MOLLOY HOMES

SUNNY BROW ROAD, MIDDLETON

Surface Water Management Report

March 2025

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Sunny Brow Road

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1.0 Introduction

ICIS Design have prepared this surface water management report to demonstrate that the detailed drainage design for the residential development at Sunny Brow Road, Middleton, M24 4BG (hereafter referred to as 'the Site'), adheres to Rochdale Metropolitan Borough Council Planning Condition 15, which states

'Prior to the commencement of development, details of a sustainable surface water drainage scheme and a foul water drainage scheme shall be submitted to and approved in writing by the Local Planning Authority.

The drainage scheme shall include:

An investigation of the hierarchy of drainage options in the National Planning Practice Guidance (or any subsequent amendment thereof). This investigation shall include evidence of an assessment of ground conditions and the potential for infiltration of surface water in accordance with Guidance note BRE365.

A restricted rate of surface water discharge to public sewer agreed with the local planning authority, if it is agreed that infiltration is discounted by the investigations. The rate shall be 5 l/s unless United Utilities agree that 6.4 l/s would be acceptable.

Levels of the proposed drainage systems including proposed ground and finished floor levels in mAOD. Foul and surface water shall drain on separate systems at least to the point of discharge from the site, in accordance with Building Control Part H Drainage requirements.

The background calculations of the MicroDrainage® model or any other software or calculations that have been used for the drainage design.

Construction details for permeable paving including sub-base details e.g. cross-section, if this type of paving forms part of the sustainable drainage system.

Provision of a Maintenance Document explaining how the surface water scheme will be maintained and managed after completion.

The approved scheme shall also be in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) or any subsequent replacement national standards. Prior to occupation/ use of the proposed development, the drainage scheme shall be completed in accordance with the approved details and retained thereafter for the lifetime of the development.

Reason: To promote sustainable development, secure proper drainage and to manage the risk of flooding and pollution. To prevent an increased risk of flooding as a result of the development and to ensure satisfactory disposal of surface water from the site in accordance with Policy G8 of the adopted Rochdale Core Strategy, saved Policy EM/7 of the adopted Rochdale Unitary Development Plan and the National Planning Policy Framework'.

Therefore, this report will describe and demonstrate how the surface water run-off rates and volume from the Site will be managed to adhere to National planning policies, regulations, and relevant design guidance, which include:

- National Planning Policy Framework (NPPF), December 2024, Paragraphs 162-163 and 182;
- National Planning Practice Guidance (NPPG), released in March 2014 and updated in August 2022;
- National Standards for Sustainable Drainage Systems (SuDS) set out by the Department for Environment, Food & Rural Affairs (DEFRA) (2011);
- CIRIA (2010) Planning for SuDS – Making it Happen C687;
- CIRIA SuDS Manual C753 (2015).

And local policies including:

- Greater Manchester Surface Water Management Plan (January 2012);
- Greater Manchester Flood Risk Management Framework (September 2018);
- Rochdale Adopted Core Strategy Policy EN/7 (October 2016).

Subsequently, Rochdale Metropolitan Borough Council (RMBC), acting as Lead Local Flood Authority (LLFA), need to be satisfied that the design and drainage principles of the proposed development:

- will address the surface water management and risk of flooding within the site;
- will ensure that the drainage is managed and maintained for its lifetime to prevent flooding;
- and will ensure that the development will not increase the risk of flooding to neighbouring land and property.

2.0 National Policy and Water Management Guidance

National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG)

The NPPF (December 2024) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced. This document is used to form this surface water management report, with particular attention to Paragraphs 162-163 (Planning for Climate Change) and Paragraph 182 (Sustainable Drainage).

NPPG, Paragraph 055 (Reference ID:7-055-20220825) states that sustainable drainage systems (SuDS) are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible, where they provide opportunities to reduce the causes and impacts of flooding; remove pollutants from urban run-off at source; and to combine water management with green space with benefits for amenity, recreation, and wildlife.

Further to this NPPG, Paragraph 056 (Reference ID:7-056-20220825) states that the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable which (in order) are into the ground (infiltration); to a surface water body; to a surface water sewer, highway drain, or another drainage system; to a combined sewer.

Flood and Water Management Act (2010)

The Flood and Water Management Act (FWMA) received royal assent in April 2010, aiming to create a simpler and more effective means of managing flood risk and coastal erosion. The FWMA incorporates and implements some of the recommendations from the Pitt Review (2008), following the severe flooding that affected a large area of the UK in 2007. The FWMA also places several new duties and responsibilities on LLFAs regarding the management of local flood risk, to:

- Develop, maintain, apply, and monitor a Local Flood Risk Management Strategy.
- Approve, adopt, and maintain Sustainable Drainage Systems (SuDS) (yet to be implemented).
- Establish and maintain a flood risk Asset Register.
- Investigate incidents of flooding (where appropriate) and publish the findings in a report.
- Ensure delivery of effective and joined up management of flood risk.

3.0 Site Setting and Description

Site Location

The Site is located approximately 9 km north of Manchester city centre, approximately 1 km west of Middleton town centre, and is bound by a golf course to the north, residential dwellings leading to Lime Gardens to the east, Sunny Brow Road and dwellings to the south, and Johnson Grove to the west.

The nearest postcode to the Site is M24 4BG, with the co-ordinates at the centre of the Site being E: 386220, N: 405920.

Existing Site and Topography

The topographical survey in Appendix A shows that the Site, in a pre-development state, consists of a detached dwelling to the centre with outbuildings to the north and west, and a driveway with access road to the south. In terms of levels, the Site has a general fall in a southerly direction, with the levels ranging from approximately 96.40m AOD, to approximately 93.43m AOD.

Proposed Development

As detailed on the plans in Appendix B, the Site, in a post development state, will consist of the demolition of the existing dwelling and outbuildings, and the erection of 7 new dwellings, with associated private and shared driveways, patios and garden / landscape areas, and an access road from the south.

Ground Conditions

Trial pits were excavated to approximately 1m deep at the Site, which found the ground to consist of clay at various depths ranging from 200mm to 600mm below existing, below topsoil.

Infiltrations tests were carried out in two of the trial pits, with the water being held within the 300mm x 300mm sump at the base of the trial pits, and therefore not infiltrating to ground. Refer to Appendix C for trial pit locations and trial pit photographs showing the clay material.

Waterbodies / Rivers / Canals

There are no waterbodies in the direct vicinity of the Site, with the nearest being an unnamed watercourse and pond within the golf course site, approximately 350m to the west.

Existing Drainage

The United Utilities plan in Appendix D shows that the neatest sewer is a 225mm combined water sewer in Sunny Brow Road.

A drainage survey also found that there is a combined water drainage at the Site, which connects / discharges to the 225mm combined water sewer, and is believed to take the surface water run-off from the existing dwelling, outbuilding, driveway and access road.

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Surface Water Management Areas

The Site boundary has an area of approximately 3,020m² / 0.302 ha

The existing dwelling, outbuildings, driveway and access road equates to 1,200m² / **0.120 ha**. Surface water from these areas currently discharge to a below ground drainage network, ad therefore, the Site has a pre-development surface water run-off area of

The proposed dwelling, driveways, patios, and access road equates to 1,600m² / **0.160 ha**. Surface water from these areas will discharge to a below ground drainage network, ad therefore, the Site has a post development surface water run-off area of

Note that surface water run-off from the garden and landscape areas will discharge off the Site at a natural / greenfield rate, and will not contribute to the surface water runoff areas.

4.0 Surface Water Management Principles

The surface water for the Site is to be managed so that it adheres to the current regulations, and local authority requirements, as detailed in previous sections of this report.

Run-Off Destination

Surface water run-off is to discharge to one or more of the following in the order of priority shown:

- Discharge into the ground (infiltration);
- Discharge to a surface water body;
- Discharge to a surface water sewer, highway drain or other drain;
- Discharge to combined sewer.

Peak Surface Water Flow

DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems states:

*'**S3** For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1-year rainfall event and the 1 in 100-year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event'.*

RMBC Planning Condition 15 states:

'A restricted rate of surface water discharge to public sewer agreed with the local planning authority, if it is agreed that infiltration is discounted by the investigations. The rate shall be 5 l/s unless United Utilities agree that 6.4 l/s would be acceptable.

Therefore, the surface water run-off is not to exceed 5 l/s and is to be a reduction of the pre-development surface water run-off rates for all storm events'.

Volume Control

DEFRA National Non-Statutory Technical Standards for Sustainable Drainage Systems states:

*'**S5** Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100-year, 6-hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.*

***S6** Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk'.*

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Flood Risk within Development

DEFRA Non-statutory technical standards for sustainable drainage systems states:

*'**S7** The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30-year rainfall event.*

***S8** The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100-year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.*

***S9** The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100-year rainfall event are managed in exceedance routes that minimise the risks to people and property'.*

Pollution

The SuDS design for the development site will ensure that the quality of any receiving water body is not adversely affected and preferably enhanced in accordance with Ciria SuDS Manual C753, Chapter 4.

Designing for Exceedance

The development site design will be such that when SuDS features fail or are exceeded, exceedance flows do not cause flooding of properties on or off site. This will be achieved by designing suitable ground exceedance or flood pathways, and run-off will be completely contained within the drainage system (including areas designed to hold or convey water) for all events up to a 1 in 100-year event.

The design of the site ensures that flows from rainfall more than a 1 in 100-year rainfall event are managed in exceedance routes that avoid risk to people and property both on and off site.

5.0 Surface Water Run-Off Destination

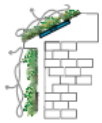
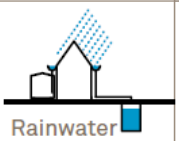
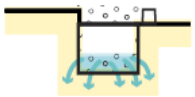
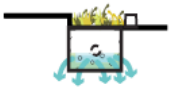
The feasibility of surface water run-off to the priority receptors are assessed and reported as follows:

Run-Off Destination (in order of Priority)	Feasible for the proposed development	Comment / Description
Discharge to Ground	No	Trial pits at the Site (Appendix C) show that the ground at the Site predominantly consists of clay. Infiltration tests failed, as clay is known to have exceptionally low or no infiltration value. Therefore, discharge to ground is not feasible.
Discharge to Surface Waterbody	No	There are no waterbodies in the direct vicinity of the Site, with the nearest being an unnamed watercourse and pond within the golf course site, approximately 350m to the west. Therefore, discharge to a waterbody is not feasible.
Discharge to Surface Water Sewer	No	The United utilities asset plan shows that there are no surface water seers near the Site, and therefore discharge to this destination is not feasible.
Discharge to Highway Drain or Other	No	There are no known highway or other drains near to the development site. Therefore, discharging the surface water run-off to a highway or other drain is not feasible.
Discharge to Combined Water Sewer	**Yes**	As the ground is formed of clay, and there are no waterbodies, surface water sewers or highway drains near the Site, the only alternative is to discharge to the existing 225mm combined water sewer in Sunny Brow Road. **Discharge to this sewer will replicate the pre-development discharge definition.**

6.0 SuDS Hierarchy

To reduce the surface water run-off rate, SuDS methods are to be introduced to the post development design.

In accordance with the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015), the SuDS methods that could potentially be used are detailed below:

	Description	Setting	Required area
 Green roofs	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	Building	Building integrated.
 Rainwater harvesting	Rainwater is collected from the roof of a building or from other paved surfaces and stored in an overground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.	Building	Water storage (underground or above ground).
 Soakaway	A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	Open space	Dependant on runoff volumes and soils.
Filter Strip	Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.	Open space	Minimum length 5 metres.
Permeable paving	Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.	Street/open space	Can typically drain double its area.
 Bioretention area	A vegetated area with gravel and sand layers below designed to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens.	Street/open space	Typically surface area is 5-10% of drained area with storage below.

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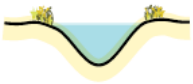
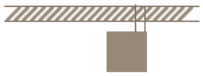
	Description	Setting	Required area
Swale	Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.	Street/open space	Account for width to allow safe maintenancce typically 2-3 metres wide.
Hardscape storage	Hardscape water features can be used to store run-off above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.	Open space	Could be above or below ground and sized to storage need.
 Pond / Basin	Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.	Open space	Dependant on runoff volumes and soils.
Wetland	Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.	Open space	Typically 5-15% of drainage area to provide good treatment.
 Underground storage	Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.	Open space	Dependant on runoff volumes and soils.

The feasibility of the above SuDS methods for the proposed development are summarised thus:

SuDS Method	**Feasible / Required**	**Description**
Livings Roofs	No	The new dwellings will have pitched roofs and therefore are not suitable for living roofs as a SuDS feature.
Soakaways	No	Trial pits at the Site (Appendix C) show that the ground at the Site predominantly consists of clay. Infiltration tests failed, as clay is known to have exceptionally low or no infiltration value. Therefore, the use of soakaways is not feasible.
Filter Strips	**Yes**	Filter drain systems can be formed along the edge of the patio areas of each of the new dwellings. The filter drains will be formed of a 300x300mm, 20mm no fine granular filled trench housing a perforated pipe.

