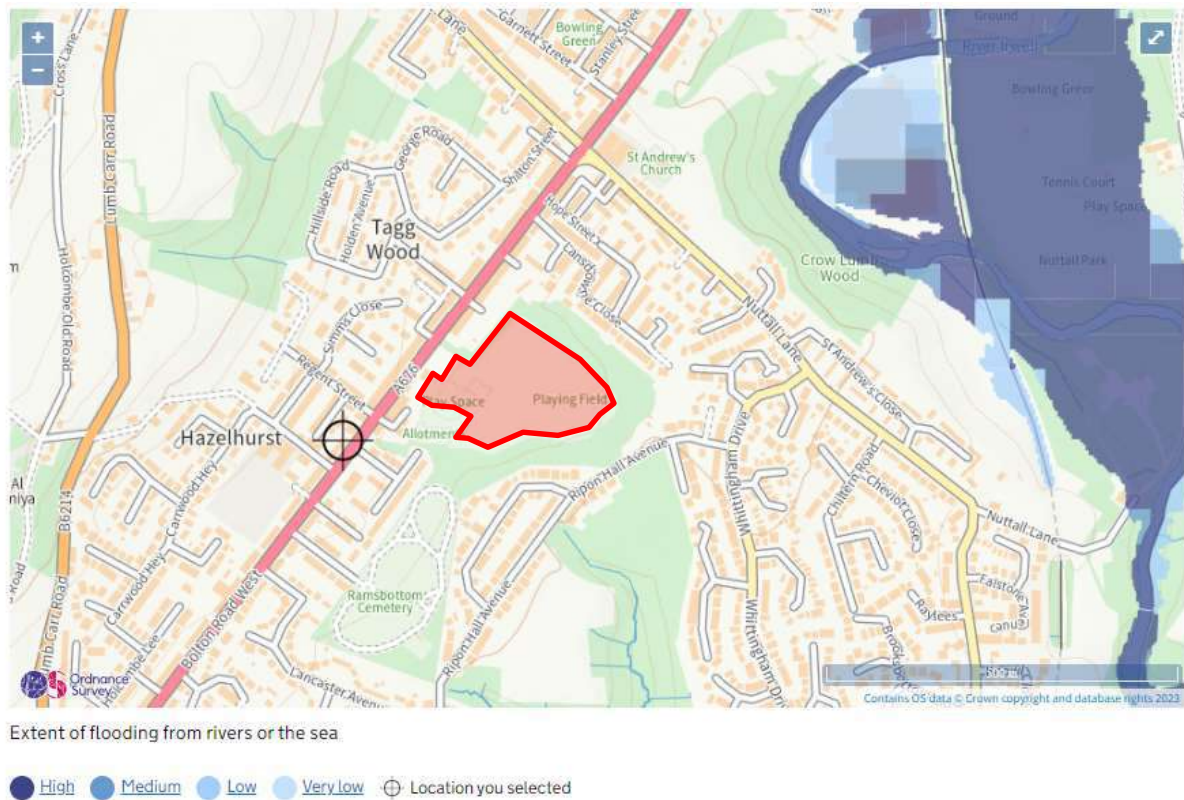
Figure 6 - Flood Risk from Surface Water



## Fluvial Flooding

1. Figure 7 shows the proposed site, outlined in red, in relation to the Environment Agency's River and sea flooding records.
2. The map indicates that the site is in Flood Zone 1 which has a very low risk of flooding from the river. The development site is not in a coastal location and therefore is not at risk of flooding from the sea.

Figure 7 - Flood Risk from Rivers or the Sea



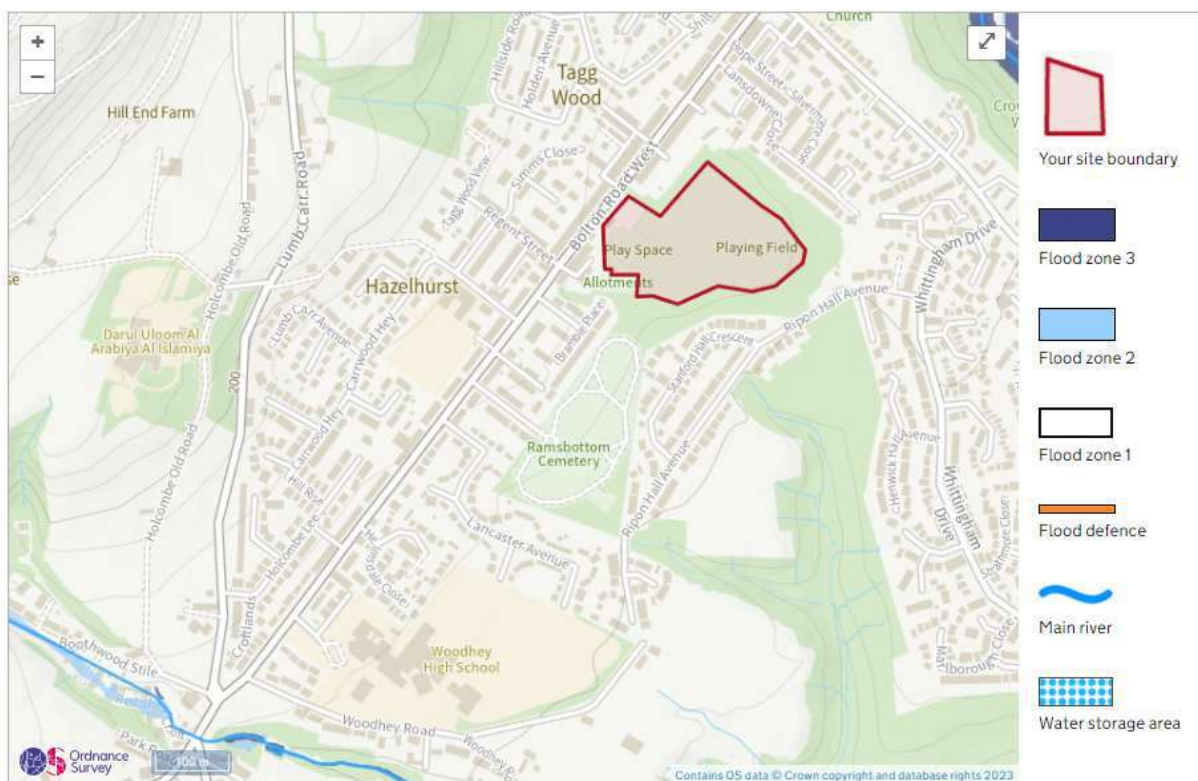
## Reservoir Flooding

1. The Environment Agency website shows the development site does not lie within the flooding extents should a reservoir breach occur.
2. The site is not at risk of flooding from a reservoir failure.

## Flood Zones

1. Flood zones show the probability of flooding without the presence of defences and significant man-made structures such as bridges, culverts, and rail and motorway embankments. They also show areas that may be at risk from flooding, and which might require further investigation in the form of an FRA to ascertain the exact risk of flooding the site.
2. The site sits within Flood Zone 1 which is currently defined by the Environment Agency as a low-risk zone and therefore should be treated as within a low-risk zone.
3. Figure 8 shows the Flood Zone for the proposed development. The extents of the development are outlined in red.

Figure 8 - Environment Agency Flood Zone Map



## Existing Drainage

### Surface Water Drainage

1. The existing United Utilities surface water drainage records are supplied in **Appendix D**.
2. Existing private surface water drainage records were not available at the time of writing this report.
3. It is assumed that the existing private surface water drainage system discharges into the adjacent UU sewer network in Bolton Road West.

### Foul Water Drainage

1. The existing United Utilities foul water drainage records are supplied in **Appendix D**.
2. Existing private foul water drainage records were not available at the time of writing this report.
3. It is assumed that the existing private foul water drainage system discharges into the adjacent UU sewer network in Bolton Road West.

## Proposed Drainage

### Outline Surface Water Drainage Strategy

1. The Proposed Drainage Strategy drawing *23061-LE-ZZ-05-DR-D-0001* is included in Appendix E.
2. The overall proposed impermeable area within the development is 0.712ha. 0.635ha from the proposed AGP, 0.071ha from the car park extension, and 0.006ha from the proposed pavilion extension. The proposed pavilion extension, at approximately 60m<sup>2</sup>, will be replacing two existing portacabins, at approximately 30m<sup>2</sup>; as this area will connect into the existing pavilion drainage system, it is deemed to be negligible and therefore not included within the MicroDrainage calculations.
3. Previously using the UK SuDS website's greenfield runoff tool, the maximum discharge from site for a 1 in 100-year storm event was restricted to Qbar (1 in 2.3 year storm) = 8.95l/s. However, under new planning conditions the maximum discharge from site for a 1 in 100-year storm event is restricted to 6.00l/s. The greenfield runoff calculation is shown in Appendix F.
4. **Appendices G, H, I and J** show the MicroDrainage Calculations, Drainage Exceedance Route, Standard Drainage Details, and SuDS Maintenance Plan, respectively.
5. The design life of the development is 20 years, therefore this falls within the central allowance for climate change as per the NPPF Climate Change guidance for peak rainfall intensity; a 35% CC rate has been used for the 1 in 30 year storm and a 40% CC rate has been used for the 1 in 100 year storm.
6. The philosophy of the surface water drainage is that the rainwater will be captured through the permeable AGP pitch which will percolate into the permeable lateral drains which will flow down to the southeast of the pitch where the flow will be directed west towards the car park.
7. The additional car park area will be captured by the means of traditional gullies and will be conveyed through a proposed petrol/oil interceptor to ensure water quality.
8. The surface water from both the pitch and car park will flow into a proposed hydrobrake chamber that will throttle discharge rates to the maximum 6.00l/s for a critical 1 in 100 year storm +40% CC. The flows will ultimately discharge into the United Utilities combined sewer to the west of the site, within Bolton Road West (A676).
9. The amount of storage required equates to 479.250m<sup>3</sup> of volume within the AGP pitch which equates to 250mm of Type 3 clean stone with 30% voids and 40mm open textured macadam at 30% voids. This amount of storage volume negates any flooding for a critical 1 in 30-year storm +35% climate change event and a 1 in 100-year storm +40% climate change event.
10. The required storage volume within the CellPave 40 porous car park equates to 16.863m<sup>3</sup>. This section of porous car park includes 40mm CellPave 40 filled with angular aggregate in ranges of 5mm-20mm at 30% voids, 35mm thick angular aggregate within range of 5mm-20mm at 30% voids, and 260mm thick sub-base layer – DoT type 3 granular fill at 30% voids. This amount of storage volume negates any flooding for a critical 1 in 30-year storm +35% climate change event and a 1 in 100-year storm +40% climate change event.

11. Based on the BGS mapping data it was identified that the development site is in an area which is underlain by superficial deposits of Devensian Till - Diamicton and is therefore unlikely to be suitable for the use of infiltration as a drainage method.

## Outline Foul Water Drainage Strategy

1. The proposed foul water drawing, produced by Steve Wells Associates, number 205-087-1010 is included in **Appendix E**.
2. There is a proposed pavilion extension of approximately 60m<sup>2</sup> which will include one additional toilet and one additional disabled toilet, as well as a small shower area. Given the nominal potential increase in foul flows associated with this part of the development, specific calculations have not been provided as part of this report.
3. The proposed foul drainage pipe from the extension will connect into the existing foul line adjacent to the existing pavilion building.
4. All proposed foul drainage will be designed and constructed in accordance with Building Regulations Part H and SSG Appendix C The Design and Construction Guidance.
5. Please refer to the aforementioned proposed foul water drawing for further information.

## Sustainable Drainage Systems

### 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).

### 2. SuDS 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.

### 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:

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

### 4. SuDS Site Constraints

SuDS techniques are not 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 both above and below ground.
- **Site Characteristics:** The cohesive nature of the underlying geology indicates that soakaways are unlikely to be a viable SuDS technique.
- **Catchment Characteristics:** The site is currently undeveloped and as such greenfield runoff rates will apply.
- **Environmental and Amenity Performance:** Safety to all future users is paramount when including SuDS within the overall development and so best practice guidance will be incorporated so that these devices blend into the surroundings without the need for significant safety precautions. Maintenance plans will be prepared for all SuDS devices that are included.

### 5. SuDS Methods

Figure 12 and Figure 13, on the next pages, 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.

