MJA CONSULTING
Civil & Structural Engineers

PROPOSED RESIDENTIAL DEVELOPMENT
LAND WEST OF OLD MANOR FARM, SOUTH OF LOWER ROAD
BEDHAMPTON
HAMPSHIRE

FLOOD RISK ASSESSMENT & DEVELOPMENT DRAINAGE STRATEGY

BARGATE HOMES LTD

JULY 2024
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DOCUMENT CONTROL RECORD

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Appendices

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Appendix B – Topographical Survey
Appendix C – Foul and Surface Water Drainage Strategy
Appendix D – Pre / Post Development Runoff and Storage Calculations
Appendix E – Public Sewer Records
Appendix F – SUDS Compatibility Matrix
Appendix G – SUDS Management and Maintenance Plan

References

Environment Agency Flood Map Information © and database right www.environment_agency.gov.uk

Contains British Geological Survey materials © NERC (2018)

National Planning Policy Framework (Department for Communities and Local Government, March 2012)

PPG Flood risk and coastal change (Department for Communities and Local Government, March 2014)

Havant Borough Council Strategic Flood Risk Assessment, 2018 (SFRA) (HBC, November 2018)

Hampshire County Council Preliminary Flood Risk Assessment (PFRA) (HCC, April 2011)

1 Executive Summary

SITE INFORMATION	CLIENT	Bargate Homes Ltd
	SITE NAME	Phase 2 Manor Farm
	SITE LOCATION	SU 69849 05991 Bedhampton Havant Hampshire
	SITE AREA CURRENT LAND USE	3.67 ha Greenfield – Arable / Agricultural grassland
	PROPOSED LAND USE	No.43 Residential Dwellings (Class C3A)
	SITE GEOLOGY – Superficial SITE GEOLOGY - Bedrock	River Terrace Deposit – Sand, Silt, Clay Lewis Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk and Portsdown Chalk Formations – Chalk
	SOIL INFILTRATION RATE	Superficial: Insufficient. Underlying Chalk: $1x10^{-4}$m/s
	GROUNDWATER LEVELS	~3.8m Below Ground Level
	GROUNDWATER SPZ / AQUIFER	SPZ 1 close by/ Principle (Bedrock), Superficial (Secondary A) Vulnerable
	GROUND CONTAMINATION	TBC – None anticipated
FLOOD RISK	ENVIRONMENT AGENCY FLOOD ZONE	Flood Zone 1 - Lowest Risk < 0.1% (<1:1000)
	FLUVIAL (RIVERS & WATERCOURSES)	Not a risk
	PLUVIAL (SURFACE WATER)	Not a risk
	GROUNDWATER	Not a risk
	EXISTING/PROPOSED SEWERS & MAINS	Not a risk
	ARTIFICIAL	Not a risk
	TIDAL	Not a risk
FOUL & SURFACE	PROPOSED SURFACE WATER STRATEGY	Gravity to ditch
	PROPOSED SUDS TYPE	Swales, Filter Trenches, Reed Bed, Attenuation Basin
	EXISTING SW PEAK FLOW RATE	Greenfield QBar: 3.3 l/s
	PROPOSED SW PEAK FLOW RATE	3.3 l/s
	FOUL WATER STRATEGY	Pumped to Phase 1 Foul Sewer
	EXISTING FW PEAK FLOW RATE	N/A
	PROPOSED FW PEAK FLOW RATE	2.0 l/s (SFA 4000 l/unit/d) for 43 Units
MISC	FURTHER INVESTIGATIONS	N/A

2 Introduction

2.1 Scope

Bargate Homes is seeking outline planning permission for the construction of up to No.43 residential dwellings, associated landscaping, open space and allotments with access from Lower Road. The 36,709m² (3.67ha) site is located at land adjacent to Lower Road, Bedhampton. Refer to Appendix A for site layout.

2.2 MJA Consulting has been appointed to provide a Flood Risk Assessment & Drainage Strategy suitable to submit as part of the planning application for the disposal of foul and surface water from the proposed development.