		The surface water run-off from the patio areas will discharge onto the filter drain, will not infiltrate directly to ground (for reasons stated above), but will convey the surface water to the main network. Filter drains will reduce the surface water run-off rates and act as a pollutant control at source.
Permeable Surfacing	**Yes**	Permeable surfacing can be formed in the driveway and shared driveway (not access road used by refuge vehicles) areas of the Site. The permeable surfacing will be built over a 300mm deep sub-base formed of 20mm no fines aggregate and wrapped in an impermeable membrane. Surface water will not discharge to ground (for reasons stated above) but will also be conveyed to the main drainage network via a perforated pipe within the sub-base material. Permeable surfacing will reduce the surface water run-off rates and act as a pollutant control at source.
Swale / Ponds / Bioretention Areas	No	All the garden areas are to be used for private amenity, with the landscape areas being formed of trees ad planting. Therefore, there are limited areas within the Site where swales, pods or bioretention areas can be formed.
Underground Storage (Cellular Units)	**Yes**	The surface water run-off from the development site will be restricted. Therefore, there will be a requirement to have underground storage for storm events up to 1 in 30-year; and to suitable sized so that the volume of water during the 1 in 100-year storm event is kept a minimum at surface level, where it can be contained on site.

7.0 Pre-Development Surface Water Run-Off Rates and Volume

The pre-development surface water run-off rates and volume are to be calculated, to establish the rate at which the surface water currently discharges off the Site, and for the post development not to exceed the existing.

The calculations to determine the pre-development surface water run-off rates and volume are based on the pre-development surface water run-off area of 0.120 ha, the rainfall data given by FEH 2022 (shown as 2013 in MicroDrainage) and simulation / calculations in the MicroDrainage computer software (see Appendix E).

Based on the FEH22 data and computer software results, the pre-development surface water run-off rates are as follows:

Q_2 = 14.0 l/s (15-minute storm duration)

Q_{30} = 37.5 l/s (15-minute storm duration)

Q_{100} = 45.2 l/s (15-minute storm duration)

Based on the FEH22 data and computer software results, the pre-development surface water run-off volume (360-minute storm duration) for the pre-developed area of 1,200m² / 0.120 ha is:

$Q_{100\ (6\text{-}Hour)}$ = 75.50m³

8.0 Climate Change

The NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are taken from the Environment Agency guidance summarised in Figure 1 below.

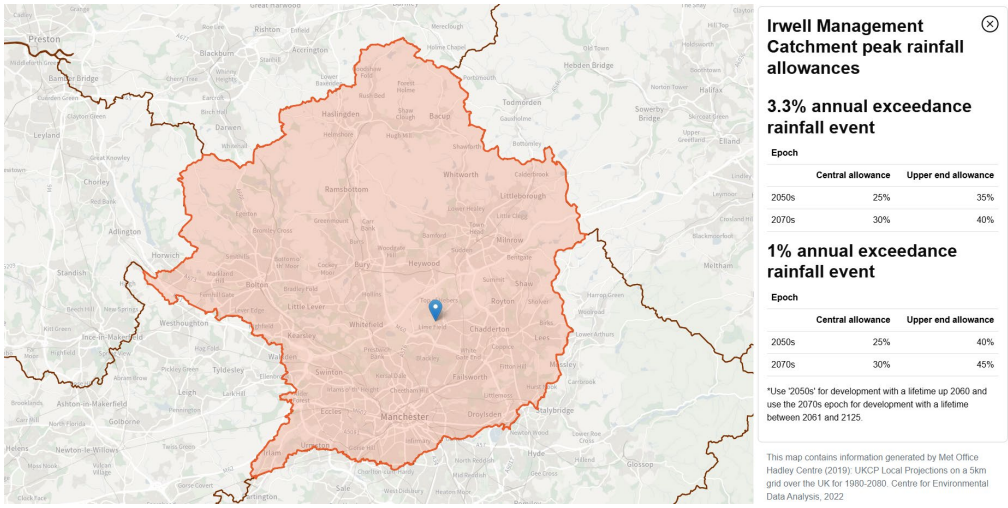


Figure 1 - DEFRA – Climate Change Allowances

The lifetime of the Site is likely to be beyond 2061, and therefore the Epoch 2070's is to be used with Upper End Allowance. Therefore, the climate change allowance for the surface water run-off will be **40%** and **45%** for the 30-year and 100-year storm respectively.

9.0 Surface Water Management Calculations

Surface Water Network Calculations

The calculations are based on the Site area 0.160 ha, and the rainfall data given by the FEH 2022.

Surface Water Drainage Network Details

As shown on the below ground drainage layouts in Appendix F, the proposed surface water network will consist of 150mm to 300mm diameter pipes, 1200mm to 1500mm diameter manholes, 2 flow control chambers containing a hydro-brake and an orifice plate, filter drains, permeable surfacing, and 2 attenuation tanks in the form of cellular units.

The surface water run-off from the building roof areas will discharge to the main network via trapped gullies (containing first 5mm of water); the surface water run-off from the patio areas will discharge to the main network via filter drains; the surface water run-off from the private and shared driveway areas parking areas will discharge to the main network via the permeable surfacing systems, and the surface water run-off from the access road will discharge to the main drainage network via gullies and channel drains with traps (containing first 5mm of water).

The surface water network will flow towards the south of the Site and will discharge through a flow control chamber prior to connection / discharge to the existing 225mm diameter combined water sewer.

The surface water will surcharge the drainage network when being restricted by the flow control chamber and will discharge back into the network and cellular units, where the water will be stored to prevent flooding.

Post storm event, the water levels in the tank will drop and flow back to the network and through the control chamber to the watercourse.

Surface Water Run-Off Rates

For the surface water run-off from the Site to be a reduction of the pre-development surface water run-off rates, they are to be restricted to less than 14.0 l/s for the 1 in 2-year storm event; 37.5 l/s for the 1 in 30-year storm event including 40% allowance, and 45.2 l/s for the 1 in 100-year storm event including 45% allowance.

For the surface water run-off from the Site to adhere to RMBC Planning Condition 15, the rates are to be no higher than 5 l/s.

Therefore, based on the above, the surface water is to be controlled by a hydro-brake with a design flow of 4.0 l/s (manhole S19) and an orifice at the outfall manhole (manhole S21) with an opening of 47mm.

As shown in the output calculation from the MicroDrainage computer software in Appendix G, with the two flow controls, the peak surface water discharge rates from the Site, in a post development state will be as follows:

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Storm	-	Rate	-	Critical Storm Event
Q_2	-	3.1 l/s	-	360-minute summer storm duration
$Q_{30 + 40\%}$	-	4.6 l/s	-	480-minute summer storm duration
$Q_{100 + 45\%}$	-	5.0 l/s	-	480-minute winter storm duration

A summary of the post development surface water run-off rates compared to the pre-development rates are as follows:

Pre-Development to Post Development Rate

Storm	-	Pre-Dev	-	Post Dev	-	Difference
Q_2	-	14.0 l/s	-	3.1 l/s	-	78% Reduction
$Q_{30 + 40\%}$	-	37.5 l/s	-	4.6 l/s	-	82% Reduction
$Q_{100 + 45\%}$	-	45.2 l/s	-	5.0 l/s	-	89% Reduction

The surface water run-off rates are a reduction of the pre-development rates, and do not exceed 5 l/s.

Therefore, the discharge rates meet the requirements of the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (S3) and RMBC Planning Condition 15.

Surface Water Run-Off Volume

The surface water run-off volumes for the post development site have also been calculated based on the peak surface water discharge rate of the 1 in 100-year event, over a 6-hour duration (+45%).

$Q_{100\ (6\text{-hour})}$	-	5.0 l/s x (60 x 60 x 6)	-	108,000 litres	-	108.00m³

A summary of the post development surface water run-off volume compared to the pre-development volumes are as follows:

Pre-Development Volume to Post Development Volume

Storm	-	Pre-Dev	-	Post Dev	-	Difference
Q_{100}	-	75.50m³	-	108.00m³	-	Increase

The surface water run-off volume for the 100-year, 6-hour storm event is an increase of the pre-development volume. However, the run-off volume is discharged off the Site at an 89% reduction of the pre-development rates.

Therefore, the run-off volume will not adversely affect flood risk to the 225mm combined water sewer, and subsequently still meets the requirements of DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems requirements (S6), which states: *'where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer, the runoff volume must be discharged at a rate that does not adversely affect flood risk'.*

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Surface Water Attenuation Calculations

As the surface water run-off from the Site, in a post development state is being restricted, there will be a requirement for below ground attenuation to prevent flooding.

Ciria SuDS Manual 2015, Paragraph 10.2.4 where it states that: *'Exceedance flows (i.e. flows more than those for which the system is designed) should be managed safely in above-ground space such that risks to people and property are acceptable'.*

The surface water attenuation for the development site will be within 2 attenuation tank in the form of cellular units. As detailed in the MicroDrainage calculations (Appendix G) and below ground drainage layouts (Appendix F), the attenuation volume for the SuDS method is as follows:

Attenuation Tank 1 (Cellular Units)			**Attenuation Tank 2 (Cellular Units)**		
Length	-	12.00m	Length	-	19.00m
Width	-	7.00m	Width	-	1.00m
Area	-	84.00m²	Area	-	19.00m²
Depth	-	0.80m	Depth	-	0.40m
Porosity	-	0.95	Porosity	-	0.95
Max. Volume	-	**63.85m³**	Max. Volume	-	**4.20m³**

MicroDrainage calculations (Appendix G) show that with the drainage network and these SuDS volume, no flooding will occur for all storms up to and including the 1 in 100-year event + 45%.

Therefore, all the attenuated water will be contained within the Site, and adheres to DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems requirements (S7-S6).

10.0 Maintenance Requirements

Details of the maintenance required, and the parties to carry out the maintenance of all drainage aspects, to ensure that the SuDS methods are working effectively, and subsequently reducing the risk of flooding on the Site, are set out below.

Drainage Responsibilities

The management and maintenance of the surface water drainage networks and SuDS features within the Site will be by contractors appointed by the owners / residents of the residential dwelling, where payments of the works will form part of the property deeds and / or rental agreement.

A copy of the drainage design layout / details and a drainage maintenance / management document will be handed to the occupants of the units on completion of the works, or signing of property deeds or signing of rental agreements, where they will be made aware of the features within their ownership, and responsibility to maintain the drainage features shown on said drawings and details.

Maintenance and Management Document on Completion

The document produced, and handed to the owners of the new properties, will state the following:

'The owners & parties with responsibilities for the surface water drainage system on this development will comprise of the following stakeholders:

Residential Dwelling Occupants and / or Owners

All of which is clearly defined on the blow ground drainage layout included within your handover pack of completed work, or property deeds, or rental agreement. As you are the residential dwelling occupant, you have responsibilities for the maintenance of the surface water drainage system which fall within the extent of the Site.

Failure to maintain or removal of surface water drainage features may result in civil litigation with neighbouring owners if flooding occurs as a result.

Surface water drainage pipes, filter drains, permeable surfacing systems, flow control and attenuation tank are the responsibility of the residential unit owners and / or occupants.

As part of the agreement, contractors to carry out necessary maintenance / repairs & replacement of drainage features are to be appointed, which will be taken as communal sums and will form part of the property deeds and / or rental agreement.

The management and maintenance of the drainage networks and SuDS features will form part of the overall site management plan.

The operation and frequency of the maintenance and management, of the features shown on the below ground drainage layout, are to be carried out as follows:

Sunny Brow Road

Drainage Network, Flow Control and Cellular Units

Operation	***Frequency***
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	*Monthly for 3 months, then six monthly*
Debris removal from manholes (where may cause risk performance)	*Monthly*
Where rainfall into network from above, check surface or filter for blockage or silt, algae, or other matter by jetting	*As required, but at least twice a year*
Remove sediment from pipework by jetting.	*Annually or as required*
Repair/check all inlets, outlets, and overflow pipes	*As required*
Inspect/check all inlets, outlets, and overflow pipes to ensure that they are in good condition and operating as designed	*Annually and after large storms*

Filter Drains and Permeable Surfacing

Operation	***Frequency***
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	*Monthly for 3 months, then six monthlies*
Debris removal from on surface of permeable surfacing and filter drains or near system (where may cause risk performance)	*Monthly*
Rainfall infiltration into permeable surfacing and filter drains is ensured working effectively.	*As required, but at least twice a year*

Linked and Further Maintenance and Maintenance Activities

The maintenance of the drainage network and SuDS features are to be linked with the wider site maintenance for the new residential landscaped / garden areas.

11.0 Water Quality

The level of water treatment for the pollutant areas of the Site is to be assessed against the details set out in Ciria SuDS Manual C753.

Chapter 26 sets out the Pollution Hazard Indices for different land classifications, and how to calculate that against the SuDS mitigation indices to show suitable levels of treatment.

External Areas Pollutant Hazard

C753 Table 26.2 Pollution Hazard Level	=	Low
C753 Table 26.2 Pollution Hazard Index:		
Total Suspended Solid (TSS)	=	0.5
Metals	=	0.4
Hydrocarbons	=	0.4
Pollution Hazard Index	=	**1.30**

External Area Pollutant Mitigation

Mitigation Measures:

Filter Drains and Permeable Surfacing

Pollutant Mitigation Indices (CIRIA 753 Table 26.3):

TSS	=	0.7
Metals	=	0.6
Hydrocarbons	=	0.7
SuDS Mitigation Indices	=	**2.00**

The mitigation indices are the equivalent to the pollution hazard index, and therefore suitable water quality is achieved.

Note: Surface water run-off from the residential dwelling roofs to have very low pollutants (in accordan e with CIRIA 753 Table 26.2), and will flow through trapped gullies (containing first 5mm of water) prior to discharge to main drainage network. Therefore, roof surface water run-off will not affect the water quality.