Figure 12 - Surface SuDS Methods

| Method               | Comment                                                                                                                                                                                                     | Suitability for Development                                                                                                                                                                                                                                                                       |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Green Roofs          | <ul style="list-style-type: none"> <li>Can be used on suitable low-rise buildings to provide retention, attenuation and treatment of rainwater, and promotes evaporation and local biodiversity.</li> </ul> | <u>Not Suitable:</u> <ul style="list-style-type: none"> <li>Although useable their benefit would be insignificant for this project.</li> <li>Additional costs of installation would influence the feasibility of the development.</li> <li>Not relevant to this scheme.</li> </ul>                |
| Water Butts          | <ul style="list-style-type: none"> <li>Plastic tanks placed at the base of rainwater down pipes to collect rainwater runoff from the roof areas.</li> </ul>                                                 | <u>Not Suitable:</u> <ul style="list-style-type: none"> <li>Although useable they are not necessary for this scheme.</li> </ul>                                                                                                                                                                   |
| Rainwater Harvesting | <ul style="list-style-type: none"> <li>Rainwater harvesting reduces the total runoff volume from the developed site and reduces treated water consumption.</li> </ul>                                       | <u>Not Suitable:</u> <ul style="list-style-type: none"> <li>Additional costs of installation would have significant effect on viability of the development.</li> <li>Running and maintenance costs would likely not be acceptable to the client.</li> <li>Not relevant to this scheme.</li> </ul> |

**Figure 12 Continued - Surface SuDS Methods**

| Method                   | Comment                                                                                                                                                                                                                                                                                                                                                                                      | Suitability for Development                                                                                                                                                                                                                                                                                                                |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Infiltration Options     | <ul style="list-style-type: none"> <li>Reduces total run off volume from the development.</li> </ul>                                                                                                                                                                                                                                                                                         | <p><u>Not Suitable:</u></p> <ul style="list-style-type: none"> <li>Infiltration viability unknown.</li> <li>Percolation testing on-site required to confirm infiltration rate.</li> <li>BGS geology is not suitable.</li> </ul>                                                                                                            |
| Permeable Surfacing      | <ul style="list-style-type: none"> <li>Can be used to enhance quality of runoff water.</li> <li>Sub-base provides 'source' storage and reduces the volume of storage downstream.</li> <li>The storage can be created with selection of the stone fill or use of plastic box stems.</li> <li>Impermeable membrane at base of construction to prevent impact on pavement stability.</li> </ul> | <p><u>Suitable:</u></p> <ul style="list-style-type: none"> <li>Permeable surfacing is preferred due to specifics of scheme and AGP.</li> <li>Stone bedding with 30% voids can be used for storage and water quality.</li> <li>Infiltration in to below ground not deemed possible unless infiltration testing states otherwise.</li> </ul> |
| Swales, basins and ponds | <ul style="list-style-type: none"> <li>Provide areas for above ground surface runoff storage.</li> <li>Swales also allow filtering of particulate matter, improving water quality.</li> </ul>                                                                                                                                                                                                | <p><u>Not Suitable:</u></p> <ul style="list-style-type: none"> <li>The requirement for swales, basins and ponds are not necessary.</li> <li>Open green space is limited on the proposed site.</li> </ul>                                                                                                                                   |
| Bio-Retention            | <ul style="list-style-type: none"> <li>Collect and retain run-off to help improve water quality, prior to discharge in piped system on infiltration.</li> </ul>                                                                                                                                                                                                                              | <p><u>Not Suitable:</u></p> <ul style="list-style-type: none"> <li>Rain gardens could make an attractive feature while improving water quality but are not deemed necessary for this project.</li> </ul>                                                                                                                                   |

**Figure 13 - Sub-surface SuDS Methods**

| Method                          | Comment                                                                                                                                                                                                                                                                                                                                   | Suitability for Development                                                                                                                                                                                                                                                         |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Geocellular Storage             | <ul style="list-style-type: none"> <li>Suitable for sites with insufficient space for basins etc.</li> <li>Suitable for sites where topography prevents the use of open basins etc.</li> </ul>                                                                                                                                            | <p><u>Not Suitable:</u></p> <ul style="list-style-type: none"> <li>The use of geocellular attenuation could be used to possible to retain excess storm water. Use of ponds is preferred, but not suitable due to site constraints.</li> <li>Not relevant to this scheme.</li> </ul> |
| Large Diameter Pipes / Culverts | <ul style="list-style-type: none"> <li>Suitable for sites with insufficient space for basins etc.</li> <li>Provide a volume of below ground storage with a high void ratio and good man entry provision to allow for future maintenance and cleaning.</li> <li>Generally suitable for adoption by the statutory water company.</li> </ul> | <p><u>Suitable:</u></p> <ul style="list-style-type: none"> <li>The use of oversized pipes may be possible to retain excess storm water.</li> <li>Used primarily on adopted drainage networks so may be suitable for this development.</li> </ul>                                    |

#### 6. SuDS Hierarchal Approach

Based on the SuDS assessment in **Figure 12** and **Figure 13**, 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 (see **Figure 14**).

**Figure 14 - SuDS Hierarchal Approach**

| Method                            | Suitability | Suitability for Development                                                                                                                                      |
|-----------------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Infiltration to Ground            | No          | Underlying bedrock geology contains deposits of Devensian Till (boulder clay). Infiltration highly unlikely and therefore not feasible.                          |
| Connection to Watercourse         | No          | No watercourses are within the existing site boundary. Connection to a watercourse would require crossing third party land which is not considered feasible.     |
| Connection to Surface Water Sewer | Yes         | Existing private surface water manhole is located to the northeast of the site but will need more investigative works to confirm as suitable discharge location. |
| Connection to a Combined Sewer    | Yes         | UU combined sewer pipe is within existing site but not the current preferred method of discharge.                                                                |

## 7. SuDS Design Philosophy

The SuDS assessment and hierarchal approach discussed in **Figures 12, 13 and 14** have defined the overall SuDS strategy. Thus, the SuDS philosophy for the main development site is the promotion of Source Control and Site Control techniques, 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 any SuDS facilities.
- Site control mostly in the form an attenuation within AGP stone bedding.
- Connections into existing private drainage potentially possible downstream.

## Conclusion

### Flood Risk Assessment

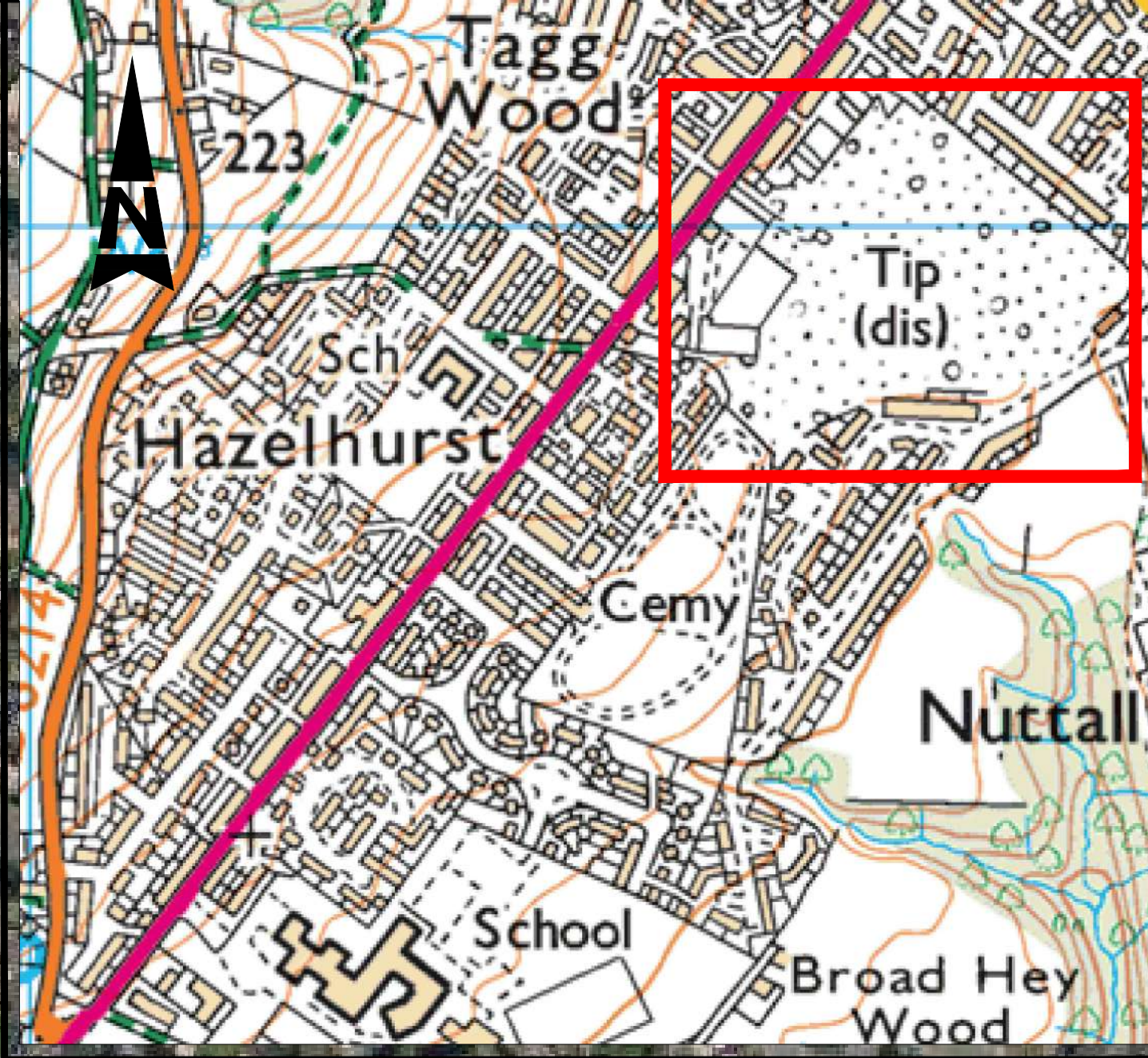
1. The risk of river, reservoir, groundwater, and surface water runoff has been assessed and measures have been recommended to minimise this flood risk to/from the site.
2. In summary:
  - The proposed development site is located inside Flood Zone 1 and is therefore currently defined as land having a less than 1 in 1,000 annual probability of river or sea flooding;
  - There are no records of fluvial flooding, or sewer surface water flooding at the existing site;
  - There is no risk of a reservoir breach flooding the site when river levels are normal;
  - The site is not affected by groundwater flooding;
  - The proposals for the site will not impact on the current flood risk.
  - The proposals have minimal impact on increasing the existing flood risk from any source, with minimal impact of causing flooding elsewhere.
  - Using Table C to determine the appropriateness of the drainage, it is concluded that the development is appropriate.

Table C. Appropriateness of Development

| Source/Pathway                    | Significant? | Comment/Reason                                                                                                                                                        |
|-----------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tidal/Coastal                     | No           | The site is not located in a coastal location; therefore, the development has a very low risk of tidal/coastal flooding.                                              |
| Pluvial                           | No           | Environment Agency Mapping indicates that the probability surface water flooding is classified as very low.                                                           |
| Fluvial                           | No           | Environment Agency Mapping indicates that the risk of flooding from nearby rivers is classified as very low.                                                          |
| Infrastructure Failure: Reservoir | No           | Environment Agency Mapping indicates that the development site does not lie within the flooding extents should a reservoir breach occur when river levels are normal. |

## Appendices

## Appendix A – Location Plan

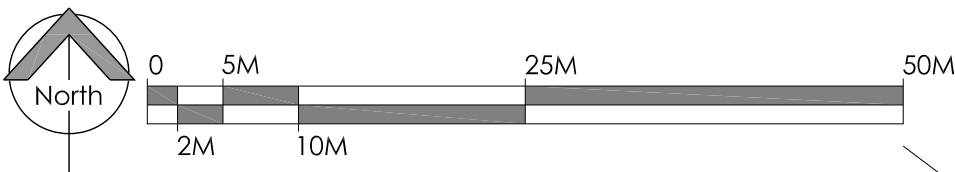


- GENERAL NOTES:
1. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, ENGINEERS, ARCHITECTS & SERVICES DRAWINGS, INCLUDING APPROVED BUILDERS WORK DRAWINGS. CONTRACTOR TO NOTIFY ENGINEER OF DISCREPANCIES BETWEEN STRUCTURAL DRAWINGS AND SPECIFICATIONS OR OTHER DRAWINGS.
  2. DO NOT SCALE FROM THIS DRAWING. WORK TO DIMENSIONS OR CO-ORDINATES PROVIDED. ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE NOTED. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS, SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY.

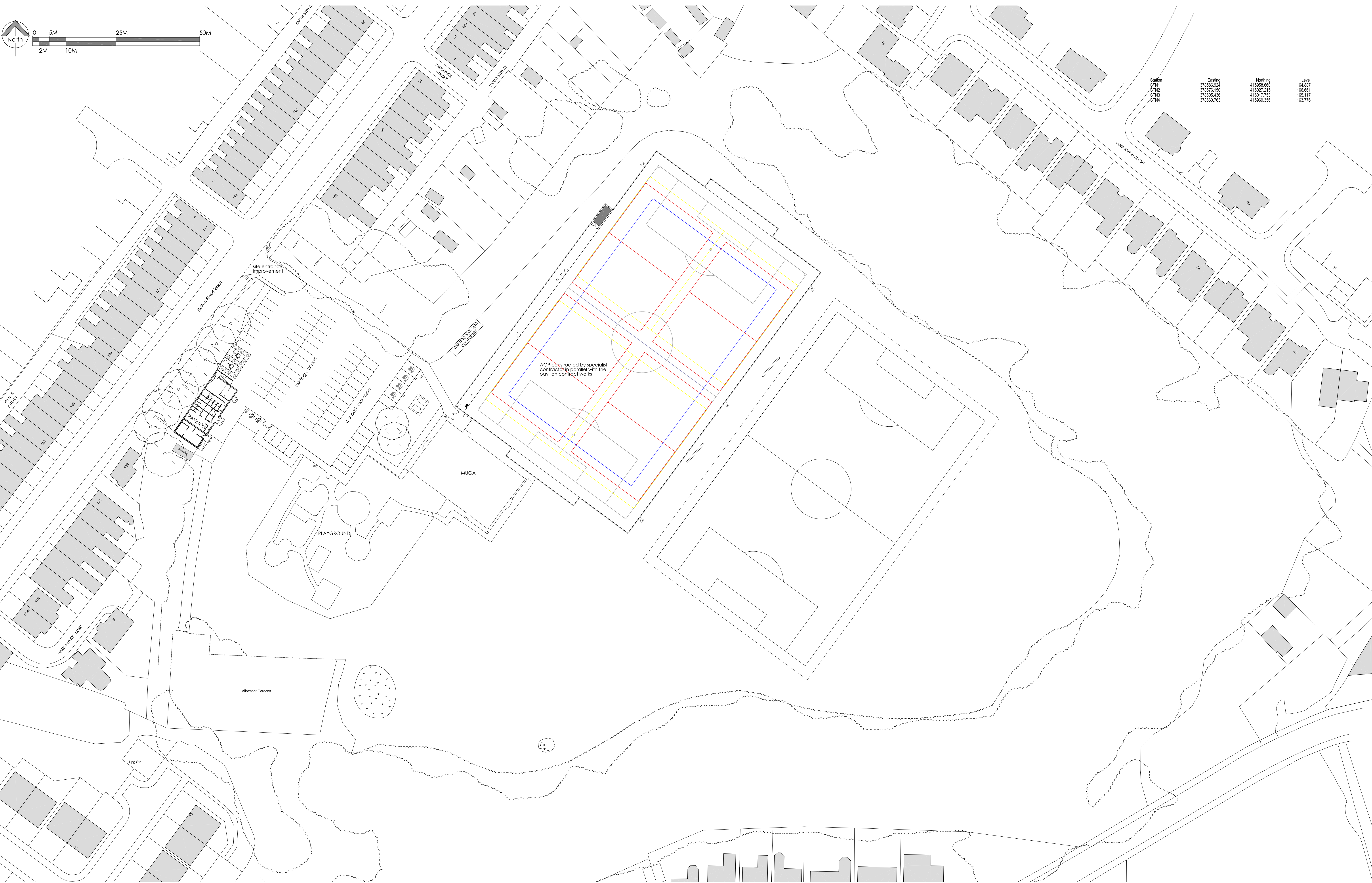
EASTINGS: 378703, NORTHINGS: 415953  
NEAREST POSTCODE: BL0 9NX  
GRID REF: SD787159