2.3 Report Structure

The National Planning Policy Framework (NPPF) and the Flood Risk and Coastal Planning Practice Guidance (PPG) is the current guidance on development and flood risk in England and Wales. The Flood Risk technical guidance for the National Planning Policy Framework requires a Flood Risk Assessment (FRA) to be carried out on sites over 1ha to consider all potential forms of flooding including that from river, sea, estuarial, land drainage, groundwater, overland flow, surface water run-off, sewer systems, and artificial water bodies (lakes, reservoirs, canals etc.) to both the development site and to offsite parties and land.

2.4 This report will take the structure of a 'Flood Risk Assessment' in accordance with the National Planning Policy Framework, the Flood Risk and Coastal Planning Practice Guidance, Environment Agency's Flood Risk Assessment Guidance and CIRIA Report 624 'Development and Flood Risk.

2.5 The objectives of this report are:

- To confirm whether the proposed development site is affected by current or anticipated future flooding from all sources for the lifetime of the site.
- To confirm that this development will not increase the risk of flooding to any offsite properties and land or increase the population within a floodplain.
- To undertake calculations to establish the foul and surface water runoff rates from the existing site and to assess the potential foul and surface water runoff from the proposed development.
- To detail a suitable strategy for the management of foul and surface water generated from the proposed development allowing for future climate change.
- To satisfy the approving planning authority that the most sustainable foul and surface water drainage solutions have been considered, in line with Environment Agency guidance, The Building Regulations (Document H 2002) and government legislation such as the Flood and Water Management Act 2010 (Defra) and The National Planning Policy Framework (NPPF & PPG).

3 The Development Site

Figure 1: Site location

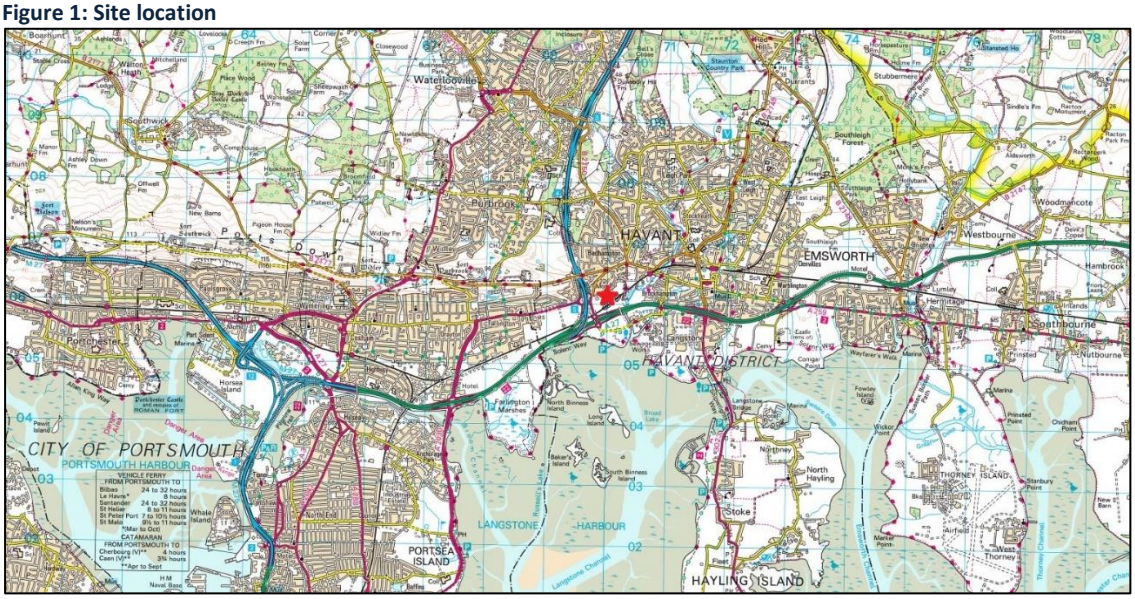


Image courtesy of: Bing Maps, 2021 Microsoft Corporation Image courtesy of Ordnance Survey

Figure 2: Development boundary

Image courtesy of: Google Maps, 2021 Microsoft Corporation

3.1 Site Location and Description

The application site is located at land south west of Bedhampton in Hampshire and directly south west of Phase 1 of the development. The site is centred on National Grid Reference SU 69849 05991 and is bound by Lower Road to the north and the railway line to the south. The A27/A3(M) lies to the west and arable land to the east of the site. The 36,709m² (3.67ha) parcel of land comprises an arable field.