12.0 Development Management and Construction Phase

Construction Environment Management Plan

Full details of the construction environment management plan (CEMP) have to be confirmed by the chosen contractor who have been appointed for the development. However, it will conform to the requirements of CIRIA 753 – The SuDS Manual – Chapter 31, and will include:

Construction Access

The main construction traffic will access the site from the southern boundary (Sunny Brow Road). Suitable protection measures such as concrete slab will be placed over the cellular units if not avoided.

Sediments and Traps

Sediment basins and traps are to be installed before any site earthworks take place, with further sediment traps and silt fences being installed as the earthworks progress. This will keep sediment contained on site at appropriate locations.

Run-Off Control Measures

Run-off control measures are to be used in conjunction with sediment traps to divert water around planned earthworks areas to remove silts. Any surface water upstream of the site is to be diverted around the development areas, and to discharge to the combined water sewer network.

Main Surface Water Run-Off Systems

The flow control chamber and cellular units are to be built prior to any phase of construction of site. Temporary inlet and outlet protection measures and appropriate silt traps are to be installed to prevent silt ingress into the main drainage network.

Clearing and Earthworks

Clearing and earthworks will only start when adequate erosion and sediment control measures are in place. Once the development areas are cleared, earthworks will follow immediately to ensure that the ground cover can be re-established quickly. Adjacent land to that being developed will be left undisturbed for as long as possible.

Surface Stabilisation Measures

Surface stabilisation measures will be applied to completed areas, channels ditches and other disturbed areas after the land is cleared and profiled. Permanent stabilisation measures will be installed as soon as possible after final profiling.

Construction of Permeable Surfacing and Filter Drains

Construction of the permeable surfacing and filter drains are to be left to the later stages of construction. Unsuitable sediment is to be removed from surfacing prior to installation of sand binder layer and paving.

13.0 Conclusion / Summary

SuDS Principles and Discharge Destination

All feasible SuDS methods, and surface water discharge destination have been assessed, with the feasible SuDS methods being permeable surfacing systems, filter drains, 2 flow control chambers and 2 attenuation tanks in the form of cellular units.

The surface water destination is to a United Utilities 225mm diameter combined water sewer in Sunny Brow Road.

Peak Flow Control

The surface water run-off rates are a reduction of the pre-development rates, and do not exceed 5 l/s. Therefore, the discharge rates meet the requirements of the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (S3) and RMBC Planning Condition 15.

Volume Control

The surface water run-off volume for the 100-year, 6-hour storm event is an of the pre-development volume. However, the run-off volume is discharged off the Site at an 89% reduction of the pre-development rates. Therefore, the run-off volume will not adversely affect flood risk to the 225mm combined water sewer, and subsequently still meets the requirements of DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems requirements (S6),

Flood Risk within the Development

With the drainage network and these SuDS volume, no flooding will occur for all storms up to and including the 1 in 100-year event + 45%. Therefore, all the attenuated water will be contained within the Site, and adheres to DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems requirements (S7-S6).

Management and Maintenance

The management and maintenance of the surface water drainage networks and SuDS features within the Site will be by contractors appointed by the owners / residents of the residential dwellings, where payments of the works will form part of the property deeds and / or rental agreement.

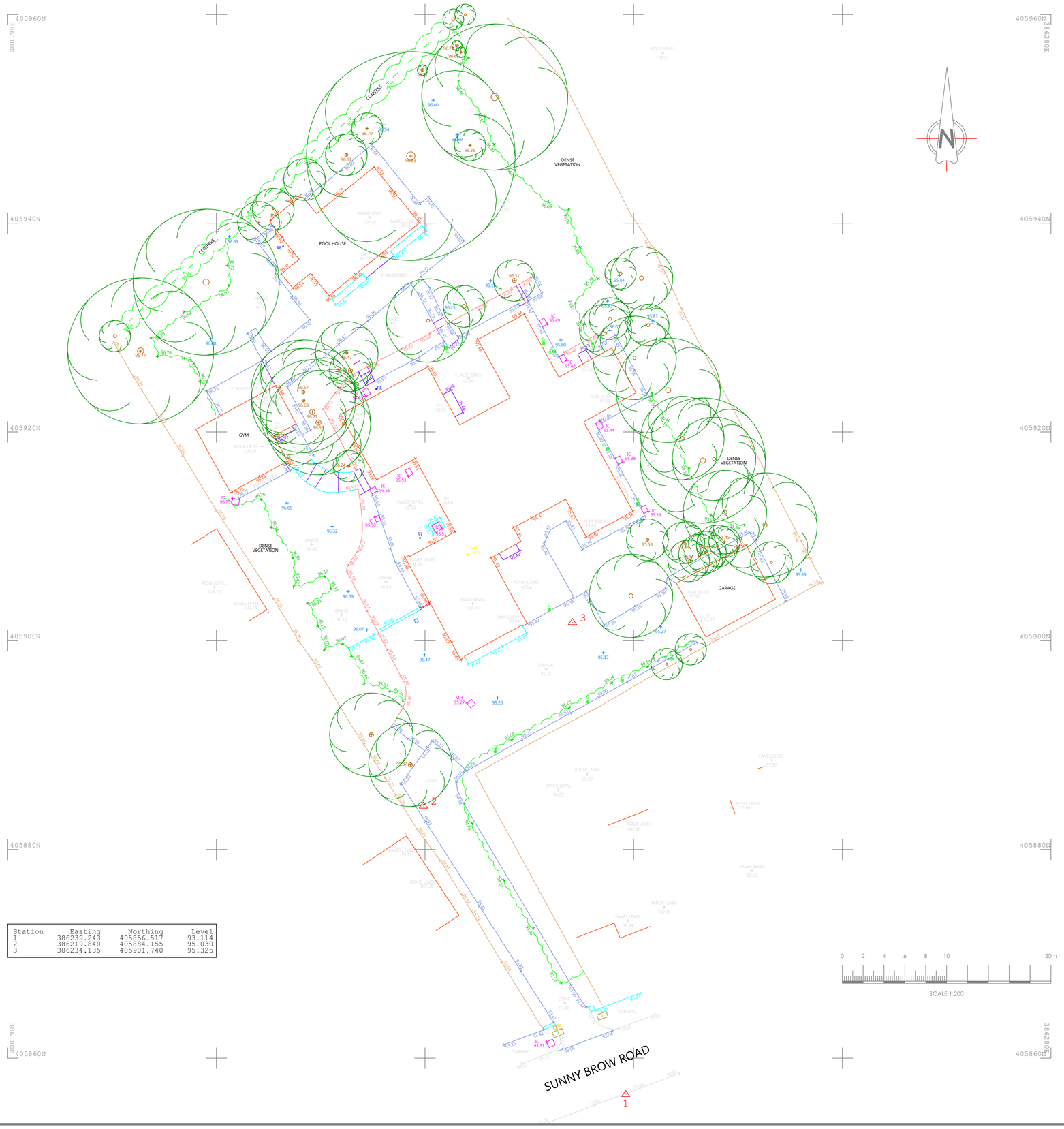
Water Quality

The level of water treatment for the pollutant areas of the site is to be assessed against the details set out in Ciria SuDS Manual C753. Chapter 26, the SuDS methods will be adequate to ensure water quality from pollutant areas of the development sites.

Development Management and Construction Phase

The CEMP will conform to the requirements of CIRIA 753 – The SuDS Manual – Chapter 31.

Appendix A – Topographical Survey



Station	Easting	Northing	Level
1	386239.243	405856.517	93.114
2	386219.840	405884.155	95.030
3	386234.135	405901.740	95.325

Abbreviations/Symbols (Measured Building Surveys):

C:	Window Cill Height
H:	Window Head Height
BH:	Beam Height
DH:	Door Height
COL:	Column
SVP:	Soil Vent Pipe
FL:	Floor Level
TH:	Threshold Level
2.34	Floor to Ceiling Height
	Vaulted Ceiling

Line types

	Hedge Lines
	Drainage Runs
	Overhead Electricity Cables
	Overhead Telephone Cables

Symbols

	Tree/Bush		Glass House
	Control Station		Osbm
	Borehole		
	Trial Hole		

Abbreviations (Topographic Survey):

AH:	Arch Height
AV:	Air Valve
BB:	Belisha Beacon
BOX:	Electricity Box, Cables Box, Etc.
BOL:	Bollard
BT/IC:	British Telecom Inspection Chamber
BS:	Bus Stop
BS/LP:	Bus Stop / Lamp Post
CATV:	CATV Inspection Chamber
CCTV:	Closed Circuit Television
CL:	Cellar Light
C.PIT:	Catch Pit
ER:	Earth Rod
EC:	Electricity Inspection Chamber
EP:	Electricity Pole
FH:	Fire Hydrant
FP:	Flag Pole
GV:	Gas Valve
G:	Gully
IC:	Inspection Chamber
KO:	Kerb Outlet
LP:	Lamp Post
LB:	Letter Box
LC:	Lighting Column
MKR:	Marker
MH:	Manhole
MP:	Mooring Point
MS:	Mile Stone
NYNEX:	Nynex Inspection Chamber
O/H:	Over Hang
P:	Post
PO/IC:	Post Office Inspection Chamber
R/S:	Road Sign
RE:	Rodding Eye
RTW:	Retaining Wall
S/P:	Sign Post
SNP:	Street Name Plate
ST:	Stop Tap
SV:	Stop Valve
T:	Telecom Inspection Chamber
TCB:	Telephone Call Box
TH:	Threshold Level
TL:	Traffic Light
TP:	Telegraph Pole
TROUGH:	Trough
WO:	Water Outlet
WM:	Water Meter

Fence Descriptions:

B/W:	Barbed Wire
C/B:	Close Boarded
C/BARRIER:	Crash Barrier
C/L:	Chain Link
C/P:	Chestnut Paling
C/I:	Corrugated Iron
I/R:	Iron Railing
MISC:	Miscellaneous
P/R:	Post & Rail
P/W:	Post & Wire
P/C:	Post & Chain
S/PAL:	Steel Palisade
W/M:	Wire Mesh

Survey Notes:

Coordinates and Levels related to Ordnance Survey Datum - GPS OSGB36

Revision	Date	Description

CPLS
Chris Partington Land Surveyors
ices
44a Green Lane
Sale
Cheshire
M33 5PP
t: 0161 976 1194
www.cpls.co.uk e:survey@cpls.co.uk

Client

Michael Leary

Project

Linkside, Sunny Brow Road, Middleton
Site Survey

Scale 1:200	Surveyed By J C	Date 14.07.22
Drawing No. 140722JC-01	Checked By CPLS	Date 15.07.22
	Drawn By J C	Date 15.07.22

Appendix B – Proposed Site Plan

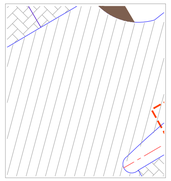
Native hedge planting schedule -
Northern and Eastern boundaries -
(planting schedule is for each boundary situation)

Species	Latin	Location	Specification
Hawthorn (dominant species)	Crataegus monogyna	Sp. A	3 plants per meter. No. 25 plants required.
Alder buckthorn	Frangula alnus	Sp. B	3 plants per meter No. 22 plants required
Holly	Ilex aquifolium	Sp. C	No. 3 plants required
Hornbeam	Carpinus betulus	Sp. D	No. 4 plants required
Crabapple	Malus sylvestris	Sp. E	No. 2 plants required
Flowering Currant	Ribes sanguineum	Sp. F	No. 7 plants required
Wild Cherry	Prunus avium	Sp. G	No. 9 plants required
Wild privet (dominant species)	Ligustrum vulgare	Sp. H	No. 7 plants required
Rowan	Sorbus aucuparia	Sp. I	No. 18 plants required
Copper beech	Fagus sylvatica 'Purpurea'	Sp. J	No. 7 plants required
Honeysuckle	Lonicera periclymenum	Sp. K	No. 7 plants required
English oak	Quercus robur	Sp. L	No. 2 plants required

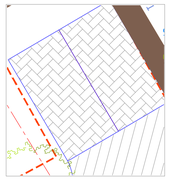
Site Plan 1:200

	Easting	Northing	Level
	386239.243	405856.517	93.114
	386219.840	405884.155	95.030
	386234.135	405901.740	95.325

GENERAL NOTE:
Existing boundary treatments to be retained where possible - any areas requiring improvement or making good to be repaired to match existing - any repaired sections of fencing/masonry walls to incorporate min 150mm x150mm apertures at base of structure and ground level.



Denotes taramc private drive to serve individual plots - permeable where possible subject to site conditions



Denotes private parking areas for individual plots formed in concrete block paving -permeable where possible subject to site conditions

LANDSCAPING SCHEDULE
Topsoil
Imported top soil to comply with BS3882:1994. Where topsoil is absent imported top soil shall be spread to a depth of 0.3m. Within any tree protection areas, to minimize disturbance of tree roots during planting operations, topsoil shall be spread to a maximum depth of 0.15m over existing top soil.

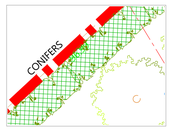
Planting.
All hardy nursery stock shall comply with BS: 3936, Specification for nursery stock. All site preparation, planting and post planting aftercare shall comply with "Handling and Establishment of Landscape Plants" 1996 published by the committee for Plant Supply and Establishment. All stock to be planted at the sizes and densities detailed in the planting schedule. All trees of a height greater than 1.5 metres shall be supported using a wooden stake of a top diameter not less than 50mm. The tree stake shall be driven to a depth of not less than 0.5m. The height of the stake above the ground level shall be equal to 1/3rd the height of the tree. All staked trees shall be attached to the top of the stake with a single proprietary tree tie.