|                                                                                                                                                                                                                                             |                          |                |               |               |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------|---------------|---------------|------|
|                                                                                                                                                                                                                                             |                          |                |               |               |      |
|                                                                                                                                                                                                                                             |                          |                |               |               |      |
|                                                                                                                                                                                                                                             |                          |                |               |               |      |
|                                                                                                                                                                                                                                             |                          |                |               |               |      |
|                                                                                                                                                                                                                                             |                          |                |               |               |      |
| S2                                                                                                                                                                                                                                          | FOR INFORMATION          |                | 03.10.23      | WF            |      |
| Stat                                                                                                                                                                                                                                        | Purpose of Issue         |                | Date          | Auth          |      |
|                                                                                                                                                                                                                                             |                          |                |               |               |      |
|                                                                                                                                                                                                                                             |                          |                |               |               |      |
|                                                                                                                                                                                                                                             |                          |                |               |               |      |
|                                                                                                                                                                                                                                             |                          |                |               |               |      |
| P01                                                                                                                                                                                                                                         | FIRST ISSUE              | WO             | 03.10.23      | WF            | WF   |
| Rev                                                                                                                                                                                                                                         | Description              | By             | Date          | Chk'd         | Auth |
| <div><div><div>LYNAS</div><div>ENGINEERS</div></div><div>Lynas Engineers<br/>Wilton Centre<br/>Redcar<br/>TS10 4RF<br/>Tel: +44 (0)1642 438273<br/>www.lynasengineers.com</div></div> <div>Copyright © Lynas Engineers Limited (2020)</div> |                          |                |               |               |      |
| Client <div><div><div></div><div>STEVE WELLS</div><div>ASSOCIATES</div><div>making sport happen</div></div></div>                                                                                                                           |                          |                |               |               |      |
| Project <div>TOP PARK, BURY</div>                                                                                                                                                                                                           |                          |                |               |               |      |
| Title <div>SITE LOCATION PLAN</div>                                                                                                                                                                                                         |                          |                |               |               |      |
| Sheet Size                                                                                                                                                                                                                                  | Original Scale           | Designed/Drawn | Checked       | Authorised    |      |
| A1                                                                                                                                                                                                                                          | 1:1000                   | WO             | WF            | WF            |      |
|                                                                                                                                                                                                                                             |                          | Date 03.10.23  | Date 03.10.23 | Date 03.10.23 |      |
| Status                                                                                                                                                                                                                                      | Drawing Number           |                |               |               | Rev  |
| S2                                                                                                                                                                                                                                          | 23061-LE-ZZ-00-DR-D-0001 |                |               |               | P01  |

## Appendix B – Proposed Development Layout



| Station | Easting    | Northing   | Level   |
|---------|------------|------------|---------|
| STN1    | 378586.924 | 415958.660 | 164.887 |
| STN2    | 378576.150 | 416027.215 | 166.861 |
| STN3    | 378605.436 | 416017.753 | 165.117 |
| STN4    | 378660.763 | 415969.356 | 163.776 |



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General Notes

| No. | Revision / Issue | Date |
|-----|------------------|------|
|-----|------------------|------|

|                                                                                             |
|---------------------------------------------------------------------------------------------|
| Issue Purpose                                                                               |
| Tender                                                                                      |
| Client                                                                                      |
| Bury Council                                                                                |
| Project                                                                                     |
| Proposed Pavilion Extension at<br>Top Park, Bolton Road West<br>Ramsbottom, Bury<br>BL0 9PE |



**STEVE WELLS**  
**ASSOCIATES**  
*making sport happen*

Churchill House, Mill Hill, Pontefract, West Yorkshire,  
WF8 4HY 1: 01977 797258 e: [mail@stevewells-associates.com](mailto:mail@stevewells-associates.com)

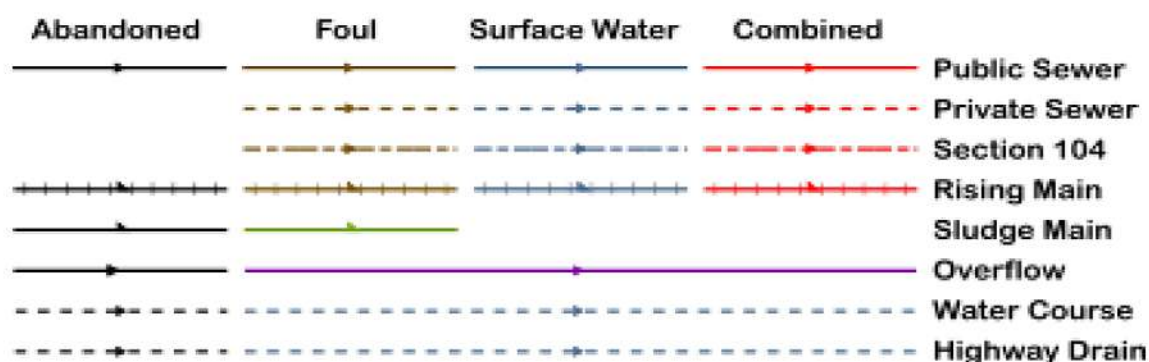
|            |                    |               |
|------------|--------------------|---------------|
| Dwg. Title | Proposed Site Plan |               |
| Dwg. No.   | 205-087-3005       | Rev.          |
| Scale      | 1:500 @ A1         | Date          |
| Drawn by   | GSB                | February 2024 |
| Checked    |                    |               |
|            |                    | DKW           |

## Appendix C – Topographical Survey Plan



## Appendix D – Existing United Utilities Drainage Layout

## Wastewater Symbolology



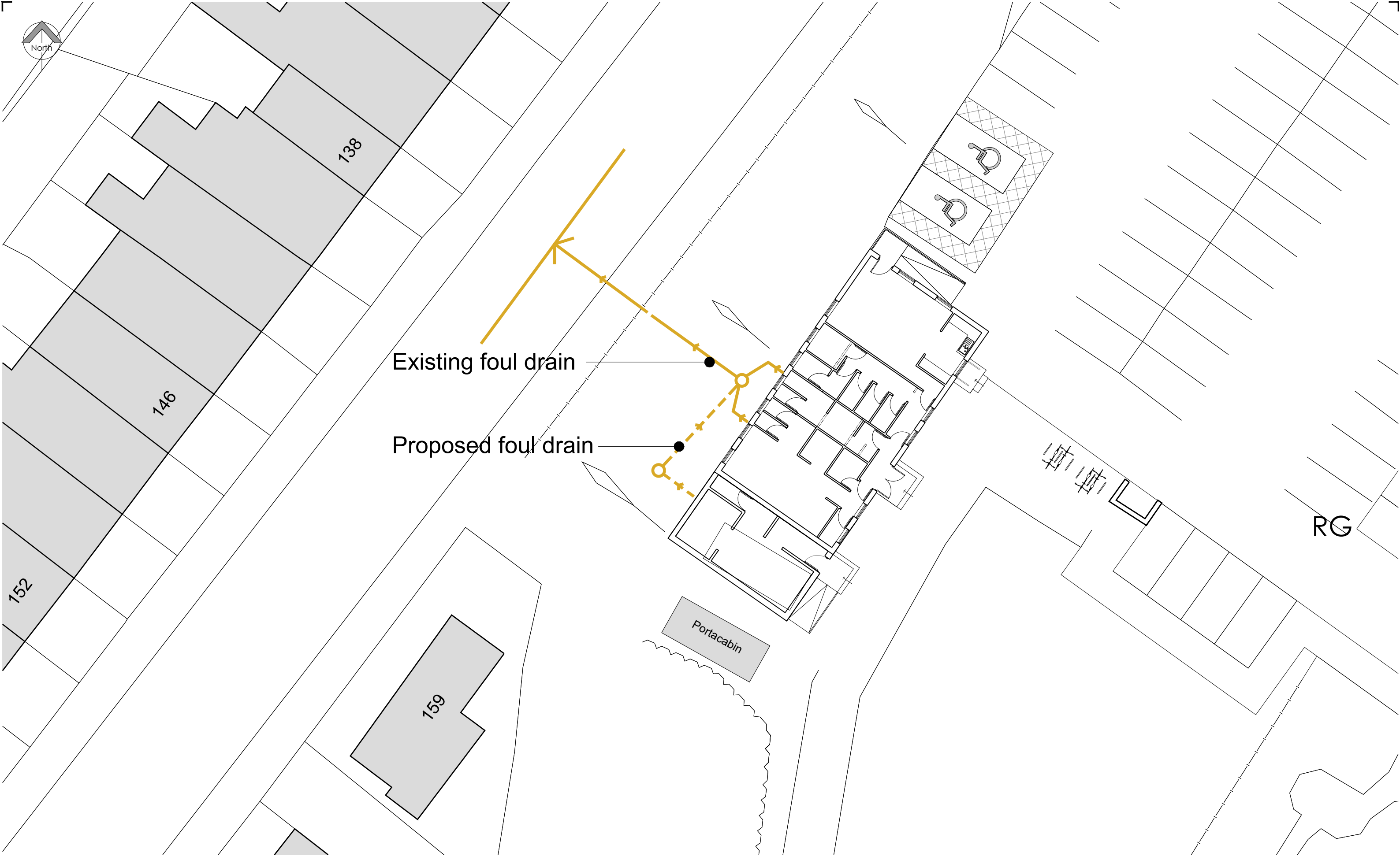
All point assets follow the standard colour convention: **red** – combined **brown** - foul  
**blue** – surface water **purple** - overflow

|                         |                                 |
|-------------------------|---------------------------------|
| <b>Manhole</b>          | <b>Side Entry Manhole</b>       |
| <b>Head of System</b>   | <b>Outfall</b>                  |
| <b>Extent of Survey</b> | <b>Screen Chamber</b>           |
| <b>Rodding Eye</b>      | <b>Inspection Chamber</b>       |
| <b>Inlet</b>            | <b>Bifurcation Chamber</b>      |
| <b>Discharge Point</b>  | <b>Lamp Hole</b>                |
| <b>Vortex</b>           | <b>T Junction / Saddle</b>      |
| <b>Penstock</b>         | <b>Catchpit</b>                 |
| <b>Washout Chamber</b>  | <b>Valve Chamber</b>            |
| <b>Valve</b>            | <b>Vent Column</b>              |
| <b>Air Valve</b>        | <b>Vortex Chamber</b>           |
| <b>Non Return Valve</b> | <b>Penstock Chamber</b>         |
| <b>Soakaway</b>         | <b>Network Storage Tank</b>     |
| <b>Gully</b>            | <b>Sewer Overflow</b>           |
| <b>Cascade</b>          | <b>Ww Treatment Works</b>       |
| <b>Flow Meter</b>       | <b>Ww Pumping Station</b>       |
| <b>Hatch Box</b>        | <b>Septic Tank</b>              |
| <b>Oil Interceptor</b>  | <b>Control Kiosk</b>            |
| <b>Summit</b>           |                                 |
| <b>Drop Shaft</b>       | <b>Change of Characteristic</b> |
| <b>Orifice Plate</b>    |                                 |



## Appendix E – Proposed Drainage Layout





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Dwg. Purpose **Planning**

| No. | Revision / Issue | Date |
|-----|------------------|------|
|     |                  |      |

Project  
**Proposed AGP and Pavilion Extension**  
**Top Park, Bolton Road West**  
**Ramsbottom, Bury**  
**BL0 9PE**

Client  
**Bury Council**

Dwg. Title  
**Proposed Foul Drainage Plan**

 **STEVE WELLS ASSOCIATES**  
*making sport happen*

Churchill House, Mill Hill, Pontefract, West Yorkshire,  
WF8 4HY t : 01977 797258 e : [mail@stevewells-associates.com](mailto:mail@stevewells-associates.com)

|                              |                         |               |
|------------------------------|-------------------------|---------------|
| Dwg. No. <b>205-087-1010</b> |                         | Rev. <b> </b> |
| Scale <b>1:500 @ A3</b>      | Date <b>August 2023</b> |               |
| Drawn by <b>GSB</b>          | Checked <b>DKW</b>      |               |

## Appendix F – Greenfield run-off Calculation

|                |            |
|----------------|------------|
| Calculated by: | Max Robson |
| Site name:     | Top Park   |
| Site location: | Bury       |

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

## Site Details

|            |                   |
|------------|-------------------|
| Latitude:  | 53.64022° N       |
| Longitude: | 2.3236° W         |
| Reference: | 3833461790        |
| Date:      | Oct 03 2023 15:49 |

## Runoff estimation approach

IH124

## Site characteristics

|                       |       |
|-----------------------|-------|
| Total site area (ha): | 0.706 |
|-----------------------|-------|

## Methodology

|                              |                             |
|------------------------------|-----------------------------|
| $Q_{BAR}$ estimation method: | Calculate from SPR and SAAR |
| SPR estimation method:       | Calculate from SOIL type    |

## Soil characteristics

|              | Default | Edited |
|--------------|---------|--------|
| SOIL type:   | 5       | 5      |
| HOST class:  | N/A     | N/A    |
| SPR/SPRHOST: | 0.53    | 0.53   |

## Hydrological characteristics

|                                | Default | Edited |
|--------------------------------|---------|--------|
| SAAR (mm):                     | 1278    | 1278   |
| Hydrological region:           | 10      | 10     |
| Growth curve factor 1 year:    | 0.87    | 0.87   |
| Growth curve factor 30 years:  | 1.7     | 1.7    |
| Growth curve factor 100 years: | 2.08    | 2.08   |
| Growth curve factor 200 years: | 2.37    | 2.37   |

## Notes

### (1) Is $Q_{BAR} < 2.0$ l/s/ha?

When  $Q_{BAR}$  is  $< 2.0$  l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