3.2 Topography

A topographical survey of the site was undertaken by Encompass Surveys in March 2021 which indicates the site falls to the south at 1 in 55 with levels ranging from 8.19mAOD to 3.73mAOD (metres above Ordnance Datum). Refer to Appendix B for a Topographical Survey of the existing site.

3.3 Geology

Information published by the British Geological Society (BGS) indicates the underlying geology at the site as Lewis Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk and Portsdown Chalk Formations – Chalk, with superficial deposits of River Terrace Deposits – Sand, Silt and Clay.

3.4 Ground investigations were carried out in September 2017 for the adjacent phase 1 site and confirmed that site is underlain by sandy, silty clay over chalk substrata. The Clay is circa 1-3m thick. The clay is at its thinnest in the south west corner. It is assumed that the geology underlaying this phase 2 land is of similar nature.

3.5 Soil Permeability

Soil infiltration testing in accordance BRE 365 methodology was carried out in eight trial pits On the adjacent phase 1 site. The tests failed to achieve 75% drain and therefore failed to comply with BRE 365 “soakaway design”. Additional testing in the chalk just below the clay layer also showed low insufficient infiltration rates. Falling head tests in boreholes circa 14-15m below ground level showed higher soakage rates of $1.4x10^{-4}$ m/s, likely due to fissures in the chalk. It is also assumed that the infiltration rates will be similar on the phase 2 land.

3.6 Groundwater

Groundwater levels were taken during the intrusive investigation on the phase 1 parcel. These tests were carried out in 2017, 2018 and 2019 during and after the winter recharge periods when groundwater levels are typically at their maximum.

3.7 Groundwater was encountered at various depths across the site but on average was 3.8m BGL, with a maximum level recorded at 3.52m BGL. Due to the topographical differences between the parcels, it is assumed that groundwater at phase 2 will be at least 2m below ground level.

3.8 Historic BGS borehole records in the *vicinity* of the site are available and show the highest water level as circa 1.2m BGL.

3.9 Hydrogeology

The Environment Agency's mapping website (http://magic.defra.gov.uk/MagicMap.aspx) has classified the site as not within a Source Protection Zone but it is located 250m south (downstream) of a Zone 1 Source Protection Zone. The flow of water from the site is away from the abstraction point, towards the coast.

3.10 The bedrock Chalk formations are classified as 'Principle' aquifers. These are layers of rock that provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

3.11 The superficial deposits are classified as a 'Secondary A' aquifer. These are permeable layers of rock that can support water supplies on a local rather than strategic scale. They may be an important source for base flows to rivers.

3.12 Hydrology and existing site drainage characteristics

The existing site is undeveloped grassland, as such rainfall that lands on the site firstly infiltrates directly at source and into the underlying soils. It is likely the site has relatively poor surface water drainage with some overland flow.

3.13 The closest watercourse is located approximately 85m east of the site and the site is located approximately 730m north of Langstone Harbour.

3.14 Ground Contamination

The available environment data does not indicate the presence of any significant sources of contamination risk on site and no visual or olfactory evidence of soil contamination was identified during a site walkover.

4 Flood Risk

4.1 The assessment of flood risk to the site requires that all potential forms of flooding are considered. In accordance with the Environment Agency's Flood Risk Assessment Guidance, NPPF, PPG and CIRIA Report 624, sources of flooding to be assessed include tidal, fluvial (rivers, streams and watercourses), pluvial (overland rainfall runoff), groundwater, artificial sources (canals and reservoirs) and existing / proposed sewerage and water mains infrastructure.