Mulching.
All planted ornamental stock shall be mulched with a course grade of part-composted wood-chip or bark mulch.The mulch shall be spread to a depth of 50mm to a radius of 300mm around all shrubs and transplants and a radius of 500mm around all trees of a height greater than 1.0m.

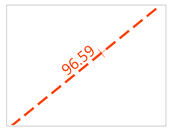
Denotes 85msq area of wildflower grassland to ecologist specification

Trees:
Tree species have been specifically selected for thier compact or fastigiate form due to thier restricted locations as well as thier flowers and berries for wildlife.

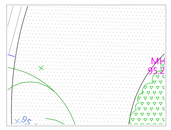
Species;
Aw- Acer campestre William Caldwell
Bp - Betula pendula 'Youngii'
Pa - Prunus padus Albertii
Ss - Sorbus auc. Sheerwater Seedling



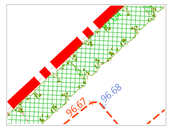
Denotes biodiversity enhancing native hedge to Northern and Eastern boundaries - see specification for plant types and distribution



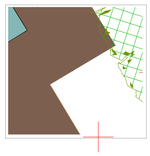
Denotes outline of buildings to be demolished



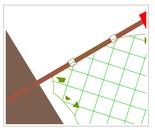
Denotes site access driveway formed in tarmac surface - permeable if site conditions allow - layout in accordance with traffic engineers assessment



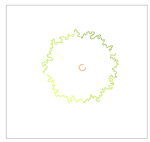
Denotes existing trees and planting areas to be retained



Denotes footpaths to house perimeter and pedestrian access formed in p.c.conc paving slabs.



Denotes new timber screen fence max 2.0m high to comprise vertically boarded timber panels supported on timber posts and horizontal rails - 150mmx150mm apertures formed in fencing at base at 4m c/c



Denotes replacement tree planting in accordance with tree planting schedule

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CDM:
Clients and contractors must fulfil their duties under the CDM regulations 2015.The client is required to notify the HSE of any projects lasting more than 30 days or involving more than 500 person days.

Location Plan 1:250

Existing site plan - topographical/tree survey 1:500

rev:	date:	description
C	20-3-23	Revised to suit ecologist report
B	25-1-23	Landscaping proposals added
A	20-1-23	Scale noted on site plan

AJ COCKER ASSOCIATES
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www.ajcockerassociates.co.uk
mail@ajcockerassociates.co.uk

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Project:
Development at 'Linkside',
Sunny Brow, Middleton
Site and location plans

scale: As shown
date: Sept. 2022
drawn: NL

Client: Mr. M. Leary
Dwg. Nr. L196-01-C

Appendix C – Ground Investigation Data

Native hedge planting schedule -
Northern and Eastern boundaries -
(planting schedule is for each boundary situation)

Species	Latin	Location	Specification
Hawthorn (dominant species)	Crataegus monogyna	Sp. A	3 plants per meter. No. 25 plants required.
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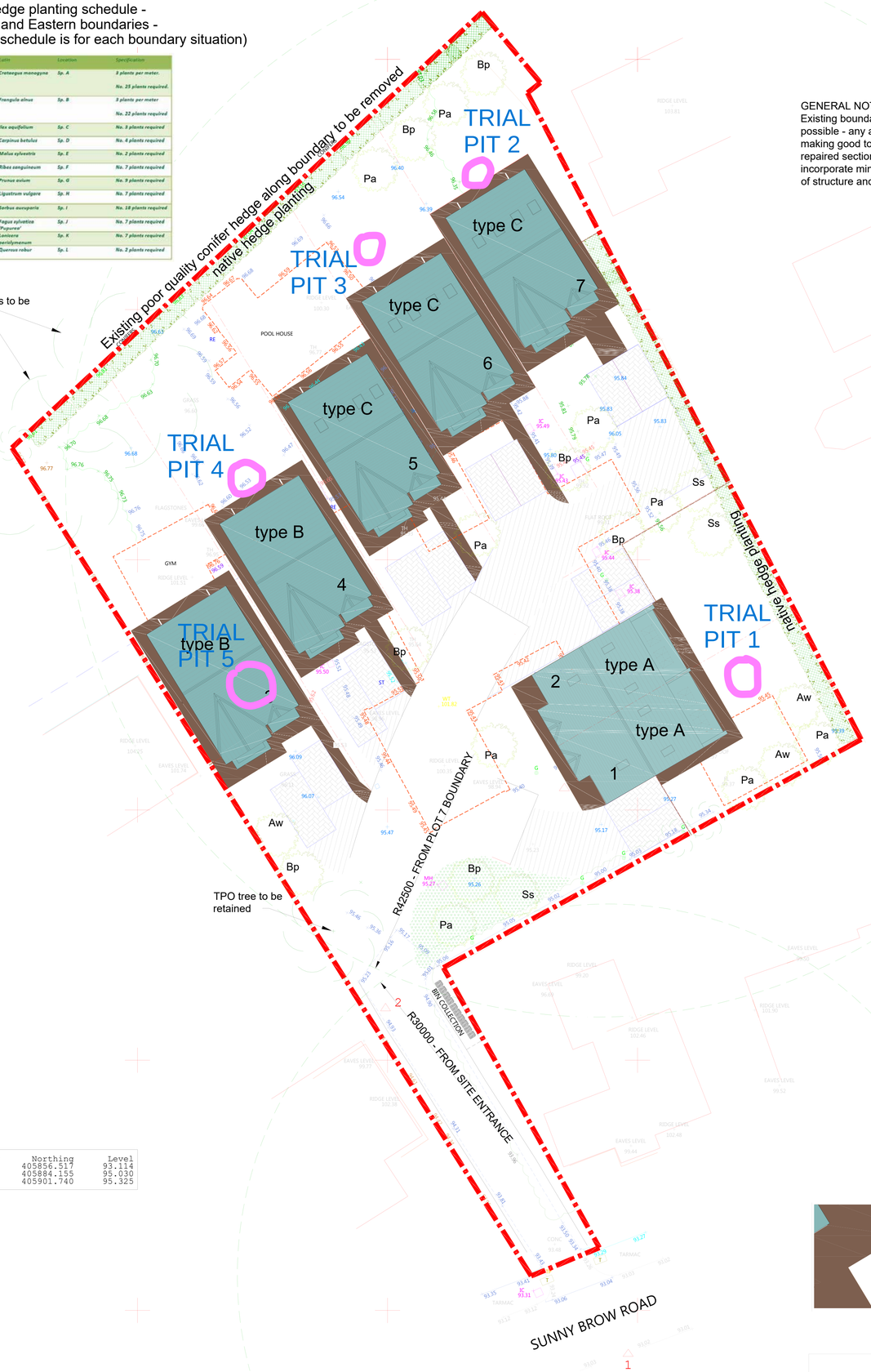

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Site Plan 1:200

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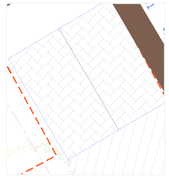

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LANDSCAPING SCHEDULE
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Planting.
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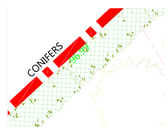
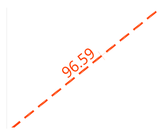
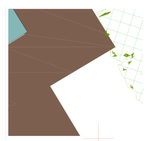


Denotes biodiversity enhancing native hedge to Northern and Eastern boundaries - see specification for plant types and distribution



Denotes outline of buildings to be demolished

Denotes site access driveway formed in tarmac surface - permeable if site conditions allow - layout in accordance with traffic engineers assessment



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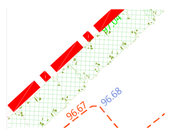

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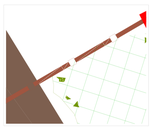

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Denotes replacement tree planting in accordance with tree planting schedule

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Location Plan 1:1250

Existing site plan - topographical/tree survey 1:500

rev:	date:	description
D	27-6-23	Bin collection area shown
C	20-3-23	Revised to suit ecologist report
B	25-1-23	Landscaping proposals added
A	20-1-23	Scale noted on site plan

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Rochdale
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mail@ajcockerassociates.co.uk

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Project:
Development at 'Linkside',
Sunny Brow, Middleton
Site and location plans

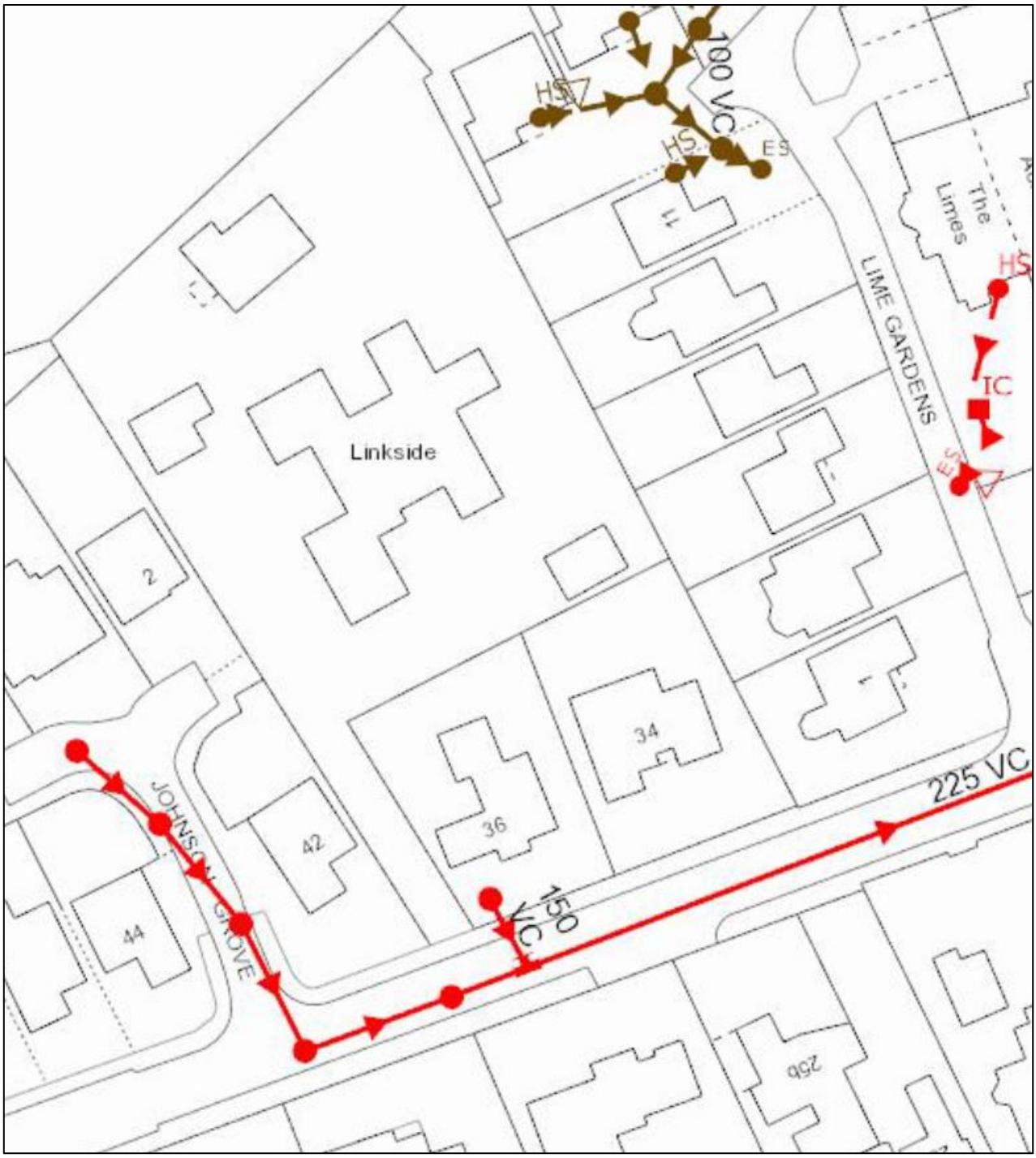
scale: As shown
date: Sept. 2022
drawn: NL

Client: Mr. M. Leary

Dwg. Nr. L196-01-D

Appendix D – Existing Drainage Plans

Drainage Utilities Maps.