### (2) Are flow rates $< 5.0$ l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

### (3) Is $SPR/SPRHOST \leq 0.3$ ?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

## Greenfield runoff rates

Default

Edited

|                               |       |       |
|-------------------------------|-------|-------|
| <b>Q<sub>BAR</sub> (l/s):</b> | 8.95  | 8.95  |
| <b>1 in 1 year (l/s):</b>     | 7.78  | 7.78  |
| <b>1 in 30 years (l/s):</b>   | 15.21 | 15.21 |
| <b>1 in 100 year (l/s):</b>   | 18.61 | 18.61 |
| <b>1 in 200 years (l/s):</b>  | 21.2  | 21.2  |

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at [www.uksuds.com](http://www.uksuds.com). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at [www.uksuds.com/terms-and-conditions.htm](http://www.uksuds.com/terms-and-conditions.htm). The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

## Appendix G – MicroDrainage Calculations

|                                         |                         |                                                                                    |
|-----------------------------------------|-------------------------|------------------------------------------------------------------------------------|
| Lynas Engineers                         |                         | Page 1                                                                             |
| Wilton Centre                           | Top Park, Bury          |  |
| Redcar                                  | Surface Water           |                                                                                    |
| TS10 4RF                                | Drainage Design Rev-P02 |                                                                                    |
| Date 05/04/2024                         | Designed by MR          |                                                                                    |
| File 23061-LE-ZZ-05-CA-D-0001-SURFAC... | Checked by WF           |                                                                                    |
| XP Solutions                            | Network 2018.1          |                                                                                    |

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

|                                        |        |                                       |        |
|----------------------------------------|--------|---------------------------------------|--------|
| FSR Rainfall Model - England and Wales |        |                                       |        |
| Return Period (years)                  | 100    | PIMP (%)                              | 100    |
| M5-60 (mm)                             | 19.000 | Add Flow / Climate Change (%)         | 40     |
| Ratio R                                | 0.250  | Minimum Backdrop Height (m)           | 20.000 |
| Maximum Rainfall (mm/hr)               | 50     | Maximum Backdrop Height (m)           | 20.000 |
| Maximum Time of Concentration (mins)   | 30     | Min Design Depth for Optimisation (m) | 1.200  |
| Foul Sewage (l/s/ha)                   | 0.000  | Min Vel for Auto Design only (m/s)    | 1.00   |
| Volumetric Runoff Coeff.               | 0.750  | Min Slope for Optimisation (1:X)      | 500    |

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

| PN      | Length<br>(m) | Fall<br>(m) | Slope<br>(1:X) | I.Area<br>(ha) | T.E.<br>(mins) | Base<br>Flow (l/s) | k<br>(mm) | HYD<br>SECT | DIA<br>(mm) | Section Type | Auto<br>Design                                                                        |
|---------|---------------|-------------|----------------|----------------|----------------|--------------------|-----------|-------------|-------------|--------------|---------------------------------------------------------------------------------------|
| SW1.000 | 2.600         | 0.006       | 433.3          | 0.000          | 5.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.001 | 10.000        | 0.020       | 500.0          | 0.071          | 0.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.002 | 10.000        | 0.020       | 500.0          | 0.063          | 0.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.003 | 10.000        | 0.020       | 500.0          | 0.062          | 0.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.004 | 10.000        | 0.020       | 500.0          | 0.061          | 0.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.005 | 10.000        | 0.020       | 500.0          | 0.063          | 0.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.006 | 10.000        | 0.020       | 500.0          | 0.063          | 0.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.007 | 10.000        | 0.020       | 500.0          | 0.063          | 0.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.008 | 10.000        | 0.020       | 500.0          | 0.069          | 0.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.009 | 10.000        | 0.020       | 500.0          | 0.061          | 0.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.010 | 5.200         | 0.010       | 520.0          | 0.063          | 0.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.011 | 93.073        | 0.303       | 306.9          | 0.000          | 0.00           | 0.0                | 0.600     | o           | 375         | Pipe/Conduit |  |
| SW2.000 | 29.682        | 0.297       | 100.0          | 0.072          | 5.00           | 0.0                | 0.600     | o           | 160         | Pipe/Conduit |  |
| SW1.012 | 48.264        | 0.157       | 306.9          | 0.040          | 0.00           | 0.0                | 0.600     | o           | 375         | Pipe/Conduit |  |

Network Results Table

| PN      | Rain<br>(mm/hr) | T.C.<br>(mins) | US/IL<br>(m) | Σ I.Area<br>(ha) | Σ Base<br>Flow (l/s) | Foul<br>(l/s) | Add Flow<br>(l/s) | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s) |
|---------|-----------------|----------------|--------------|------------------|----------------------|---------------|-------------------|--------------|--------------|---------------|
| SW1.000 | 50.00           | 5.09           | 162.646      | 0.000            | 0.0                  | 0.0           | 0.0               | 0.50         | 10.0         | 0.0           |
| SW1.001 | 50.00           | 5.45           | 162.640      | 0.071            | 0.0                  | 0.0           | 3.9               | 0.46         | 9.3«         | 13.5          |
| SW1.002 | 50.00           | 5.81           | 162.620      | 0.134            | 0.0                  | 0.0           | 7.3               | 0.46         | 9.3«         | 25.5          |
| SW1.003 | 50.00           | 6.17           | 162.600      | 0.197            | 0.0                  | 0.0           | 10.6              | 0.46         | 9.3«         | 37.3          |
| SW1.004 | 50.00           | 6.53           | 162.580      | 0.258            | 0.0                  | 0.0           | 14.0              | 0.46         | 9.3«         | 48.9          |
| SW1.005 | 50.00           | 6.89           | 162.560      | 0.321            | 0.0                  | 0.0           | 17.4              | 0.46         | 9.3«         | 60.9          |
| SW1.006 | 50.00           | 7.25           | 162.540      | 0.385            | 0.0                  | 0.0           | 20.8              | 0.46         | 9.3«         | 72.9          |
| SW1.007 | 50.00           | 7.61           | 162.520      | 0.448            | 0.0                  | 0.0           | 24.3              | 0.46         | 9.3«         | 84.9          |
| SW1.008 | 50.00           | 7.97           | 162.500      | 0.517            | 0.0                  | 0.0           | 28.0              | 0.46         | 9.3«         | 98.0          |
| SW1.009 | 50.00           | 8.33           | 162.480      | 0.578            | 0.0                  | 0.0           | 31.3              | 0.46         | 9.3«         | 109.7         |
| SW1.010 | 50.00           | 8.52           | 162.470      | 0.641            | 0.0                  | 0.0           | 34.7              | 0.45         | 9.1«         | 121.6         |
| SW1.011 | 50.00           | 10.03          | 162.460      | 0.641            | 0.0                  | 0.0           | 34.7              | 1.03         | 113.6«       | 121.6         |
| SW2.000 | 50.00           | 5.47           | 164.374      | 0.072            | 0.0                  | 0.0           | 3.9               | 1.05         | 21.1         | 13.7          |
| SW1.012 | 50.00           | 10.81          | 162.157      | 0.754            | 0.0                  | 0.0           | 40.8              | 1.03         | 113.6«       | 142.9         |

Manhole Schedules for Storm

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam., L*W (mm) | PN      | Pipe Out Invert Level (m) | Diameter (mm) | PN      | Pipes In Invert Level (m) | Diameter (mm) | Backdrop (mm) |
|---------|-----------|--------------|---------------|--------------------|---------|---------------------------|---------------|---------|---------------------------|---------------|---------------|
| SWS1.01 | 163.187   | 0.541        | Junction      |                    | SW1.000 | 162.646                   | 160           |         |                           |               |               |
| SWS1.02 | 163.165   | 0.525        | Junction      |                    | SW1.001 | 162.640                   | 160           | SW1.000 | 162.640                   | 160           |               |
| SWS1.03 | 163.165   | 0.545        | Junction      |                    | SW1.002 | 162.620                   | 160           | SW1.001 | 162.620                   | 160           |               |
| SWS1.04 | 163.165   | 0.565        | Junction      |                    | SW1.003 | 162.600                   | 160           | SW1.002 | 162.600                   | 160           |               |
| SWS1.05 | 163.165   | 0.585        | Junction      |                    | SW1.004 | 162.580                   | 160           | SW1.003 | 162.580                   | 160           |               |
| SWS1.06 | 163.165   | 0.605        | Junction      |                    | SW1.005 | 162.560                   | 160           | SW1.004 | 162.560                   | 160           |               |
| SWS1.07 | 163.165   | 0.625        | Junction      |                    | SW1.006 | 162.540                   | 160           | SW1.005 | 162.540                   | 160           |               |
| SWS1.08 | 163.165   | 0.645        | Junction      |                    | SW1.007 | 162.520                   | 160           | SW1.006 | 162.520                   | 160           |               |
| SWS1.09 | 163.165   | 0.665        | Junction      |                    | SW1.008 | 162.500                   | 160           | SW1.007 | 162.500                   | 160           |               |
| SWS1.10 | 163.165   | 0.685        | Junction      |                    | SW1.009 | 162.480                   | 160           | SW1.008 | 162.480                   | 160           |               |
| SWS1.11 | 163.165   | 0.705        | Junction      |                    | SW1.010 | 162.470                   | 160           | SW1.009 | 162.460                   | 160           |               |
| SWS1.12 | 163.215   | 0.755        | Junction      |                    | SW1.011 | 162.460                   | 375           | SW1.010 | 162.460                   | 160           |               |
| SWS1.13 | 164.874   | 0.500        | Open Manhole  | 1200               | SW2.000 | 164.374                   | 160           |         |                           |               |               |
| SWS1.14 | 164.776   | 2.619        | Open Manhole  | 1350               | SW1.012 | 162.157                   | 375           | SW1.011 | 162.157                   | 375           |               |
|         |           |              |               |                    |         |                           |               | SW2.000 | 164.077                   | 160           | 1705          |
| SW      | 166.100   | 4.100        | Open Manhole  | 0                  |         | OUTFALL                   |               | SW1.012 | 162.000                   | 375           |               |

PIPELINE SCHEDULES for Storm

Upstream Manhole

| PN      | Hyd<br>Sect | Diam<br>(mm) | MH<br>Name | C.Level<br>(m) | I.Level<br>(m) | D.Depth<br>(m) | MH<br>Connection | MH DIAM., L*W<br>(mm) |
|---------|-------------|--------------|------------|----------------|----------------|----------------|------------------|-----------------------|
| SW1.000 | o           | 160          | SWS1.01    | 163.187        | 162.646        | 0.381          | Junction         |                       |
| SW1.001 | o           | 160          | SWS1.02    | 163.165        | 162.640        | 0.365          | Junction         |                       |
| SW1.002 | o           | 160          | SWS1.03    | 163.165        | 162.620        | 0.385          | Junction         |                       |
| SW1.003 | o           | 160          | SWS1.04    | 163.165        | 162.600        | 0.405          | Junction         |                       |
| SW1.004 | o           | 160          | SWS1.05    | 163.165        | 162.580        | 0.425          | Junction         |                       |
| SW1.005 | o           | 160          | SWS1.06    | 163.165        | 162.560        | 0.445          | Junction         |                       |
| SW1.006 | o           | 160          | SWS1.07    | 163.165        | 162.540        | 0.465          | Junction         |                       |
| SW1.007 | o           | 160          | SWS1.08    | 163.165        | 162.520        | 0.485          | Junction         |                       |
| SW1.008 | o           | 160          | SWS1.09    | 163.165        | 162.500        | 0.505          | Junction         |                       |
| SW1.009 | o           | 160          | SWS1.10    | 163.165        | 162.480        | 0.525          | Junction         |                       |
| SW1.010 | o           | 160          | SWS1.11    | 163.165        | 162.470        | 0.535          | Junction         |                       |
| SW1.011 | o           | 375          | SWS1.12    | 163.215        | 162.460        | 0.380          | Junction         |                       |
| SW2.000 | o           | 160          | SWS1.13    | 164.874        | 164.374        | 0.340          | Open Manhole     | 1200                  |
| SW1.012 | o           | 375          | SWS1.14    | 164.776        | 162.157        | 2.244          | Open Manhole     | 1350                  |

Downstream Manhole

| PN      | Length<br>(m) | Slope<br>(1:X) | MH<br>Name | C.Level<br>(m) | I.Level<br>(m) | D.Depth<br>(m) | MH<br>Connection | MH DIAM., L*W<br>(mm) |
|---------|---------------|----------------|------------|----------------|----------------|----------------|------------------|-----------------------|
| SW1.000 | 2.600         | 433.3          | SWS1.02    | 163.165        | 162.640        | 0.365          | Junction         |                       |
| SW1.001 | 10.000        | 500.0          | SWS1.03    | 163.165        | 162.620        | 0.385          | Junction         |                       |
| SW1.002 | 10.000        | 500.0          | SWS1.04    | 163.165        | 162.600        | 0.405          | Junction         |                       |
| SW1.003 | 10.000        | 500.0          | SWS1.05    | 163.165        | 162.580        | 0.425          | Junction         |                       |
| SW1.004 | 10.000        | 500.0          | SWS1.06    | 163.165        | 162.560        | 0.445          | Junction         |                       |
| SW1.005 | 10.000        | 500.0          | SWS1.07    | 163.165        | 162.540        | 0.465          | Junction         |                       |
| SW1.006 | 10.000        | 500.0          | SWS1.08    | 163.165        | 162.520        | 0.485          | Junction         |                       |
| SW1.007 | 10.000        | 500.0          | SWS1.09    | 163.165        | 162.500        | 0.505          | Junction         |                       |
| SW1.008 | 10.000        | 500.0          | SWS1.10    | 163.165        | 162.480        | 0.525          | Junction         |                       |
| SW1.009 | 10.000        | 500.0          | SWS1.11    | 163.165        | 162.460        | 0.545          | Junction         |                       |
| SW1.010 | 5.200         | 520.0          | SWS1.12    | 163.215        | 162.460        | 0.595          | Junction         |                       |
| SW1.011 | 93.073        | 306.9          | SWS1.14    | 164.776        | 162.157        | 2.244          | Open Manhole     | 1350                  |
| SW2.000 | 29.682        | 100.0          | SWS1.14    | 164.776        | 164.077        | 0.539          | Open Manhole     | 1350                  |
| SW1.012 | 48.264        | 306.9          | SW         | 166.100        | 162.000        | 3.725          | Open Manhole     | 0                     |