4.2 History of Flooding

During the data collection process it is important to consider the information which already exists for the site location with respect to flood risk. The main sources of data for flood risk and recorded incidents of flooding for this site has been the *Havant Borough Council Strategic Flood Risk Assessment (SFRA) (HBC, November 2018)* and the *Hampshire County Council Preliminary Flood Risk Assessment (PFRA) (HCC, April 2011).* Additional information has been obtained from The Environment Agency, British Society Chronology of Extreme Hydrological Events, local news and media outlets.

4.3 Within the SFRA/PRFA studies, consultation was carried out with all appropriate authorities and organisations including the Environment Agency, Southern Water, Havant Borough Council and local community stakeholders to identify known or perceived problem areas with respect to flooding.

4.4 With reference to the above, and in the context of the proposed development, there are no historic issues of flooding from the following potential sources including:

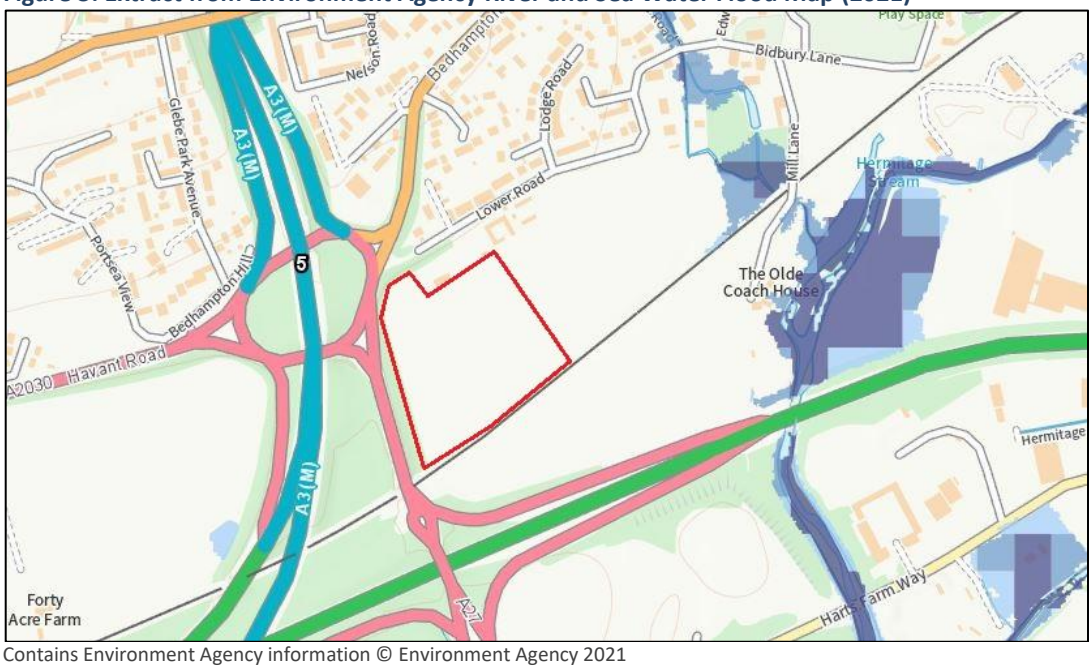
- Fluvial (Rivers)
- Tidal.
- Groundwater.
- Pluvial (Surface water runoff).
- Existing foul, storm and combined sewers or potable water main infrastructure.
- Artificial infrastructure.

4.5 Fluvial

The closest stream, also a main river classification, to the site runs north to south ~340m to the east and flows into Langstone Channel and the Solent. The Environment Agency confirms that no incidents of flooding from main rivers or ordinary watercourses have been recorded within the site boundary.

4.6 The Environment Agency (EA) is the principal flood risk management operating authority in England. The EA have carried out a national flood risk assessment (NaFRA) which assesses the probability of flooding to land from all main rivers in England. The results of this modelling are combined and calibrated against data from recorded flood events to produce the Environment Agency's Flood Zone Map (Figure 3).

Figure 3: Extract from Environment Agency River and Sea Water Flood Map (2021)



Contains Environment Agency information © Environment Agency 2021

Key:

Main Rivers

Dark Blue : (Flood Zone 3)
Shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded: from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Light Blue : (Flood Zone 2)
Shows the additional extent of an extreme flood from rivers or the sea.
These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.
These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

Clear : (Flood Zone 1)
Shows the area where flooding from rivers and the sea is very unlikely.
There is less than a 0.1% (1 in 1000) chance of flooding occurring each year.