RWG
Combined system upstream confirmed by dye testing.
MH1 1.16m
MH Assumed position from survey
MH Assumed position from survey
MH Assumed position from survey
MH Unable to push past this chamber.
Main Combined Sewer 1.20m
Johnson Grove
Sunny Brow Rd
8
34
42
44
46
Layers
Google

Appendix E – Pre-Development Run-Off Rates and Volume

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location GB 386220 405920 SD 86220 05920	
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.073	4-8	0.018	8-12	0.016	12-16	0.013

Total Area Contributing (ha) = 0.120

Total Pipe Volume (m³) = 0.795

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0	Number of Offline Controls 0	Number of Time/Area Diagrams 0
Number of Online Controls 0	Number of Storage Structures 0	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	100	Winter Storms	Yes
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location GB 386220 405920 SD 86220 05920		Cv (Winter)	0.840
Data Type	Point	Storm Duration (mins)	30

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2 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 Coeffiecient 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 Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
FEH Rainfall Version 2013 Cv (Summer) 1.000
Site Location GB 386220 405920 SD 86220 05920 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	1	30 Summer	2	+0%					94.055	-0.170	0.000	0.13
1.001	2	15 Summer	2	+0%	100/15 Summer				93.989	-0.136	0.000	0.32

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1			5.8	OK	
1.001	2			14.0	OK	

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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 Coeffiecient 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 Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
FEH Rainfall Version 2013 Cv (Summer) 1.000
Site Location GB 386220 405920 SD 86220 05920 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	1	15 Summer	30	+0%					94.084	-0.141	0.000	0.28
1.001	2	15 Summer	30	+0%	100/15 Summer				94.064	-0.061	0.000	0.87

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1			12.1	OK	
1.001	2			37.5	OK	

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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 Coeffiecient 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 Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
FEH Rainfall Version 2013 Cv (Summer) 1.000
Site Location GB 386220 405920 SD 86220 05920 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	1	15 Summer	100	+0%					94.153	-0.072	0.000	0.37
1.001	2	15 Summer	100	+0%	100/15 Summer				94.136	0.011	0.000	1.04

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1			15.8	OK	
1.001	2			45.2	SURCHARGED	

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Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.073	4-8	0.018	8-12	0.016	12-16	0.013

Total Area Contributing (ha) = 0.120

Total Pipe Volume (m³) = 0.795

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	0	Number of Storage Structures	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	100	Winter Storms	Yes
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 386220 405920 SD 86220 05920	Cv (Winter)	0.840
Data Type	Point	Storm Duration (mins)	30

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Summary Wizard of 60 minute 100 year Winter I+0% 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 Coeffiecient 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 Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
FEH Rainfall Version 2013 Cv (Summer) 1.000
Site Location GB 386220 405920 SD 86220 05920 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Discharge Vol (m³)	Half Drain Time (mins)
1.000	1	60 minute 100 year Winter I+0%	95.500	94.089	-0.136	0.000	0.33		24.321	
1.001	2	60 minute 100 year Winter I+0%	95.500	94.037	-0.088	0.000	0.67		48.615	

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	1	14.4	OK
1.001	2	29.1	OK

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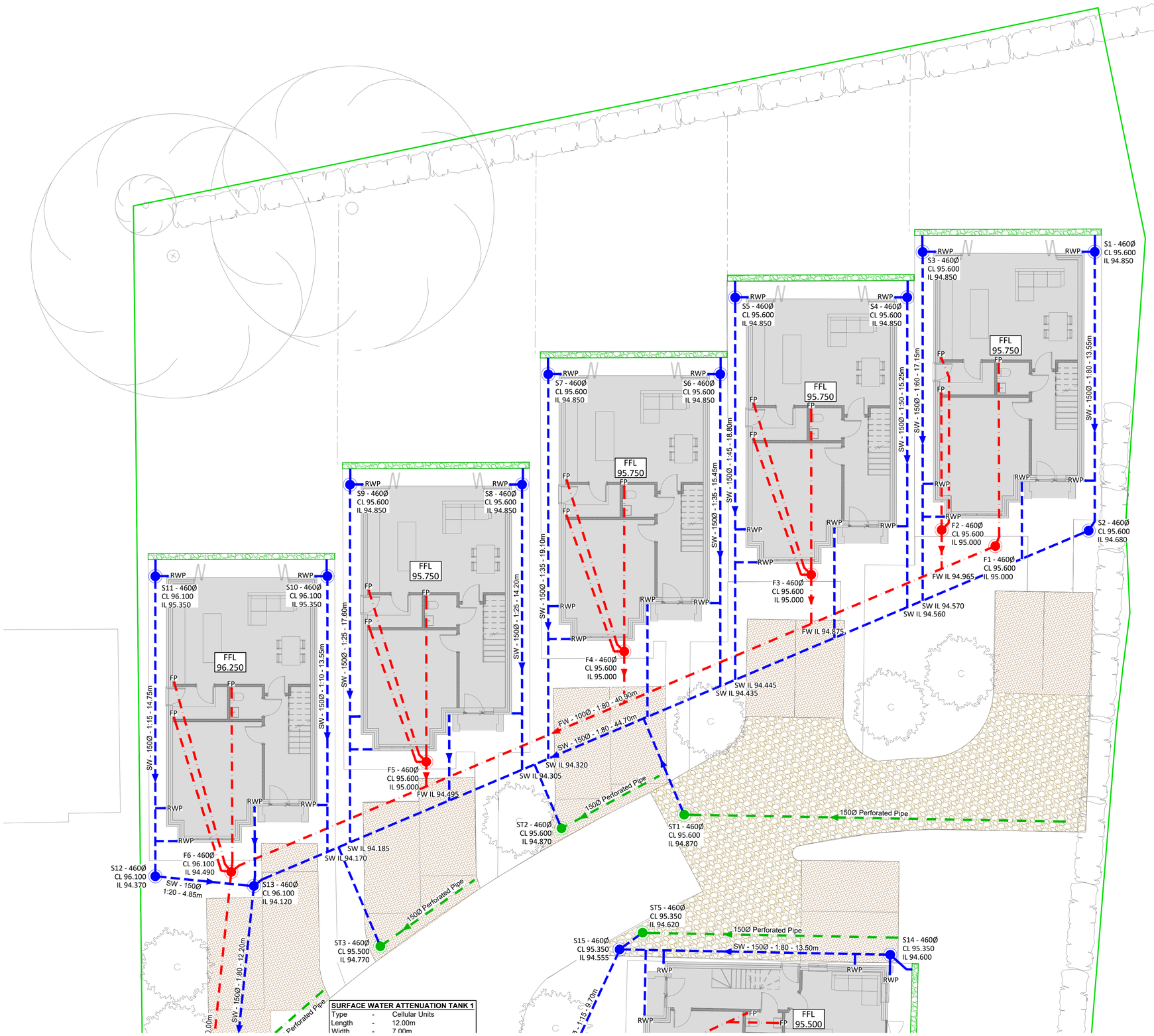
Appendix F – Below Ground Drainage Layouts and Details



SURFACE WATER ATTENUATION TANK 1

Type	-	Cellular Units
Length	-	12.00m
Width	-	7.00m

GENERAL DRAINAGE NOTES:

Existing details shown on this drawing including kerblines, existing drains, chambers, sewers, pipework, stub connections where new connections, diversions or abandonment are shown, invert levels and pipe sizes shall be checked and confirmed to the engineer prior to the commencement of any works. Any discrepancies shall be reported to the engineer for action prior to any new construction.

All drainage works shall be carried out in accordance with the requirements of the local authority and in conjunction with all relevant British Standards and Codes of Practice

All drainage shall comply with the typical drainage construction details and the requirements of BS EN 752.

Access covers and frames shall comply with the loadings specified and to BS EN 124 and kitemarked or if recessed covers are specified then in accordance with FACTA association equivalent.

The proposed building outlines shown on this drawing are for information only. Refer to Architects plans for precise location setting out information and details.

All underslab drainage shall be clear of foundations unless shown otherwise with long radius bends kept to a minimum and used where unavoidable.

All private drainage pipework for foul and surface water systems have been designed on the basis of UPVC to BS EN 1401-1, unless noted otherwise.

Where new drainage is situated within 5 metres of new or existing trees the pipework shall be encased in concrete to reduce the risk of root ingress.

Concrete encasement of the pipework shall be required where the vertical clearance between two pipes crossing is less than 300mm.

All existing drainage shall be assumed to be 'live' and shall be maintained at all times during the works. Existing drainage shall be reconnected to the new drainage system unless proven to be redundant for abandonment. All existing drainage to be abandoned shall be sealed by appropriate means.

Upon completion all new drainage installation together with any existing drainage retained shall be jetted and CCTV surveyed upon completion. Contractor to ensure that the drainage system is fully operational, free of excess debris/silt and all identified faults rectified.

HEALTH & SAFETY: The works shall be carried out by specialist competent and experienced contractors. All operatives shall have received full and appropriate training with appropriate qualifications for the operations they are required to undertake. All work shall be carried out in accordance with the relevant Health & Safety Regulations.

SITE SPECIFIC DRAINAGE NOTES:

Any existing drainage within the development site to remain live and to be diverted if required. Existing sewer location, size and depths, to which the networks are connecting / discharging, to be confirmed prior to the commencement of any drainage work.

Proposed rainwater and foul down pipe locations to be confirmed prior to the commencement of any drainage works. Design subject to change.

External levels and subsequent manhole cover levels and gully / channel drain locations to be confirmed by Architect prior to commencement of any drainage works. Design subject to change.

Surface and foul water discharge subject to United Utilities and local authority approval. No drainage work to commence until Section 106 agreement and approval notice is given.

All foul water pipes to be 100Ø, and all surface water pipes to be 150Ø unless stated otherwise.

Foul water down pipes invert level 450mm below finished floor level
unless stated otherwise.

Rainwater pipes to have invert level of 600mm below finished floor level unless stated otherwise.

DRAINAGE SPECIFICATIONS

Foul water pipes to be Polypipe to BS EN 1401-1 or similar

Surface water pipes to be Polypipe Ridgidrain or similar

Manholes by FP McCann or similar

Flow Control to be a Hydro-Brake by Hydro-International or similar

Attenuation tanks to be WAVIN AquaCell Core-R or similar

Inspection chambers and silt trap chambers to be Polypipe or similar

Channel drain to be ACO M150D 0.0 or similar

Gully to be Heptworth Road Gully or similar

PERMEABLE SURFACING

Permeable asphalt layers over over a 300mm deep sub-base consisting of 20mm no fines aggregate and housing a perforated pipe to convey surface water to the main drainage network. Permeable surfacing to take surface water run-off shared driveway areas.

PERMEABLE PAVING NOTE

Paving and laying course over over a 300mm deep sub-base consisting of 20mm no fines aggregate and housing a perforated pipe to convey surface water to the main drainage network. Permeable paving to take surface water run-off private driveway areas.

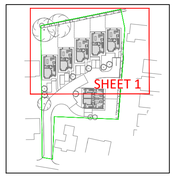
FILTER DRAIN

300x300mm deep, 20mm no fines aggregate trench and housing a perforated pipe to convey surface water to the main drainage network. Filter drains to take surface water run-off from patio areas.

DRAIANGE KEY:

- Surface Water Pipes - Solid
- Proposed 150Ø Perforated Pipe
- Proposed Foul Water Pipes
- Existing CW Sewer Network
- Permeable Surfacing (See Notes)
- Permeable Surfacing (See Notes)
- Filter Drain (See Notes)
- Development Boundary

N



Role	Zone	Level	Type	Number	Rev
C	XX	XX	GA	6001	P01

Rev.	Description	Date
P01	Preliminary Issue	17.03.2025

Project
Sunny Brow Road
Middleton

Client
Molloy Homes

Drawn	Checked	Approved	Date	Scale @ A1
DW	RS	GC	Mar'25	1:100

Drawing Title
Below Ground Drainage Layout
Sheet 1

Drawing Status
Preliminary

Project No.	Drawing No.	Revision
11426 – C – XX – 00 – GA – 6001	– P01	

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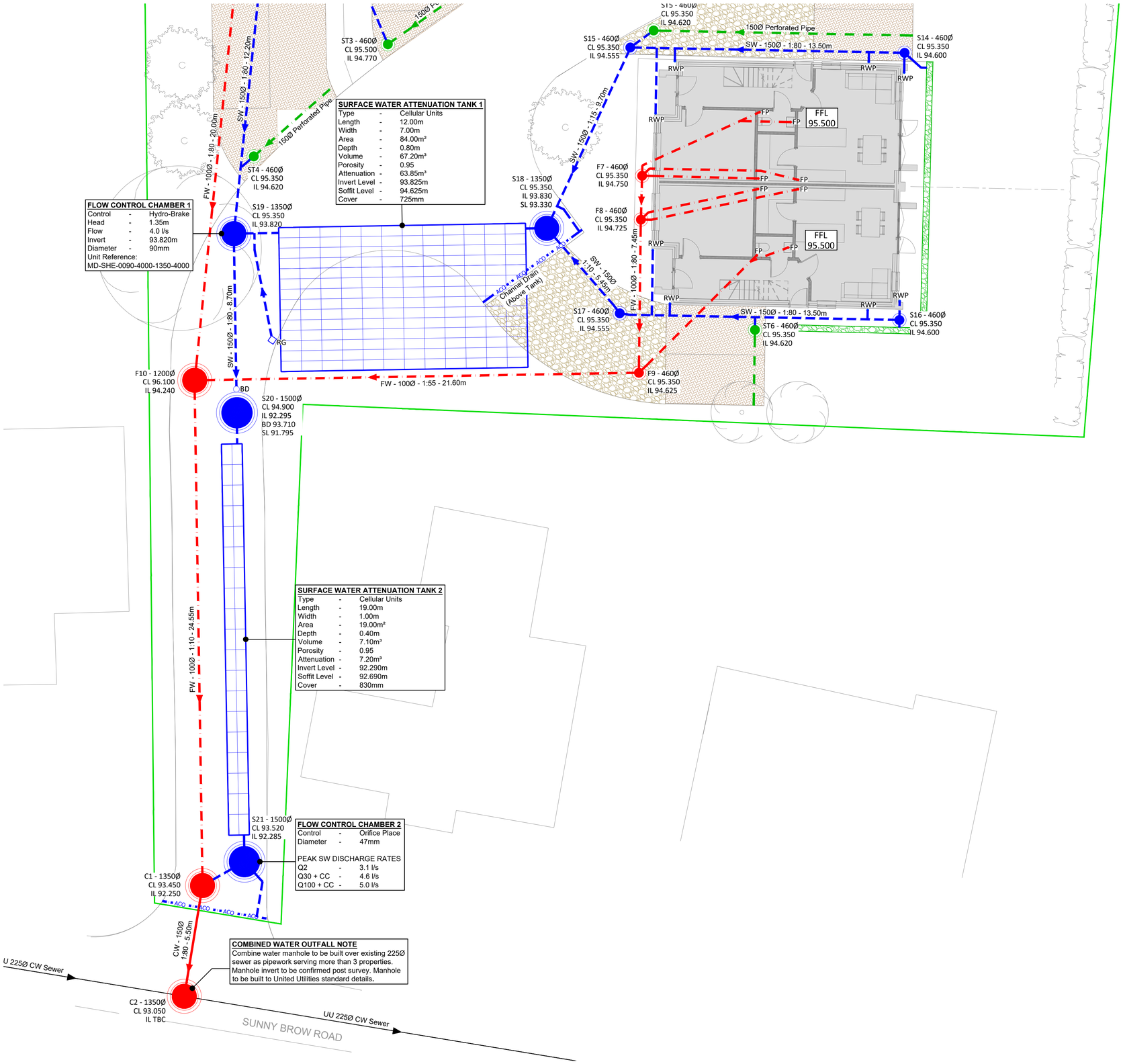