Area Summary for Storm

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|-------------|-----------|-----------|----------|-----------------|----------------|-----------------|
| 1.000       | -         | -         | 100      | 0.000           | 0.000          | 0.000           |
| 1.001       | User      | -         | 100      | 0.071           | 0.071          | 0.071           |
| 1.002       | User      | -         | 100      | 0.063           | 0.063          | 0.063           |
| 1.003       | User      | -         | 100      | 0.062           | 0.062          | 0.062           |
| 1.004       | User      | -         | 100      | 0.061           | 0.061          | 0.061           |
| 1.005       | User      | -         | 100      | 0.063           | 0.063          | 0.063           |
| 1.006       | User      | -         | 100      | 0.063           | 0.063          | 0.063           |
| 1.007       | User      | -         | 100      | 0.063           | 0.063          | 0.063           |
| 1.008       | User      | -         | 100      | 0.069           | 0.069          | 0.069           |
| 1.009       | User      | -         | 100      | 0.061           | 0.061          | 0.061           |
| 1.010       | User      | -         | 100      | 0.063           | 0.063          | 0.063           |
| 1.011       | -         | -         | 100      | 0.000           | 0.000          | 0.000           |
| 2.000       | User      | -         | 100      | 0.072           | 0.072          | 0.072           |
| 1.012       | -         | -         | 100      | 0.040           | 0.040          | 0.040           |
|             |           |           |          | Total           | Total          | Total           |
|             |           |           |          | 0.754           | 0.754          | 0.754           |

Free Flowing Outfall Details for Storm

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---------------------|--------------|--------------|--------------|------------------|----------|--------|
| SW1.012             | SW           | 166.100      | 162.000      | 162.000          | 0        | 0      |

Online Controls for Storm

Orifice Manhole: SWS1.12, DS/PN: SW1.011, Volume (m³): 0.1

Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 162.460

Hydro-Brake® Optimum Manhole: SWS1.14, DS/PN: SW1.012, Volume (m³): 14.5

|                                   |                            |
|-----------------------------------|----------------------------|
| Unit Reference                    | MD-SHE-0094-6000-2610-6000 |
| Design Head (m)                   | 2.610                      |
| Design Flow (l/s)                 | 6.0                        |
| Flush-Flo™                        | Calculated                 |
| Objective                         | Minimise upstream storage  |
| Application                       | Surface                    |
| Sump Available                    | Yes                        |
| Diameter (mm)                     | 94                         |
| Invert Level (m)                  | 162.157                    |
| Minimum Outlet Pipe Diameter (mm) | 150                        |
| Suggested Manhole Diameter (mm)   | 1200                       |

| Control Points            | Head (m) | Flow (l/s) | Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|---------------------------|----------|------------|
| Design Point (Calculated) | 2.610    | 6.0        | Kick-Flo®                 | 0.845    | 3.6        |
| Flush-Flo™                | 0.411    | 4.5        | Mean Flow over Head Range | -        | 4.6        |

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) | Depth (m) | Flow (l/s) |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| 0.100     | 3.0        | 0.800     | 3.8        | 2.000     | 5.3        | 4.000     | 7.3        | 7.000     | 9.6        |
| 0.200     | 4.1        | 1.000     | 3.8        | 2.200     | 5.5        | 4.500     | 7.7        | 7.500     | 9.9        |
| 0.300     | 4.4        | 1.200     | 4.2        | 2.400     | 5.8        | 5.000     | 8.1        | 8.000     | 10.2       |
| 0.400     | 4.5        | 1.400     | 4.5        | 2.600     | 6.0        | 5.500     | 8.5        | 8.500     | 10.5       |
| 0.500     | 4.4        | 1.600     | 4.8        | 3.000     | 6.4        | 6.000     | 8.9        | 9.000     | 10.8       |
| 0.600     | 4.3        | 1.800     | 5.0        | 3.500     | 6.9        | 6.500     | 9.2        | 9.500     | 11.0       |

Volume Summary (Static)

Length Calculations based on Centre-Centre

| Pipe Number | USMH Name | Storage Structure Volume (m³) | Total Volume (m³) |
|-------------|-----------|-------------------------------|-------------------|
| SW1.000     | SWS1.01   | 0.000                         | 0.000             |
| SW1.001     | SWS1.02   | 53.250                        | 53.250            |
| SW1.002     | SWS1.03   | 47.250                        | 47.250            |
| SW1.003     | SWS1.04   | 46.500                        | 46.500            |
| SW1.004     | SWS1.05   | 45.750                        | 45.750            |
| SW1.005     | SWS1.06   | 47.250                        | 47.250            |
| SW1.006     | SWS1.07   | 47.250                        | 47.250            |
| SW1.007     | SWS1.08   | 47.250                        | 47.250            |
| SW1.008     | SWS1.09   | 51.750                        | 51.750            |
| SW1.009     | SWS1.10   | 45.750                        | 45.750            |
| SW1.010     | SWS1.11   | 47.250                        | 47.250            |
| SW1.011     | SWS1.12   | 0.000                         | 0.000             |
| SW2.000     | SWS1.13   | 16.863                        | 16.863            |
| SW1.012     | SWS1.14   | 0.000                         | 0.000             |
| Total       |           | 496.113                       | 496.113           |

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

| Simulation Criteria                |                                           |                                     |                   |
|------------------------------------|-------------------------------------------|-------------------------------------|-------------------|
| Areal Reduction Factor             | 1.000                                     | Additional Flow - % of Total Flow   | 0.000             |
| Hot Start (mins)                   | 0                                         | MADD Factor * 10m³/ha Storage       | 2.000             |
| Hot Start Level (mm)               | 0                                         | Inlet Coefficient                   | 0.800             |
| Manhole Headloss Coeff (Global)    | 0.500                                     | Flow per Person per Day (l/per/day) | 0.000             |
| Foul Sewage per hectare (l/s)      | 0.000                                     |                                     |                   |
| Number of Input Hydrographs        | 0                                         | Number of Offline Controls          | 0                 |
| Number of Online Controls          | 2                                         | Number of Time/Area Diagrams        | 0                 |
|                                    |                                           | Number of Storage Structures        | 11                |
|                                    |                                           | Number of Real Time Controls        | 0                 |
| Synthetic Rainfall Details         |                                           |                                     |                   |
| Rainfall Model                     | FSR M5-60 (mm)                            | 19.000                              | Cv (Summer) 0.750 |
| Region                             | England and Wales                         | Ratio R                             | 0.250             |
|                                    |                                           | Cv (Winter)                         | 0.850             |
| Margin for Flood Risk Warning (mm) |                                           |                                     | 300.0             |
| Analysis Timestep                  | 2.5                                       | Second Increment (Extended)         |                   |
| DTS Status                         |                                           |                                     | ON                |
| DVD Status                         |                                           |                                     | OFF               |
| Inertia Status                     |                                           |                                     | OFF               |
| 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 (%)                 |                                           | 0, 35, 40                           |                   |

| PN      | US/MH Name | Storm      | Return Period | Climate Change | First (X) Surge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m³) |
|---------|------------|------------|---------------|----------------|-----------------|-----------------|--------------------|---------------|-----------------|----------------------|---------------------|
| SW1.000 | SWS1.01    | 60 Winter  | 1             | +0%            |                 |                 |                    |               | 162.806         | 0.000                | 0.000               |
| SW1.001 | SWS1.02    | 480 Winter | 1             | +0%            | 1/15 Summer     |                 |                    |               | 162.848         | 0.048                | 0.000               |
| SW1.002 | SWS1.03    | 480 Winter | 1             | +0%            | 1/15 Summer     |                 |                    |               | 162.847         | 0.067                | 0.000               |
| SW1.003 | SWS1.04    | 480 Winter | 1             | +0%            | 1/15 Summer     |                 |                    |               | 162.846         | 0.086                | 0.000               |
| SW1.004 | SWS1.05    | 480 Winter | 1             | +0%            | 1/15 Summer     |                 |                    |               | 162.844         | 0.104                | 0.000               |
| SW1.005 | SWS1.06    | 480 Winter | 1             | +0%            | 1/15 Summer     |                 |                    |               | 162.841         | 0.121                | 0.000               |
| SW1.006 | SWS1.07    | 480 Winter | 1             | +0%            | 1/15 Summer     |                 |                    |               | 162.838         | 0.138                | 0.000               |
| SW1.007 | SWS1.08    | 480 Winter | 1             | +0%            | 1/15 Summer     |                 |                    |               | 162.834         | 0.154                | 0.000               |
| SW1.008 | SWS1.09    | 360 Winter | 1             | +0%            | 1/15 Summer     |                 |                    |               | 162.830         | 0.170                | 0.000               |
| SW1.009 | SWS1.10    | 240 Winter | 1             | +0%            | 1/15 Summer     |                 |                    |               | 162.825         | 0.185                | 0.000               |
| SW1.010 | SWS1.11    | 240 Winter | 1             | +0%            | 1/15 Summer     |                 |                    |               | 162.820         | 0.190                | 0.000               |
| SW1.011 | SWS1.12    | 60 Winter  | 1             | +0%            |                 |                 |                    |               | 162.835         | 0.000                | 0.000               |
| SW2.000 | SWS1.13    | 30 Winter  | 1             | +0%            | 100/30 Summer   |                 |                    |               | 164.425         | -0.109               | 0.000               |
| SW1.012 | SWS1.14    | 120 Winter | 1             | +0%            | 1/15 Summer     |                 |                    |               | 162.828         | 0.296                | 0.000               |

|         |            | Pipe        |                | Level           |             |
|---------|------------|-------------|----------------|-----------------|-------------|
| PN      | US/MH Name | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status      |
| SW1.000 | SWS1.01    | 0.00        |                | 0.0             | SURCHARGED* |
| SW1.001 | SWS1.02    | 0.48        |                | 3.5             | SURCHARGED* |
| SW1.002 | SWS1.03    | 0.55        |                | 4.0             | SURCHARGED* |
| SW1.003 | SWS1.04    | 0.55        |                | 4.0             | SURCHARGED* |
| SW1.004 | SWS1.05    | 0.58        |                | 4.2             | SURCHARGED* |
| SW1.005 | SWS1.06    | 0.66        |                | 4.8             | SURCHARGED* |
| SW1.006 | SWS1.07    | 0.66        |                | 4.8             | SURCHARGED* |
| SW1.007 | SWS1.08    | 0.75        |                | 5.5             | SURCHARGED* |
| SW1.008 | SWS1.09    | 0.72        |                | 5.3             | SURCHARGED* |
| SW1.009 | SWS1.10    | 0.86        |                | 6.3             | SURCHARGED* |
| SW1.010 | SWS1.11    | 0.48        |                | 6.1             | SURCHARGED* |
| SW1.011 | SWS1.12    | 0.06        |                | 6.3             | SURCHARGED* |
| SW2.000 | SWS1.13    | 0.23        |                | 4.5             | OK          |

|                                                            |                                                            |                                                                                    |
|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------------------------------|
| Lynas Engineers                                            |                                                            | Page 7                                                                             |
| Wilton Centre<br>Redcar<br>TS10 4RF                        | Top Park, Bury<br>Surface Water<br>Drainage Design Rev-P02 |  |
| Date 05/04/2024<br>File 23061-LE-ZZ-05-CA-D-0001-SURFAC... | Designed by MR<br>Checked by WF                            |                                                                                    |
| XP Solutions                                               | Network 2018.1                                             |                                                                                    |

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

| PN      | US/MH<br>Name | Flow / Overflow |       | Pipe<br>Flow | Status     | Level    |
|---------|---------------|-----------------|-------|--------------|------------|----------|
|         |               | Cap.            | (l/s) | (l/s)        |            | Exceeded |
| SW1.012 | SWS1.14       | 0.04            |       | 4.5          | SURCHARGED |          |

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

| Simulation Criteria                |                                           |                                     |                   |
|------------------------------------|-------------------------------------------|-------------------------------------|-------------------|
| Areal Reduction Factor             | 1.000                                     | Additional Flow - % of Total Flow   | 0.000             |
| Hot Start (mins)                   | 0                                         | MADD Factor * 10m³/ha Storage       | 2.000             |
| Hot Start Level (mm)               | 0                                         | Inlet Coefficient                   | 0.800             |
| Manhole Headloss Coeff (Global)    | 0.500                                     | Flow per Person per Day (l/per/day) | 0.000             |
| Foul Sewage per hectare (l/s)      | 0.000                                     |                                     |                   |
| Number of Input Hydrographs        | 0                                         | Number of Offline Controls          | 0                 |
| Number of Online Controls          | 2                                         | Number of Time/Area Diagrams        | 0                 |
|                                    |                                           | Number of Storage Structures        | 11                |
|                                    |                                           | Number of Real Time Controls        | 0                 |
| Synthetic Rainfall Details         |                                           |                                     |                   |
| Rainfall Model                     | FSR M5-60 (mm)                            | 19.000                              | Cv (Summer) 0.750 |
| Region                             | England and Wales                         | Ratio R                             | 0.250             |
|                                    |                                           | Cv (Winter)                         | 0.850             |
| Margin for Flood Risk Warning (mm) |                                           |                                     | 300.0             |
| Analysis Timestep                  | 2.5                                       | Second Increment (Extended)         |                   |
| DTS Status                         |                                           |                                     | ON                |
| DVD Status                         |                                           |                                     | OFF               |
| Inertia Status                     |                                           |                                     | OFF               |
| 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 (%)                 |                                           | 0, 35, 40                           |                   |

| PN      | US/MH Name | Storm      | Return Period | Climate Change | First (X) Surge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m³) |
|---------|------------|------------|---------------|----------------|-----------------|-----------------|--------------------|---------------|-----------------|----------------------|---------------------|
| SW1.000 | SWS1.01    | 60 Winter  | 30            | +35%           |                 |                 |                    |               | 162.806         | 0.000                | 0.000               |
| SW1.001 | SWS1.02    | 960 Winter | 30            | +35%           | 1/15 Summer     |                 |                    |               | 163.030         | 0.230                | 0.000               |
| SW1.002 | SWS1.03    | 960 Winter | 30            | +35%           | 1/15 Summer     |                 |                    |               | 163.029         | 0.249                | 0.000               |
| SW1.003 | SWS1.04    | 960 Winter | 30            | +35%           | 1/15 Summer     |                 |                    |               | 163.028         | 0.268                | 0.000               |
| SW1.004 | SWS1.05    | 960 Winter | 30            | +35%           | 1/15 Summer     |                 |                    |               | 163.025         | 0.285                | 0.000               |
| SW1.005 | SWS1.06    | 960 Winter | 30            | +35%           | 1/15 Summer     |                 |                    |               | 163.022         | 0.302                | 0.000               |
| SW1.006 | SWS1.07    | 960 Winter | 30            | +35%           | 1/15 Summer     |                 |                    |               | 163.018         | 0.318                | 0.000               |
| SW1.007 | SWS1.08    | 960 Winter | 30            | +35%           | 1/15 Summer     |                 |                    |               | 163.013         | 0.333                | 0.000               |
| SW1.008 | SWS1.09    | 960 Winter | 30            | +35%           | 1/15 Summer     |                 |                    |               | 163.008         | 0.348                | 0.000               |
| SW1.009 | SWS1.10    | 960 Winter | 30            | +35%           | 1/15 Summer     |                 |                    |               | 163.001         | 0.361                | 0.000               |
| SW1.010 | SWS1.11    | 960 Winter | 30            | +35%           | 1/15 Summer     |                 |                    |               | 162.993         | 0.363                | 0.000               |
| SW1.011 | SWS1.12    | 60 Winter  | 30            | +35%           |                 |                 |                    |               | 162.835         | 0.000                | 0.000               |
| SW2.000 | SWS1.13    | 60 Summer  | 30            | +35%           | 100/30 Summer   |                 |                    |               | 164.500         | -0.034               | 0.000               |
| SW1.012 | SWS1.14    | 60 Summer  | 30            | +35%           | 1/15 Summer     |                 |                    |               | 164.447         | 1.915                | 0.000               |

|         |            | Pipe        |                | Level           |             |
|---------|------------|-------------|----------------|-----------------|-------------|
| PN      | US/MH Name | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status      |
| SW1.000 | SWS1.01    | 0.00        |                | 0.0             | SURCHARGED* |
| SW1.001 | SWS1.02    | 0.07        |                | 0.5             | FLOOD RISK* |
| SW1.002 | SWS1.03    | 0.13        |                | 0.9             | FLOOD RISK* |
| SW1.003 | SWS1.04    | 0.18        |                | 1.3             | FLOOD RISK* |
| SW1.004 | SWS1.05    | 0.24        |                | 1.8             | FLOOD RISK* |
| SW1.005 | SWS1.06    | 0.30        |                | 2.2             | FLOOD RISK* |
| SW1.006 | SWS1.07    | 0.36        |                | 2.6             | FLOOD RISK* |
| SW1.007 | SWS1.08    | 0.42        |                | 3.1             | FLOOD RISK* |
| SW1.008 | SWS1.09    | 0.50        |                | 3.6             | FLOOD RISK* |
| SW1.009 | SWS1.10    | 0.57        |                | 4.1             | FLOOD RISK* |
| SW1.010 | SWS1.11    | 0.54        |                | 6.9             | FLOOD RISK* |
| SW1.011 | SWS1.12    | 0.06        |                | 6.3             | SURCHARGED* |
| SW2.000 | SWS1.13    | 0.76        |                | 15.4            | OK          |

|                                         |                         |                                                                                    |
|-----------------------------------------|-------------------------|------------------------------------------------------------------------------------|
| Lynas Engineers                         |                         | Page 9                                                                             |
| Wilton Centre                           | Top Park, Bury          |  |
| Redcar                                  | Surface Water           |                                                                                    |
| TS10 4RF                                | Drainage Design Rev-P02 |                                                                                    |
| Date 05/04/2024                         | Designed by MR          |                                                                                    |
| File 23061-LE-ZZ-05-CA-D-0001-SURFAC... | Checked by WF           |                                                                                    |
| XP Solutions                            | Network 2018.1          |                                                                                    |

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

| PN      | US/MH<br>Name | Flow / Overflow |       | Pipe<br>Flow | Status     | Level    |
|---------|---------------|-----------------|-------|--------------|------------|----------|
|         |               | Cap.            | (l/s) | (l/s)        |            | Exceeded |
| SW1.012 | SWS1.14       | 0.05            |       | 5.6          | SURCHARGED |          |

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

| Simulation Criteria                |                                           |                                     |                   |
|------------------------------------|-------------------------------------------|-------------------------------------|-------------------|
| Areal Reduction Factor             | 1.000                                     | Additional Flow - % of Total Flow   | 0.000             |
| Hot Start (mins)                   | 0                                         | MADD Factor * 10m³/ha Storage       | 2.000             |
| Hot Start Level (mm)               | 0                                         | Inlet Coefficient                   | 0.800             |
| Manhole Headloss Coeff (Global)    | 0.500                                     | Flow per Person per Day (l/per/day) | 0.000             |
| Foul Sewage per hectare (l/s)      | 0.000                                     |                                     |                   |
| Number of Input Hydrographs        | 0                                         | Number of Offline Controls          | 0                 |
| Number of Online Controls          | 2                                         | Number of Storage Structures        | 11                |
| Number of Time/Area Diagrams       | 0                                         | Number of Real Time Controls        | 0                 |
| Synthetic Rainfall Details         |                                           |                                     |                   |
| Rainfall Model                     | FSR M5-60 (mm)                            | 19.000                              | Cv (Summer) 0.750 |
| Region                             | England and Wales                         | Ratio R                             | 0.250             |
|                                    |                                           | Cv (Winter)                         | 0.850             |
| Margin for Flood Risk Warning (mm) |                                           |                                     | 300.0             |
| Analysis Timestep                  | 2.5                                       | Second Increment (Extended)         |                   |
| DTS Status                         |                                           |                                     | ON                |
| DVD Status                         |                                           |                                     | OFF               |
| Inertia Status                     |                                           |                                     | OFF               |
| 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 (%)                 |                                           | 0, 35, 40                           |                   |

|         |            |             |               |                |                 |                 |                    |               | Water     | Surcharged | Flooded     |
|---------|------------|-------------|---------------|----------------|-----------------|-----------------|--------------------|---------------|-----------|------------|-------------|
| PN      | US/MH Name | Storm       | Return Period | Climate Change | First (X) Surge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Level (m) | Depth (m)  | Volume (m³) |
| SW1.000 | SWS1.01    | 60 Winter   | 100           | +40%           |                 |                 |                    |               | 162.806   | 0.000      | 0.000       |
| SW1.001 | SWS1.02    | 1440 Winter | 100           | +40%           | 1/15 Summer     |                 |                    |               | 163.050   | 0.250      | 0.000       |
| SW1.002 | SWS1.03    | 1440 Winter | 100           | +40%           | 1/15 Summer     |                 |                    |               | 163.050   | 0.270      | 0.000       |
| SW1.003 | SWS1.04    | 240 Winter  | 100           | +40%           | 1/15 Summer     |                 |                    |               | 163.050   | 0.290      | 0.000       |
| SW1.004 | SWS1.05    | 240 Winter  | 100           | +40%           | 1/15 Summer     |                 |                    |               | 163.050   | 0.310      | 0.000       |
| SW1.005 | SWS1.06    | 240 Winter  | 100           | +40%           | 1/15 Summer     |                 |                    |               | 163.050   | 0.330      | 0.000       |
| SW1.006 | SWS1.07    | 240 Winter  | 100           | +40%           | 1/15 Summer     |                 |                    |               | 163.050   | 0.350      | 0.000       |
| SW1.007 | SWS1.08    | 240 Winter  | 100           | +40%           | 1/15 Summer     |                 |                    |               | 163.050   | 0.370      | 0.000       |
| SW1.008 | SWS1.09    | 240 Winter  | 100           | +40%           | 1/15 Summer     |                 |                    |               | 163.050   | 0.390      | 0.000       |
| SW1.009 | SWS1.10    | 240 Winter  | 100           | +40%           | 1/15 Summer     |                 |                    |               | 163.050   | 0.410      | 0.000       |
| SW1.010 | SWS1.11    | 240 Winter  | 100           | +40%           | 1/15 Summer     |                 |                    |               | 163.050   | 0.420      | 0.000       |
| SW1.011 | SWS1.12    | 60 Winter   | 100           | +40%           |                 |                 |                    |               | 162.835   | 0.000      | 0.000       |
| SW2.000 | SWS1.13    | 960 Winter  | 100           | +40%           | 100/30 Summer   |                 |                    |               | 164.769   | 0.235      | 0.000       |
| SW1.012 | SWS1.14    | 960 Winter  | 100           | +40%           | 1/15 Summer     |                 |                    |               | 164.767   | 2.235      | 0.000       |

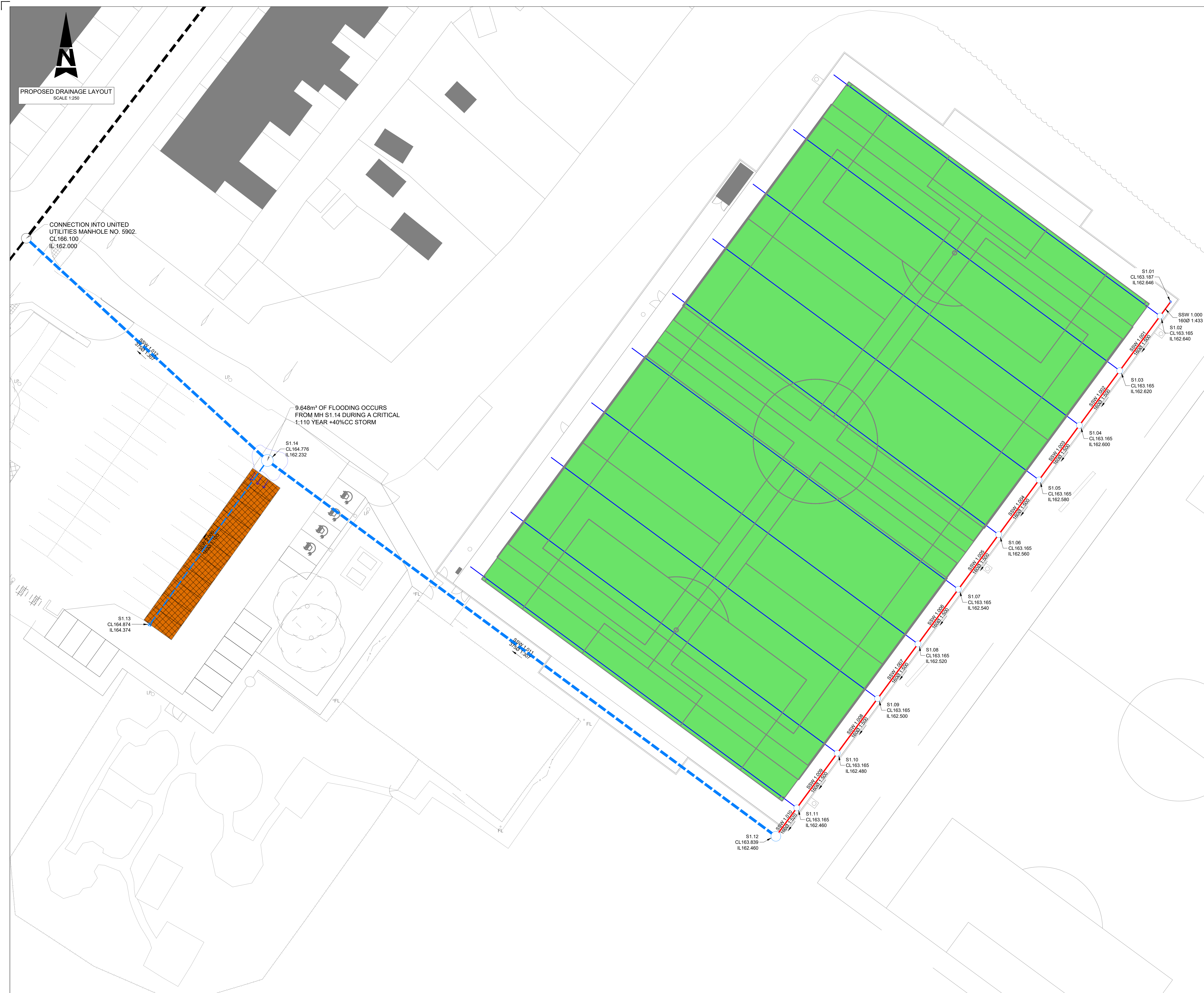
|         |            | Pipe        |                |                 |             |                |  |
|---------|------------|-------------|----------------|-----------------|-------------|----------------|--|
| PN      | US/MH Name | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status      | Level Exceeded |  |
| SW1.000 | SWS1.01    | 0.00        |                | 0.0             | SURCHARGED* |                |  |
| SW1.001 | SWS1.02    | 0.10        |                | 0.7             | FLOOD RISK* |                |  |
| SW1.002 | SWS1.03    | 0.18        |                | 1.3             | FLOOD RISK* |                |  |
| SW1.003 | SWS1.04    | 0.34        |                | 2.5             | FLOOD RISK* |                |  |
| SW1.004 | SWS1.05    | 0.42        |                | 3.1             | FLOOD RISK* |                |  |
| SW1.005 | SWS1.06    | 0.49        |                | 3.6             | FLOOD RISK* |                |  |
| SW1.006 | SWS1.07    | 0.53        |                | 3.8             | FLOOD RISK* |                |  |
| SW1.007 | SWS1.08    | 0.56        |                | 4.1             | FLOOD RISK* |                |  |
| SW1.008 | SWS1.09    | 0.62        |                | 4.5             | FLOOD RISK* |                |  |
| SW1.009 | SWS1.10    | 0.72        |                | 5.2             | FLOOD RISK* |                |  |
| SW1.010 | SWS1.11    | 0.48        |                | 6.1             | FLOOD RISK* |                |  |
| SW1.011 | SWS1.12    | 0.06        |                | 6.3             | SURCHARGED* |                |  |
| SW2.000 | SWS1.13    | 0.18        |                | 3.6             | FLOOD RISK  |                |  |

|                                                            |                                                            |                                                                                    |
|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------------------------------|
| Lynas Engineers                                            |                                                            | Page 11                                                                            |
| Wilton Centre<br>Redcar<br>TS10 4RF                        | Top Park, Bury<br>Surface Water<br>Drainage Design Rev-P02 |  |
| Date 05/04/2024<br>File 23061-LE-ZZ-05-CA-D-0001-SURFAC... | Designed by MR<br>Checked by WF                            |                                                                                    |
| XP Solutions                                               | Network 2018.1                                             |                                                                                    |

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

| PN      | US/MH<br>Name | Flow / Overflow<br>Cap. (l/s) | Pipe<br>Flow<br>(l/s) | Status     | Level<br>Exceeded |
|---------|---------------|-------------------------------|-----------------------|------------|-------------------|
| SW1.012 | SWS1.14       | 0.06                          | 6.0                   | FLOOD RISK |                   |

## Appendix H – Exceedance Route



**GENERAL NOTES:**

1. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, ENGINEERS, ARCHITECTS & SERVICES DRAWINGS, INCLUDING APPROVED BUILDERS WORK DRAWINGS. CONTRACTOR TO NOTIFY ENGINEER OF DISCREPANCIES BETWEEN STRUCTURAL DRAWINGS AND SPECIFICATIONS OR OTHER DRAWINGS.
2. DO NOT SCALE FROM THIS DRAWING. WORK TO DIMENSIONS OR CO-ORDINATES PROVIDED. ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE NOTED. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS, SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY.