SURFACE WATER ATTENUATION TANK 1

Type	-	Cellular Units
Length	-	12.00m
Width	-	7.00m
Area	-	84.00m²
Depth	-	0.80m
Volume	-	67.20m³
Porosity	-	0.95
Attenuation	-	63.85m³
Invert Level	-	93.825m
Soffit Level	-	94.625m
Cover	-	725mm

FLOW CONTROL CHAMBER 1

Control	-	Hydro-Brake
Head	-	1.35m
Flow	-	4.0 l/s
Invert	-	93.820m
Diameter	-	90mm
Unit Reference:		
MD-SHE-0090-4000-1350-4000		

SURFACE WATER ATTENUATION TANK 2

Type	-	Cellular Units
Length	-	19.00m
Width	-	1.00m
Area	-	19.00m²
Depth	-	0.40m
Volume	-	7.10m³
Porosity	-	0.95
Attenuation	-	7.20m³
Invert Level	-	92.290m
Soffit Level	-	92.690m
Cover	-	830mm

FLOW CONTROL CHAMBER 2

Control	-	Orifice Place
Diameter	-	47mm
PEAK SW DISCHARGE RATES		
Q2	-	3.1 l/s
Q30 + CC	-	4.6 l/s
Q100 + CC	-	5.0 l/s

COMBINED WATER OUTFALL NOTE

Combine water manhole to be built over existing 225Ø sewer as pipework serving more than 3 properties. Manhole invert to be confirmed post survey. Manhole to be built to United Utilities standard details.

GENERAL DRAINAGE NOTES:

Existing details shown on this drawing including kerblines, existing drains, chambers, sewers, pipework, stub connections where new connections, diversions or abandonment are shown, invert levels and pipe sizes shall be checked and confirmed to the engineer prior to the commencement of any works. Any discrepancies shall be reported to the engineer for action prior to any new construction.

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300x300mm deep, 20mm no fines aggregate trench and housing a perforated pipe to convey surface water to the main drainage network. Filter drains to take surface water run-off from patio areas.

DRAIANGE KEY:

- Surface Water Pipes - Solid
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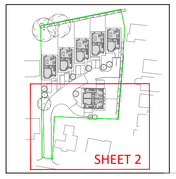
- Proposed Foul Water Pipes
- Existing CW Sewer Network
- Permeable Surfacing (See Notes)
- Permeable Surfacing (See Notes)
- Filter Drain (See Notes)
- Development Boundary

N



Role	Zone	Level	Type	Number	Rev
C	XX	XX	GA	6002	P01

Rev.	Description	Date
P01	Preliminary Issue	17.03.2025

Project
Sunny Brow Road
Middleton

Client
Molloy Homes

Drawn	Checked	Approved	Date	Scale @ A1
DW	RS	GC	Mar'25	1:100

Drawing Title
Below Ground Drainage Layout
Sheet 2

Drawing Status
Preliminary

Project No. / Drawing No. / Revision
11426 – C – XX – 00 – GA – 6002 – P01

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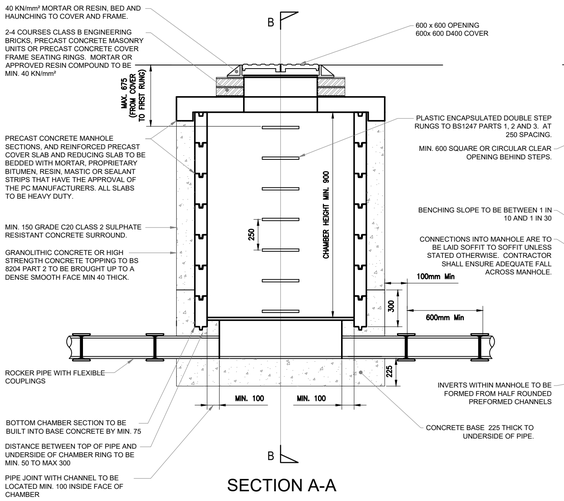
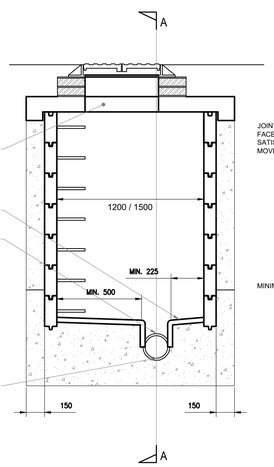
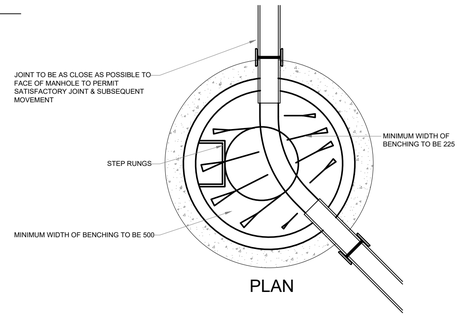


SECTION A-A

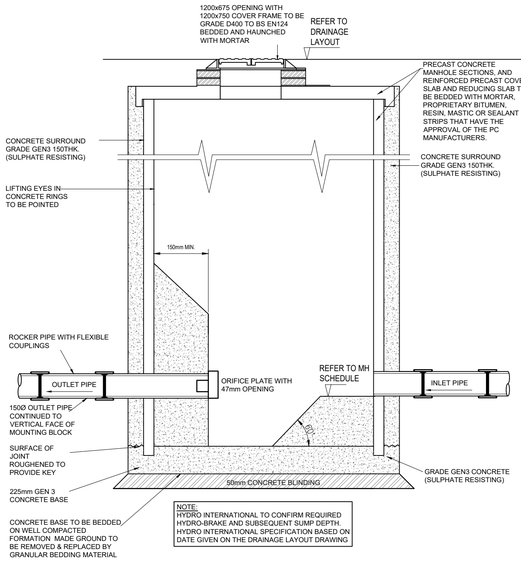


SECTION B-B

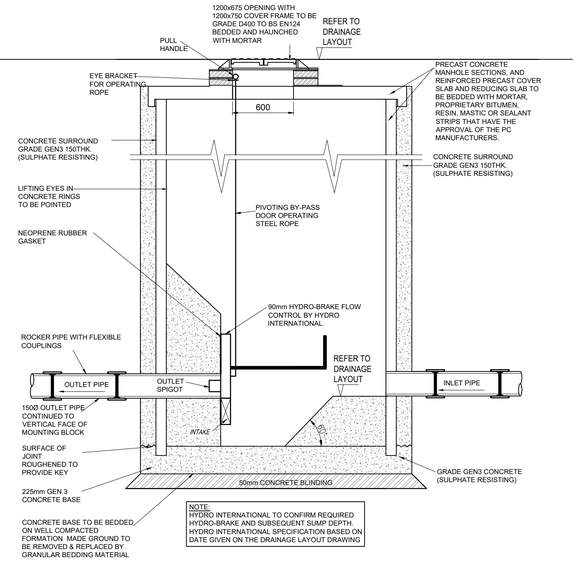


PLAN

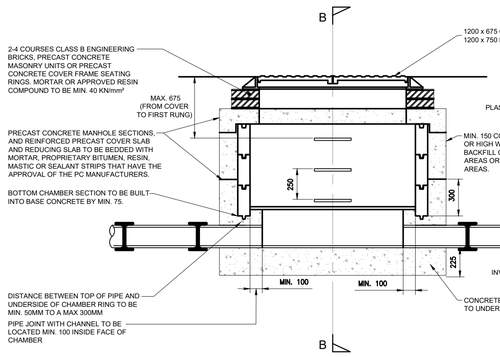
MANHOLE TYPE B
CIRCULAR PRECAST CONCRETE MANHOLE DETAIL
(DEPTH MORE THAN 1.50m TO PIPE SOFFIT)



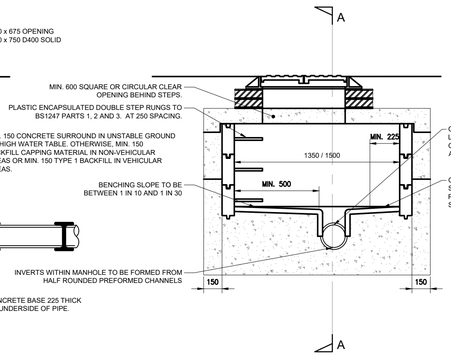
FLOW CONTROL MANHOLE DETAIL
ORIFICE



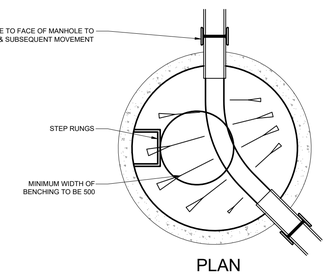
FLOW CONTROL MANHOLE DETAIL
HYDRO-BRAKE



SECTION A-A

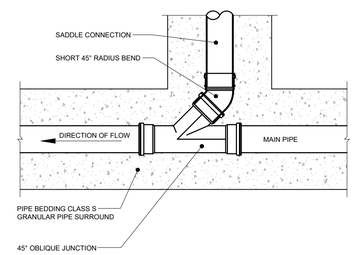


SECTION B-B

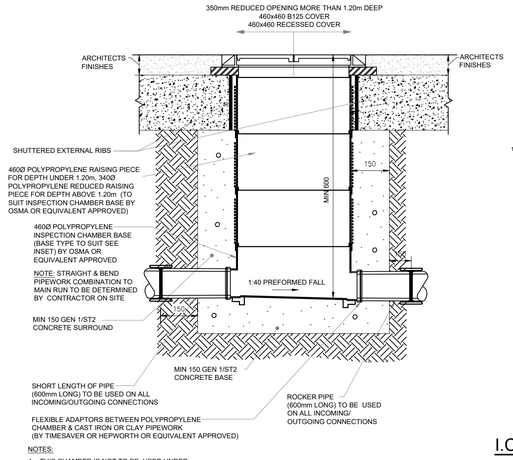


PLAN

MANHOLE TYPE C
CIRCULAR PRECAST CONCRETE AND / OR BRICKWORK MANHOLE DETAIL
(DEPTH LESS THAN 1.50m TO PIPE SOFFIT)



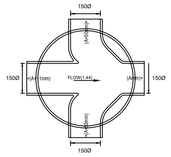
TYPICAL 45° PIPE JUNCTION
CONNECTION DETAIL



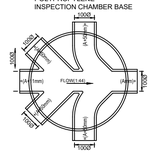
NOTES:
1. THIS CHAMBER IS NOT TO BE USED UNDER HEAVY VEHICULAR AREAS.
2. MAXIMUM INCOMING/OUTGOING PIPE DIAMETER SHALL BE 100 OR 150Ø.

MANHOLE TYPE D
POLYPROPYLENE INSPECTION CHAMBER
(MAXIMUM DEPTH 3.00m)

NOTE:
COVERS TO BE ORIENTATED BY CONTRACTOR ON SITE TO SUIT PAVEMENT FINISHES.
COVERS SHOULD NOT STRADDLE TWO PAVEMENT FINISHES.