**PROPOSED DRAINAGE KEY:**

|                                                                                     |                 |
|-------------------------------------------------------------------------------------|-----------------|
|  | AGP AREA        |
|  | CARRIER DRAIN   |
|  | LATERAL DRAIN   |
|  | MAIN DRAINAGE   |
|  | RODDING EYE     |
|  | PPIC            |
|  | POROUS CAR PARK |

EXISTING DRAINAGE KEY:

 UNITED UTILITIES COMBINED SEWER  
(LOCATION SHOWN INDICATIVELY)

**EXCEEDANCE PLAN KEY:**

|                                                                                     |                           |
|-------------------------------------------------------------------------------------|---------------------------|
|  | INDICATIVE FLOODING AREA  |
|  | INDICATIVE FLOODING ROUTE |

|      |                         |    |          |       |     |
|------|-------------------------|----|----------|-------|-----|
|      |                         |    |          |       |     |
|      |                         |    |          |       |     |
|      |                         |    |          |       |     |
| S2   | FOR CONSTRUCTION        |    | 05.04.24 | WF    |     |
| S2   | FOR INFORMATION         |    | 16.10.23 | WF    |     |
| S2   | FOR INFORMATION         |    | 25.09.23 | WF    |     |
| Stat | Purpose of Issue        |    | Date     |       | Aut |
|      |                         |    |          |       |     |
|      |                         |    |          |       |     |
|      |                         |    |          |       |     |
|      |                         |    |          |       |     |
|      |                         |    |          |       |     |
| P03  | DRAINAGE LAYOUT AMENDED | MR | 05.04.24 | WF    | WF  |
| P02  | DRAINAGE LAYOUT AMENDED | MR | 16.10.23 | WF    | WF  |
| P01  | FIRST ISSUE             | MR | 25.09.23 | WF    | WF  |
| Rev  | Description             | By | Date     | Chk'd | Aut |

 Lynas Engineers  
Wilton Centre  
Redcar  
TS10 4RF  
Tel: +44 (0)1642 438273  
[www.lynasengineers.com](http://www.lynasengineers.com)

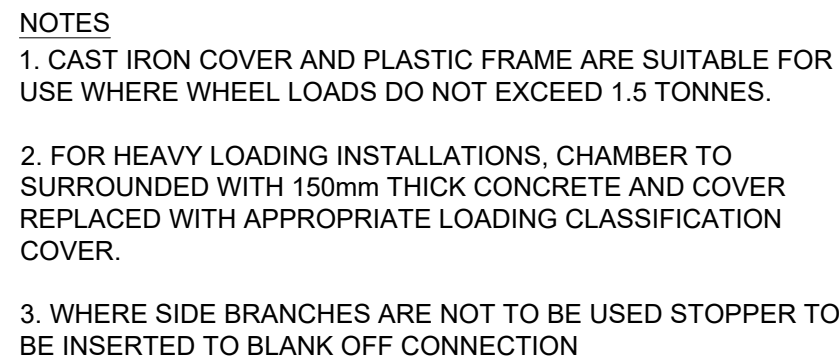
Client  **STEVE WELLS**  
ASSOCIATES  
*making sport happen*

|         |                |
|---------|----------------|
| Project | TOP PARK, BURY |
|---------|----------------|

|       |                 |
|-------|-----------------|
| Title | EXCEEDANCE PLAN |
|-------|-----------------|

|            |                                 |                |               |               |
|------------|---------------------------------|----------------|---------------|---------------|
| Sheet Size | Original Scale                  | Designed/Drawn | Checked       | Authorised    |
| <b>A1</b>  | <b>AS SHOWN</b>                 | <b>MR</b>      | <b>WF</b>     | <b>WF</b>     |
|            |                                 | Date 25.09.23  | Date 25.09.23 | Date 25.09.23 |
| Status     | Drawing Number                  |                |               | Rev           |
| <b>S2</b>  | <b>23061-LE-ZZ-05-DR-D-0002</b> |                |               | <b>P03</b>    |

## Appendix I – Standard Drainage Details



POLY-PROPYLENE INSPECTION CHAMBER (PPIC)  
SCALE NTS



|        |                          |     |
|--------|--------------------------|-----|
| Status | Drawing Number           | Rev |
| S2     | 23061-LE-ZZ-05-DR-D-0003 | P02 |

MORTAR BEDDING AND HAUNCHING TO COVER AND FRAME (UNDER VEHICULAR AREAS, MORTAR TO BE POLYESTER RESIN).

MINIMUM 2 COURSES OF CLASS B ENGINEERING BRICKS OR PRECAST CONCRETE COVER FRAME SEATING RINGS.

675 MM MAXIMUM TO FIRST STEP RUNG FROM COVER LEVEL.

150 MM CONCRETE SURROUND, CLASS GEN3 (DESIGNED TO BRE SPECIAL DIGEST 1, CONCRETE IN AGGRESSIVE GROUND).

LIFTING EYES IN CONCRETE RINGS TO BE POINTED.

HIGH STRENGTH CONCRETE TOPPING TO BE BROUGHT UP TO A DENSE, SMOOTH FACE.

THE BOTTOM OF THE PRECAST MANHOLE RING TO BE BUILT INTO BASE CONCRETE, MINIMUM 75 MM.

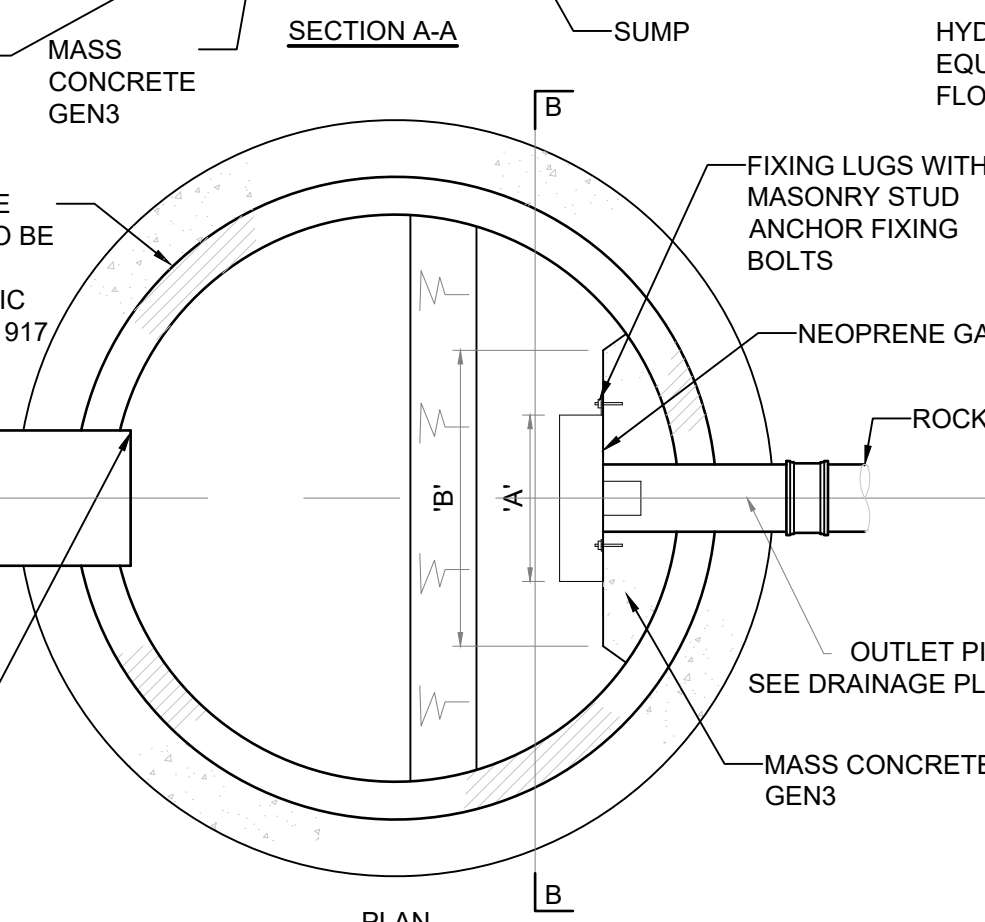
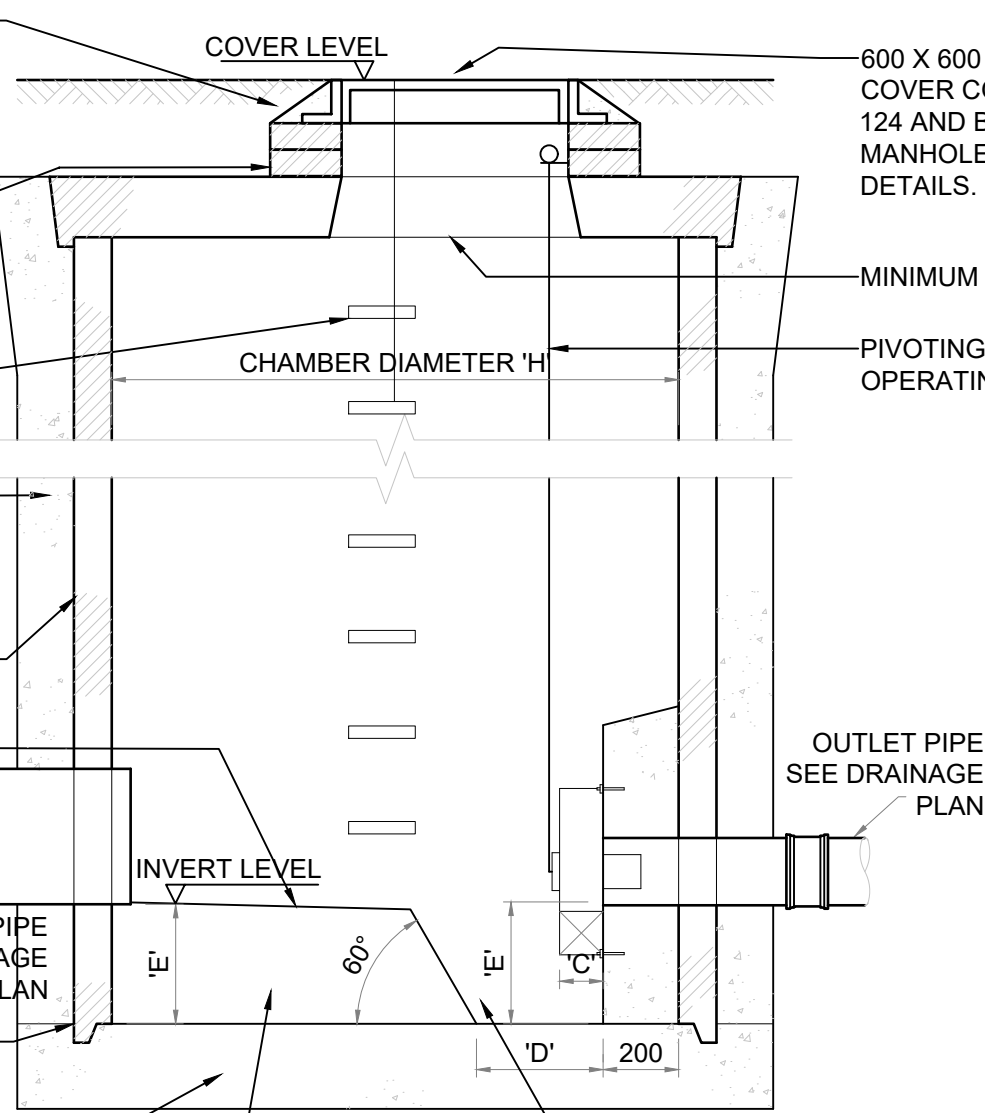
225 MM MINIMUM THICKNESS GEN3 CONCRETE BASE ON 50MM BLINDING.

PRECAST CONCRETE MANHOLE SECTIONS AND COVER SLAB TO BE BEDDED WITH MORTAR, PLASTOMERIC OR ELASTOMERIC SEAL CONFORMING TO BS EN 1917 AND BS 5911-3.

INLET PIPE SEE DRAINAGE PLAN

ROCKER PIPE

INLET PIPE TO TERMINATE 50 MM BEYOND FACE OF CONCRETE CHAMBER.