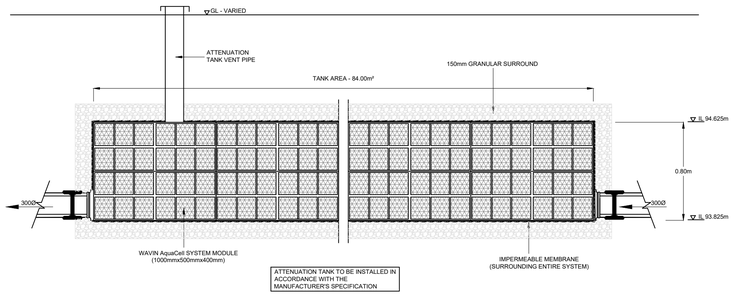


3x150Ø INLET POLYPROPYLENE INSPECTION CHAMBER BASE

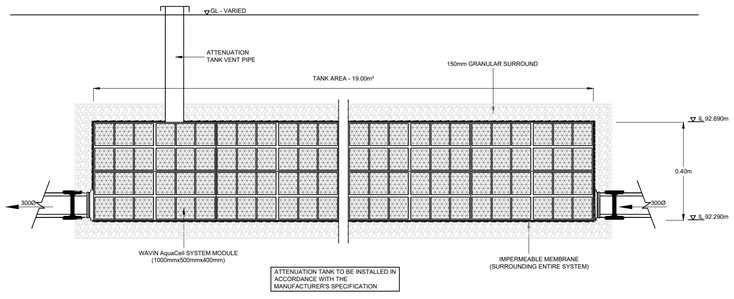


5x100Ø INLET POLYPROPYLENE INSPECTION CHAMBER BASE

I.C. TYPE 2 BASE TYPES



ATTENUATION TANK 1 DETAIL



ATTENUATION TANK 2 DETAIL

Role	Zone	Level	Type	Number	Rev
C	XX	XX	GA	6003	P01

Rev	Description	Date
P01	Preliminary Issue	17.03.2025

Project
Sunny Brow Road
Middleton
Client
Molloy Homes

Drawn	Checked	Approved	Date	Scale @ A1
DW	RS	GC	Mar'25	N.T.S

Drawing Title
Below Ground Drainage Details
Sheet 1
Drawing Status
Preliminary

Project No.	Drawing No.	Revision
11426 – C – XX – 00 – GA – 6003 – P01		

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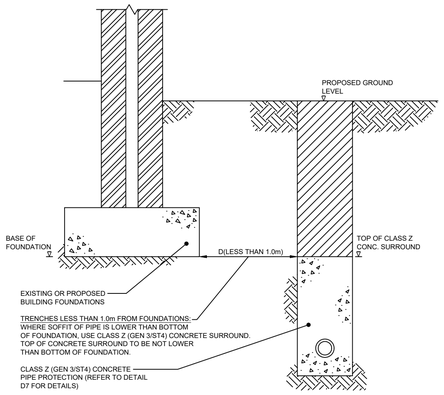
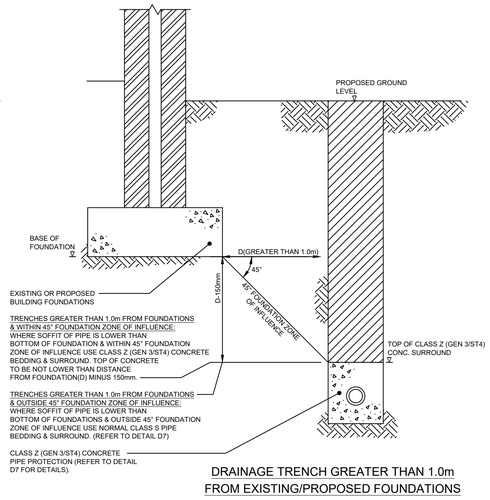
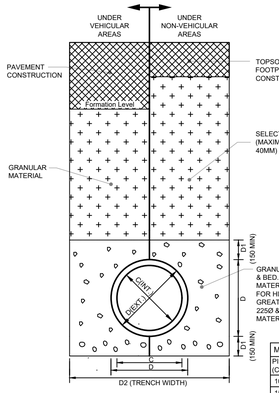


DRAINAGE TRENCH LESS THAN 1.0m
FROM EXISTING/PROPOSED FOUNDATIONS



DRAINAGE TRENCH GREATER THAN 1.0m
FROM EXISTING/PROPOSED FOUNDATIONS

PIPE PROTECTION ADJACENT TO EXISTING/PROPOSED FOUNDATIONS



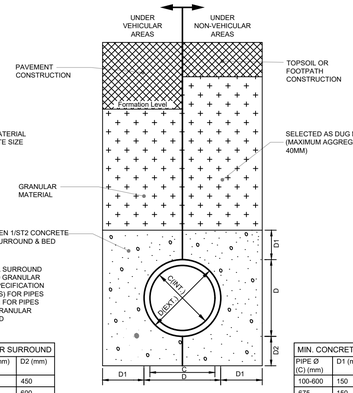
TO BE USED UNDER:

1. VEHICULAR AREAS WHERE COVER TO PIPE SOFFIT IS GREATER THAN 900mm.
2. ALL NON-VEHICULAR AREAS WHERE COVER TO PIPE SOFFIT IS GREATER THAN 600mm.

NOTE:
ALL PIPEWORK SHALL HAVE FLEXIBLE COUPLINGS

MIN. GRANULAR SURROUND		
PIPE Ø (C) (mm)	D1 (mm)	D2 (mm)
100	150	450
150	150	600
225	150	700
300	150	850
375	200	1050
450	200	1150
525	200	1200
600	200	1350
675	200	1450
750	200	1500

CLASS S PIPE BEDDING & SURROUND (TO BE USED FOR PLASTIC, VITRIFIED CLAY & CONCRETE PIPEWORK)



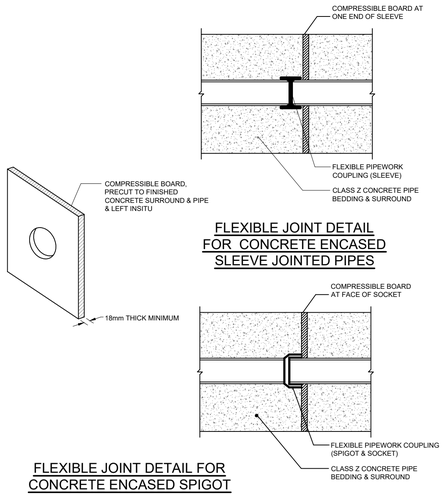
TO BE USED UNDER:

1. VEHICULAR AREAS WHERE COVER TO PIPE SOFFIT IS EQUAL TO OR LESS THAN 900mm.
2. ALL NON-VEHICULAR AREAS WHERE COVER TO PIPE SOFFIT IS EQUAL TO OR LESS THAN 600mm.

NOTE:
ALL PIPEWORK WITH CLASS Z (GEN 3/ST4) CONCRETE SURROUND SHALL HAVE FLEXIBLE COUPLINGS WITH FLEXI-BOARDS ON ALL JOINTS (REFER TO DETAIL D8)

MIN. CONCRETE ENCASEMENT		
PIPE Ø (C) (mm)	D1 (mm)	D2 (mm)
100-600	150	150
675	150	170
750	150	190
825	150	210
900	150	225
975	150	250
1050	150	270
1200	170	300
1350	180	350
1500	200	375
1650	220	420

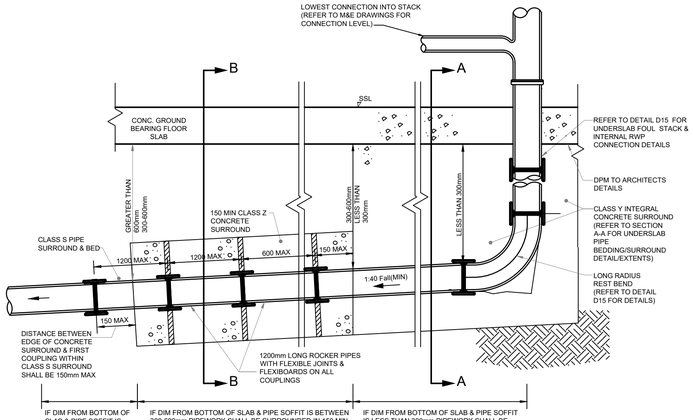
CLASS Z PIPE BEDDING & SURROUND (TO BE USED FOR PLASTIC, VITRIFIED CLAY & CONCRETE PIPEWORK)



FLEXIBLE JOINT DETAIL FOR CONCRETE ENCASED SLEEVE JOINTED PIPES

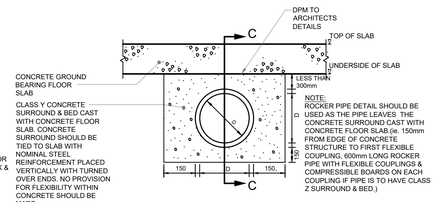
FLEXIBLE JOINT DETAIL FOR CONCRETE ENCASED SPIGOT & SOCKET JOINTED PIPES

FLEXIBLE JOINT DETAIL FOR CONCRETE ENCASED PIPES (TO B.S. 1142)

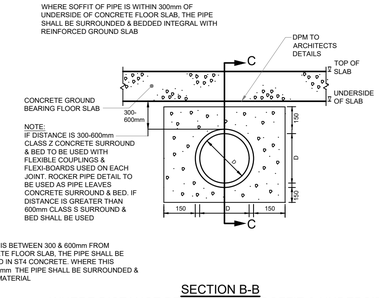


SECTION C-C

NOTES:
1. THIS DETAIL SHALL ONLY BE USED UNDER AREAS OF GROUND BEARING SLAB WHERE UNDER SLAB PIPEWORK CAN BE SUPPORTED BY UNDER SLAB FILL MATERIAL.
2. CONNECTION INTO INTERNAL MANHOLE OR MAIN UNDER SLAB RUN OR EXIT THROUGH FOUNDATION EDGE DETAIL AS PER DETAIL D (REFER TO DRAINAGE PLAN)

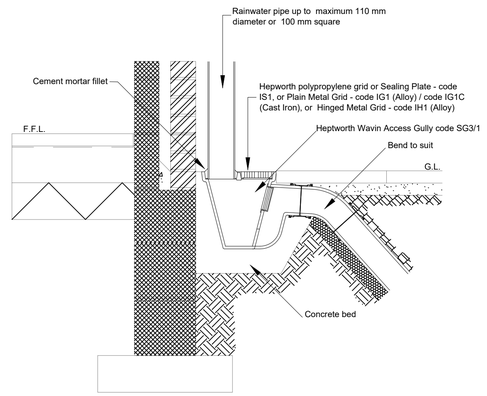


SECTION A-A
WHERE DISTANCE BETWEEN PIPE SOFFIT & UNDERSIDE OF CONCRETE GROUND BEARING FLOOR SLAB/GROUND BEAM IS LESS THAN 300mm

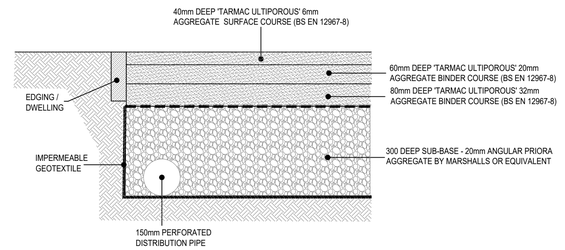


SECTION B-B
WHERE DISTANCE BETWEEN PIPE SOFFIT & UNDERSIDE OF CONCRETE GROUND BEARING FLOOR SLAB/GROUND BEAM IS GREATER THAN 300mm

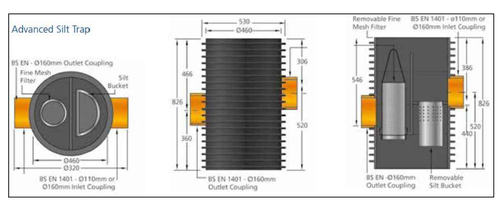
FOUL AND RAINWATER PIPE TYPICAL UNDERSLAB PIPE BEDDING DETAILS FOR PIPEWORK UNDER STRUCTURAL SLAB (FOR ALL UNDER SLAB PIPE DEPTHS)



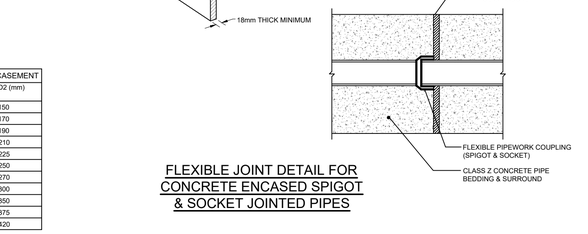
RAINWATER PIPE TO GULLY DRAINAGE DETAIL



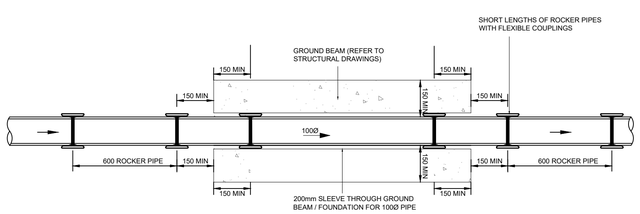
PERMEABLE SURFACING DRAINAGE DETAIL (ACCESS AREAS)



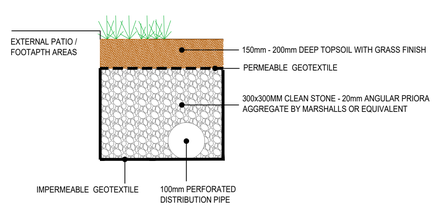
SILT TRAP CHAMBER DETAIL



PERMEABLE PAVING DRAINAGE DETAIL (DRIVEWAY AREAS)



TYPICAL PIPE THROUGH GROUND BEAM / FOUNDATION DETAIL



FILTER DRAIN DETAIL (LANDSCAPE AREA ADJACENT TO PAVING)

Role	Zone	Level	Type	Number	Rev
C	XX	XX	GA	6004	P01

Rev.	Description	Date
P01	Preliminary Issue	17.03.2025

Project
Sunny Brow Road
Middleton

Client
Molloy Homes

Drawn	Checked	Approved	Date	Scale @ A1
DW	RS	GC	Mar'25	N.T.S

Drawing Title
Below Ground Drainage Details
Sheet 2

Drawing Status
Preliminary

Project No.	Drawing No.	Revision
11426 – C – XX – 00 – GA – 6004	– P01	

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Barrington House, Heyes Lane, Alderley Edge, Cheshire SK9 7LA

Appendix G – Surface Water Network / Management Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 386220 405920 SD 86220 05920
Data Type	Point
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	45
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.063	4-8	0.035	8-12	0.033	12-16	0.030	16-20	0.000

Total Area Contributing (ha) = 0.160

Total Pipe Volume (m³) = 1.491

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	44.700	0.560	79.8	0.065	15.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	12.200	0.150	81.3	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	1.000	0.005	200.0	0.057	15.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	1.000	0.005	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	15.66	94.680	0.065	0.0	0.0	0.0	1.13	19.9	0.0
1.001	0.00	15.84	94.120	0.082	0.0	0.0	0.0	1.12	19.7	0.0
2.000	0.00	15.02	93.830	0.057	0.0	0.0	0.0	1.11	78.3	0.0
2.001	0.00	15.03	93.825	0.057	0.0	0.0	0.0	1.11	78.3	0.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.002	8.700	0.110	79.1	0.007	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	1.000	0.005	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	1.000	0.005	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	2.800	0.035	80.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.002	0.00	15.97	93.820	0.146	0.0	0.0	0.0	1.13	20.0	0.0
1.003	0.00	15.99	92.295	0.146	0.0	0.0	0.0	1.11	78.3	0.0
1.004	0.00	16.00	92.290	0.146	0.0	0.0	0.0	1.11	78.3	0.0
1.005	0.00	16.04	92.285	0.160	0.0	0.0	0.0	1.12	19.9	0.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S2	95.600	0.920	Open Manhole	460	1.000	94.680	150				
S13	96.100	1.980	Open Manhole	460	1.001	94.120	150	1.000	94.120	150	
S18	95.350	1.520	Open Manhole	1350	2.000	93.830	300				
Tank 1	95.350	1.525	Open Manhole	1	2.001	93.825	300	2.000	93.825	300	
S19	95.350	1.530	Open Manhole	1350	1.002	93.820	150	1.001	93.970	150	150
								2.001	93.820	300	
S20	94.900	2.605	Open Manhole	1500	1.003	92.295	300	1.002	93.710	150	1265
Tank 2	93.520	1.230	Open Manhole	1	1.004	92.290	300	1.003	92.290	300	
S21	93.520	1.235	Open Manhole	1500	1.005	92.285	150	1.004	92.285	300	
C1	93.450	1.200	Open Manhole	1350		OUTFALL		1.005	92.250	150	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	S2	95.600	94.680	0.770	Open Manhole	460
1.001	o	150	S13	96.100	94.120	1.830	Open Manhole	460
2.000	o	300	S18	95.350	93.830	1.220	Open Manhole	1350
2.001	o	300	Tank 1	95.350	93.825	1.225	Open Manhole	1
1.002	o	150	S19	95.350	93.820	1.380	Open Manhole	1350
1.003	o	300	S20	94.900	92.295	2.305	Open Manhole	1500
1.004	o	300	Tank 2	93.520	92.290	0.930	Open Manhole	1
1.005	o	150	S21	93.520	92.285	1.085	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	44.700	79.8	S13	96.100	94.120	1.830	Open Manhole	460
1.001	12.200	81.3	S19	95.350	93.970	1.230	Open Manhole	1350
2.000	1.000	200.0	Tank 1	95.350	93.825	1.225	Open Manhole	1
2.001	1.000	200.0	S19	95.350	93.820	1.230	Open Manhole	1350
1.002	8.700	79.1	S20	94.900	93.710	1.040	Open Manhole	1500
1.003	1.000	200.0	Tank 2	93.520	92.290	0.930	Open Manhole	1
1.004	1.000	200.0	S21	93.520	92.285	0.935	Open Manhole	1500
1.005	2.800	80.0	C1	93.450	92.250	1.050	Open Manhole	1350

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Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	S2	150	0.770	1.830	Unclassified	460	0	0.770	Unclassified
1.001	S13	150	1.230	1.830	Unclassified	460	0	1.830	Unclassified
2.000	S18	300	1.220	1.225	Unclassified	1350	0	1.220	Unclassified
2.001	Tank 1	300	1.225	1.230	Unclassified	1	0	1.225	Unclassified
1.002	S19	150	1.040	1.380	Unclassified	1350	0	1.380	Unclassified
1.003	S20	300	0.930	2.305	Unclassified	1500	0	2.305	Unclassified
1.004	Tank 2	300	0.930	0.935	Unclassified	1	0	0.930	Unclassified
1.005	S21	150	1.050	1.085	Unclassified	1500	0	1.085	Unclassified

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)
1.005	C1	93.450	92.250	0.000	1350	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	2	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	No
Return Period (years)	100	Winter Storms	Yes
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location GB 386220 405920 SD 86220 05920		Cv (Winter)	1.000
Data Type	Point	Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S19, DS/PN: 1.002, Volume (m³): 2.4

Unit Reference	MD-SHE-0090-4000-1350-4000
Design Head (m)	1.350
Design Flow (l/s)	4.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	90
Invert Level (m)	93.820
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)	1.350	4.0	Kick-Flo®	0.802	3.1
Flush-Flo™	0.396	3.9	Mean Flow over Head Range	-	3.5

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	2.8	0.800	3.2	2.000	4.8	4.000	6.6	7.000	8.6
0.200	3.6	1.000	3.5	2.200	5.0	4.500	7.0	7.500	8.9
0.300	3.9	1.200	3.8	2.400	5.2	5.000	7.4	8.000	9.2
0.400	3.9	1.400	4.1	2.600	5.4	5.500	7.7	8.500	9.5
0.500	3.9	1.600	4.3	3.000	5.8	6.000	8.0	9.000	9.7
0.600	3.8	1.800	4.6	3.500	6.2	6.500	8.3	9.500	10.0

Orifice Manhole: S21, DS/PN: 1.005, Volume (m³): 2.2

Diameter (m) 0.047 Discharge Coefficient 0.600 Invert Level (m) 92.285

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Storage Structures for Storm

Cellular Storage Manhole: Tank 1, DS/PN: 2.001

Invert Level (m) 93.825 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	84.0	0.0	1.800	0.0	0.0	3.600	0.0	0.0
0.200	84.0	0.0	2.000	0.0	0.0	3.800	0.0	0.0
0.400	84.0	0.0	2.200	0.0	0.0	4.000	0.0	0.0
0.600	84.0	0.0	2.400	0.0	0.0	4.200	0.0	0.0
0.800	84.0	0.0	2.600	0.0	0.0	4.400	0.0	0.0
1.000	0.0	0.0	2.800	0.0	0.0	4.600	0.0	0.0
1.200	0.0	0.0	3.000	0.0	0.0	4.800	0.0	0.0
1.400	0.0	0.0	3.200	0.0	0.0	5.000	0.0	0.0
1.600	0.0	0.0	3.400	0.0	0.0			

Cellular Storage Manhole: Tank 2, DS/PN: 1.004

Invert Level (m) 92.290 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	19.0	0.0	0.900	0.0	0.0	1.800	0.0	0.0
0.100	19.0	0.0	1.000	0.0	0.0	1.900	0.0	0.0
0.200	19.0	0.0	1.100	0.0	0.0	2.000	0.0	0.0
0.300	19.0	0.0	1.200	0.0	0.0	2.100	0.0	0.0
0.400	19.0	0.0	1.300	0.0	0.0	2.200	0.0	0.0
0.500	0.0	0.0	1.400	0.0	0.0	2.300	0.0	0.0
0.600	0.0	0.0	1.500	0.0	0.0	2.400	0.0	0.0
0.700	0.0	0.0	1.600	0.0	0.0	2.500	0.0	0.0
0.800	0.0	0.0	1.700	0.0	0.0			

Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
1.000	S2	0.500
1.001	S13	0.500
2.000	S18	0.500
2.001	Tank 1	0.500
1.002	S19	0.500
1.003	S20	0.500
1.004	Tank 2	0.500
1.005	S21	0.500

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Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	S2	0.153	0.790	0.000	0.943
1.001	S13	0.329	0.216	0.000	0.545
2.000	S18	2.176	0.071	0.000	2.246
2.001	Tank 1	0.000	0.071	69.160	69.231
1.002	S19	2.190	0.154	0.000	2.344
1.003	S20	4.603	0.071	0.000	4.674
1.004	Tank 2	0.000	0.071	7.822	7.892
1.005	S21	2.182	0.049	0.000	2.232
Total		11.634	1.491	76.982	90.107

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	S2	0.153	0.782	0.000	0.935
1.001	S13	0.329	0.200	0.000	0.529
2.000	S18	2.176	0.023	0.000	2.199
2.001	Tank 1	0.000	0.023	69.160	69.183
1.002	S19	2.190	0.129	0.000	2.319
1.003	S20	4.603	0.018	0.000	4.621
1.004	Tank 2	0.000	0.018	7.822	7.839
1.005	S21	2.182	0.024	0.000	2.207
Total		11.634	1.215	76.982	89.831

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2 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 Coeffiecient 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 Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
FEH Rainfall Version 2013 Cv (Summer) 1.000
Site Location GB 386220 405920 SD 86220 05920 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	S2	30 Summer	2	+0%	30/30 Summer				94.739	-0.091	0.000	0.33
1.001	S13	30 Summer	2	+0%	30/15 Summer				94.192	-0.078	0.000	0.46
2.000	S18	240 Summer	2	+0%	30/15 Summer				93.993	-0.137	0.000	0.06
2.001	Tank 1	240 Summer	2	+0%	30/15 Summer				93.993	-0.132	0.000	0.04
1.002	S19	180 Summer	2	+0%	2/60 Summer				94.004	0.034	0.000	0.20
1.003	S20	360 Summer	2	+0%	2/60 Summer				92.753	0.158	0.000	0.06
1.004	Tank 2	360 Summer	2	+0%	2/60 Summer				92.753	0.163	0.000	0.05
1.005	S21	360 Summer	2	+0%	2/15 Summer				92.752	0.317	0.000	0.26

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S2			6.3	OK	
1.001	S13			8.3	OK	
2.000	S18			3.3	OK	
2.001	Tank 1		70	2.6	OK	
1.002	S19			3.5	SURCHARGED	
1.003	S20			3.4	SURCHARGED	
1.004	Tank 2		92	3.0	SURCHARGED	
1.005	S21			3.1	SURCHARGED	

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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 Coeffiecient	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 Time/Area Diagrams	0
Number of Online Controls	2	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 386220 405920 SD 86220 05920	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	S2	60 Summer	30	+40%	30/30 Summer				94.944	0.114	0.000	0.97
1.001	S13	180 Summer	30	+40%	30/15 Summer				94.483	0.213	0.000	0.81
2.000	S18	180 Summer	30	+40%	30/15 Summer				94.473	0.343	0.000	0.17
2.001	Tank 1	180 Summer	30	+40%	30/15 Summer				94.473	0.348	0.000	0.08
1.002	S19	120 Summer	30	+40%	2/60 Summer				94.494	0.524	0.000	0.22
1.003	S20	480 Summer	30	+40%	2/60 Summer				93.313	0.718	0.000	0.07
1.004	Tank 2	480 Summer	30	+40%	2/60 Summer				93.312	0.722	0.000	0.07
1.005	S21	480 Summer	30	+40%	2/15 Summer				93.312	0.877	0.000	0.39

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S2			18.7	SURCHARGED	
1.001	S13			14.5	SURCHARGED	
2.000	S18			9.9	SURCHARGED	
2.001	Tank 1		150	4.6	SURCHARGED	
1.002	S19			3.9	SURCHARGED	
1.003	S20			4.0	SURCHARGED	
1.004	Tank 2		377	4.0	FLOOD RISK	
1.005	S21			4.6	FLOOD RISK	

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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 Coeffiecient 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 Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
FEH Rainfall Version 2013 Cv (Summer) 1.000
Site Location GB 386220 405920 SD 86220 05920 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	S2	60 Summer	100	+45%	30/30 Summer				95.587	0.757	0.000	1.25
1.001	S13	180 Winter	100	+45%	30/15 Summer				95.286	1.016	0.000	0.77
2.000	S18	180 Winter	100	+45%	30/15 Summer				95.278	1.148	0.000	0.16
2.001	Tank 1	180 Winter	100	+45%	30/15 Summer				95.278	1.153	0.000	0.08
1.002	S19	180 Winter	100	+45%	2/60 Summer				95.277	1.307	0.000	0.24
1.003	S20	480 Summer	100	+45%	2/60 Summer				93.495	0.900	0.000	0.07
1.004	Tank 2	480 Summer	100	+45%	2/60 Summer				93.494	0.904	0.000	0.07
1.005	S21	480 Summer	100	+45%	2/15 Summer				93.494	1.059	0.000	0.43

PN	US/MH Name	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S2			24.1	FLOOD RISK	
1.001	S13			13.7	SURCHARGED	
2.000	S18			9.3	FLOOD RISK	
2.001	Tank 1			4.4	FLOOD RISK	
1.002	S19			4.1	FLOOD RISK	
1.003	S20			3.9	SURCHARGED	
1.004	Tank 2		558	3.9	FLOOD RISK	
1.005	S21			5.0	FLOOD RISK	

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