PLAN  
HYDROBRAKE MANHOLE  
SCALE 1:20

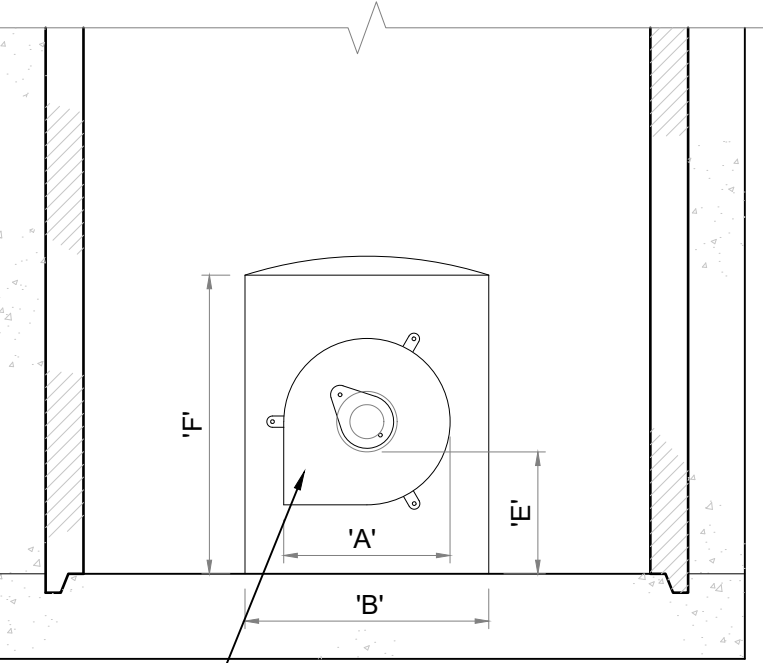
600 X 600 MM CLEAR OPENING COVER COMPLYING WITH BS 124 AND BS 7903. REFER TO MANHOLE SCHEDULE FOR DETAILS.

MINIMUM CLEAR ACCESS 600 MM

PIVOTING BYPASS DOOR OPERATING STEEL ROPE.

OUTLET PIPE  
SEE DRAINAGE  
PLAN

HYDROBRAKE OR EQUIVALENT VORTEX FLOW CONTROL DEVICE.



SECTION B-B

### HYDROBRAKE TECHNICAL SPECIFICATION

GRADE 304 STAINLESS STEEL VORTEX FLOW CONTROL UNIT WITH INTEGRAL STAINLESS STEEL PIVOTING BYPASS DOOR ALLOWING CLEAR LINE OF SIGHT THROUGH TO OUTLET, C/W STAINLESS STEEL OPERATING ROPE. STAINLESS STEEL FIXINGS AND NEOPRENE GASKET SEAL TO OUTLET.

|                            |         |                         |         |
|----------------------------|---------|-------------------------|---------|
| Manhole Reference:         |         | S1.14                   |         |
| Cover Level (m):           | 164.776 | Invert Level (m):       | 162.157 |
| Hydrobrake Reference:      |         | SHE-0094-6000-2610-6000 |         |
| Design Head (m):           |         | 2.610                   |         |
| Design Flow (l/s):         |         | 6.0                     |         |
| Inlet Pipe diameter (mm):  |         | 375                     |         |
| Outlet Pipe diameter (mm): |         | 375                     |         |
| Dimension 'A' (mm):        | 575     | Dimension 'E' (mm):     | 370     |
| Dimension 'B' (mm):        | 780     | Dimension 'F' (mm):     | 920     |
| Dimension 'C' (mm):        | 100     | Dimension 'G' (mm):     | N/A     |
| Dimension 'D' (mm):        | 200     | Dimension 'H' (mm):     | 1500    |

- GENERAL NOTES:
- DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, ENGINEERS, ARCHITECTS & SERVICES DRAWINGS, INCLUDING APPROVED BUILDERS WORK DRAWINGS. CONTRACTOR TO NOTIFY ENGINEER OF DISCREPANCIES BETWEEN STRUCTURAL DRAWINGS AND SPECIFICATIONS OR OTHER DRAWINGS.
  - DO NOT SCALE FROM THIS DRAWING, WORK TO DIMENSIONS OR CO-ORDINATES PROVIDED. ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE NOTED. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS, SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY.

|                                                                                                                                                                                                                                                                                                              |                          |                |                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------|-----------------|
| FOR INFORMATION                                                                                                                                                                                                                                                                                              |                          | 05.04.24       | WF              |
| FOR INFORMATION                                                                                                                                                                                                                                                                                              |                          | 25.09.23       | WF              |
| Stat                                                                                                                                                                                                                                                                                                         | Purpose of Issue         | Date           | Auth            |
| P02 DRAINAGE LAYOUT AMENDED                                                                                                                                                                                                                                                                                  |                          | MR 05.04.24    | WF WF           |
| P01 FIRST ISSUE                                                                                                                                                                                                                                                                                              |                          | MR 25.09.23    | WF WF           |
| Rev                                                                                                                                                                                                                                                                                                          | Description              | By             | Date Chk'd Auth |
|  <div>Lynas Engineers<br/>Suite 3, Cargo Fleet Offices<br/>Middlesbrough road<br/>Middlesbrough<br/>TS6 6XH<br/>Tel: +44 (0)1642 438273<br/>www.lynasengineers.com<br/>Copyright © Lynas Engineers Limited (2021)</div> |                          |                |                 |
| Client<br> <div>STEVE WELLS<br/>ASSOCIATES<br/>making sport happen</div>                                                                                                                                                |                          |                |                 |
| Project<br>TOP PARK, BURY                                                                                                                                                                                                                                                                                    |                          |                |                 |
| Title<br>S1.14 - PROPOSED HYDROBRAKE CONTROL MANHOLE DETAIL                                                                                                                                                                                                                                                  |                          |                |                 |
| Sheet Size                                                                                                                                                                                                                                                                                                   | Original Scale           | Designed/Drawn | Checked         |
| A3                                                                                                                                                                                                                                                                                                           | As Shown                 | MR             | WF              |
| Date                                                                                                                                                                                                                                                                                                         | 25.09.23                 | Date           | 25.09.23        |
| Status                                                                                                                                                                                                                                                                                                       | Drawing Number           | Rev            |                 |
| S2                                                                                                                                                                                                                                                                                                           | 23035-LE-ZZ-05-DR-D-0004 | P02            |                 |



## Appendix J – SuDS Maintenance Schedule

## Top Park, Bury: ARTIFICIAL GRASS PITCH (AGP)

### Sustainable Drainage Systems (SuDS): Maintenance Plan

#### Introduction

This document sets out the principles for the long-term management and maintenance of the proposed AGP; specifically with respect to the stone sub-base, which doubles up as the SuDS attenuation for the site; at the proposed development works, Top Park, Bury. Many of the guidance points contained within this document relate directly to CIRIA C753: The SuDS Manual.

For the purpose of this report, we have referred to the AGP SuDS feature as pervious paving due to the nature of the collection, conveyance, and storage of stormwater throughout the system.

The objective of this document is to set out the basis of the development SuDS Maintenance Plan and ensure that the proposed pervious paving is provided with a robust inspection and maintenance programme, ensuring the optimum operation of the surface water drainage network. The pervious paving is to be maintained for the lifetime of the development and to prevent the increased risk of flooding, both on and off site, in accordance with the National Planning Policy Framework (NPPF).

The activities listed in this document are generic to the proposed SuDS AGP pervious paving and represent the minimum maintenance and inspection needed; however, additional tasks or a varied maintenance frequency may be required. The specific maintenance needs of the pervious paving should be monitored, and the maintenance schedules should be adjusted to suit the requirements.

All maintenance procedures listed within this report, including lone working, should follow the relevant Health and Safety legislation (Health and Safety at Work Regulations, 1999). Appropriate risk assessments should always be undertaken.

The pervious paving shall be maintained periodically in accordance with the schedules listed in this report. Inspection checks shall be carried out by a competent person, at the minimum intervals listed within the schedules, and the appropriate work should be carried out.

|          |     |        |        |          |            |
|----------|-----|--------|--------|----------|------------|
| 03.04.24 | P02 | S2     | MR     | WF       | WF         |
| Date     | Rev | Status | Author | Reviewer | Authoriser |

## SuDS AGP Pervious Paving Layout and Design

The storm water drainage strategy for the proposed development utilises a SuDS pervious paving feature to intercept and store all pluvial surface water runoff. The design of the pervious paving aims to attenuate the runoff within the sub-base of the AGP, suspend any solids and significantly improve water quality.

There are three categories of maintenance activates referred to in this report:

- **Regular Maintenance (including inspections and monitoring)**
  - Consists of basic tasks done on a frequent and predictable schedule, including sweeping/power brushing, litter/debris removal and inspection.
- **Occasional Maintenance**
  - Comprises tasks that are likely to be required periodically but on a much less frequent and predictable basis than the routine tasks (e.g. vegetation/sediment removal).
- **Remedial Maintenance**
  - Comprises intermittent tasks that may be required to rectify faults associated with the system (note – the likelihood of faults is minimised by good design and construction methods).

## SuDS Management and Maintenance

The proposed SuDS drainage system, inclusive of pervious surfacing, pipework, and chambers will be subject to a routine monitoring and maintenance schedule as part of the general site management. The following guidelines are offered as an initial regime but may be either increased or decreased depending on the local environment and any external contributing factors.

The key maintenance requirement for pervious paving and its associated pipework will be the inspection of the surface and monitoring the operation of the system. Regular sweeping/power brushing is also recommended. General maintenance will include the removal of any accumulated sediments and collection of litter and debris.

During the inspections the general operation, structural condition, and any issues relating to the chambers should be identified and addressed as required.

Any vegetation found to be developing within the pervious surface should be removed/trimmed and treated with immediately with an appropriate herbicide. Cuttings from any localised clearance work should be removed from the pervious surface to avoid it causing any issues to the operation of the system.

Any build-up of sediments should be removed from the surface as required. The frequency of this operation can vary depending on local conditions (wind, dust, nearby trees, footfall, etc.) though regular inspection of the surface will identify any unacceptable build-up.

The relevant table for the operation and maintenance of the proposed pervious paving can be found on the following page.

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For layout and details of proposed AGP SuDS pervious paving please refer to accompanying drawing numbers 23061-LE-ZZ-05-DR-D-0001, 23061-LE-ZZ-05-DR-D-0002, 23061-LE-ZZ-05-DR-D-0003 and 23061-LE-ZZ-05-DR-D-0004.

Table 1: Pervious paving Operation and Maintenance

| TABLE 20.15 Operation and maintenance requirements for pervious pavements |                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                              |  |
|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Maintenance schedule                                                      | Required action                                                                                                                                                                      | Typical frequency                                                                                                                                                                                                                                                                                                            |  |
| Regular maintenance                                                       | Brushing and vacuuming (standard cosmetic sweep over whole surface)                                                                                                                  | Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment |  |
| Occasional maintenance                                                    | Stabilise and mow contributing and adjacent areas                                                                                                                                    | As required                                                                                                                                                                                                                                                                                                                  |  |
|                                                                           | Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying                                                                | As required – once per year on less frequently used pavements                                                                                                                                                                                                                                                                |  |
| Remedial Actions                                                          | Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving                                             | As required                                                                                                                                                                                                                                                                                                                  |  |
|                                                                           | Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material | As required                                                                                                                                                                                                                                                                                                                  |  |
|                                                                           | Rehabilitation of surface and upper substructure by remedial sweeping                                                                                                                | Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)                                                                                                                                                                                                                     |  |
| Monitoring                                                                | Initial inspection                                                                                                                                                                   | Monthly for three months after installation                                                                                                                                                                                                                                                                                  |  |
|                                                                           | Inspect for evidence of poor operation and/or weed growth – if required, take remedial action                                                                                        | Three-monthly, 48 h after large storms in first six months                                                                                                                                                                                                                                                                   |  |
|                                                                           | Inspect silt accumulation rates and establish appropriate brushing frequencies                                                                                                       | Annually                                                                                                                                                                                                                                                                                                                     |  |
|                                                                           | Monitor inspection chambers                                                                                                                                                          | Annually                                                                                                                                                                                                                                                                                                                     |  |

Table 2: Pipework and Manholes Operation and Maintenance

| Maintenance schedule   | Required action                                             | Recommended frequency         |
|------------------------|-------------------------------------------------------------|-------------------------------|
| Occasional maintenance | Visual inspection of covers, gratings and manhole chambers. | Annually or as required.      |
|                        | Cleaning out manholes.                                      | Annually or as required.      |
|                        | CCTV inspection of drainage pipes.                          | Annually or as required.      |
| Remedial actions       | Reactive cleaning of manholes and drains.                   | During flooding events.       |
|                        | Cleaning out drains by water jetting.                       | As required.                  |
|                        | Replace damaged covers, grating and manhole components.     | As required.                  |
|                        | Rehabilitation – repairs, relining or replacement.          | As determined by inspections. |

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Table 3: Permeable Paving Operation and Maintenance

| TABLE 20.15 Operation and maintenance requirements for pervious pavements |                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Maintenance schedule                                                      | Required action                                                                                                                                                                      | Typical frequency                                                                                                                                                                                                                                                                                                            |
| Regular maintenance                                                       | Brushing and vacuuming (standard cosmetic sweep over whole surface)                                                                                                                  | Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment |
| Occasional maintenance                                                    | Stabilise and mow contributing and adjacent areas                                                                                                                                    | As required                                                                                                                                                                                                                                                                                                                  |
|                                                                           | Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying                                                                | As required – once per year on less frequently used pavements                                                                                                                                                                                                                                                                |
| Remedial Actions                                                          | Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving                                             | As required                                                                                                                                                                                                                                                                                                                  |
|                                                                           | Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material | As required                                                                                                                                                                                                                                                                                                                  |
|                                                                           | Rehabilitation of surface and upper substructure by remedial sweeping                                                                                                                | Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)                                                                                                                                                                                                                     |
| Monitoring                                                                | Initial inspection                                                                                                                                                                   | Monthly for three months after installation                                                                                                                                                                                                                                                                                  |
|                                                                           | Inspect for evidence of poor operation and/or weed growth – if required, take remedial action                                                                                        | Three-monthly, 48 h after large storms in first six months                                                                                                                                                                                                                                                                   |
|                                                                           | Inspect silt accumulation rates and establish appropriate brushing frequencies                                                                                                       | Annually                                                                                                                                                                                                                                                                                                                     |
|                                                                           | Monitor inspection chambers                                                                                                                                                          | Annually                                                                                                                                                                                                                                                                                                                     |

|          |     |        |        |          |            |
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