4.7 The latest Environment Agency 'Flood Zone Map' (March 2019) indicates the site is located within the lowest risk category - Flood Zone 1. 'Flood Zone 1' is land assessed as having a less than 1 in 1000 (<0.1%) annual probability of flooding from a main river in each year and is not within an area of recorded river flooding.

4.8 Hampshire County Council as the Lead Local Flood Authority (LLFA) are responsible for assessing the flood risk from all other ordinary watercourses (non-main rivers) in the Bedhampton area, with this information detailed in the Havant SFRA. This study has concluded that the site is not at risk of flooding from all ordinary watercourses within the locality of the development.

4.9 It is demonstrated that safe and dry access and egress at the site is achievable to a publicly accessible location outside the 1:100 year (plus climate change) flood event extent, in accordance with DEFRA Report FD2320/TR2 - 'Flood Risk Assessment Guidance for New Developments'.

4.10 Tidal

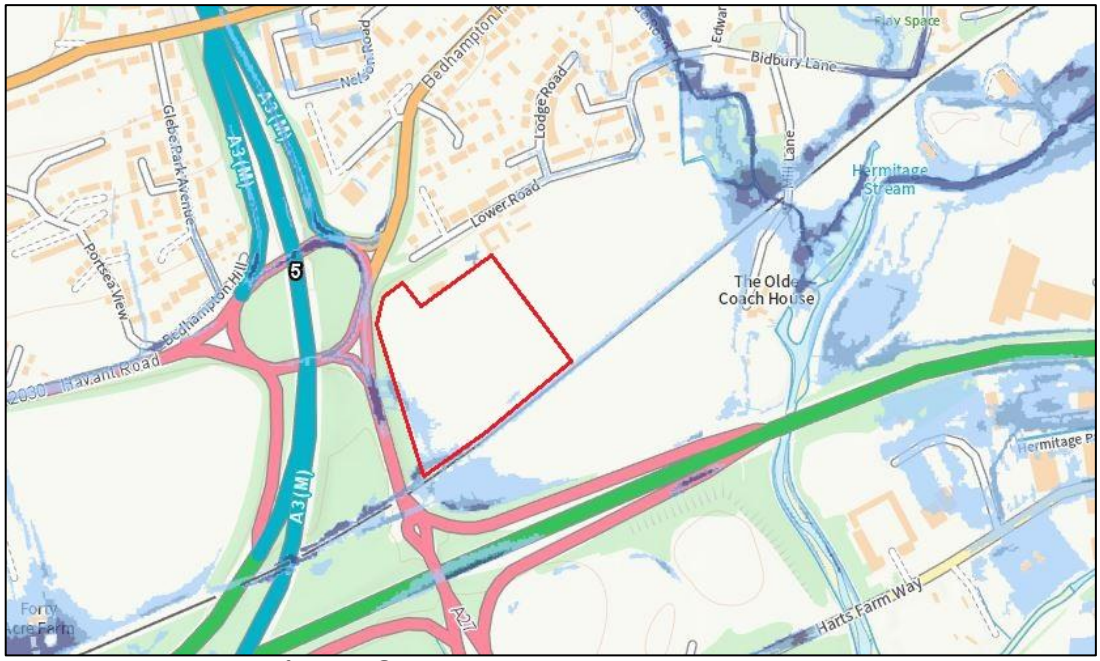
Lying 1km from the coast, parts of Bedhampton and its local river networks encounter a risk from tidal flooding. However, the site itself is not at risk of tidal flooding as confirmed by the SFRA, PFRA and the Environment Agency.

4.11 Surface Water

The 'FMfSWF' (Flood Map for Surface Water Flooding) presented within the SFRA confirms that no incidents of flooding from surface water runoff have been recorded within the site boundary. Since the SFRA/PFRA reports were produced, no further evidence of surface water flooding at the site has been identified.

4.12 The Environment Agency's 'uFMfSW' (updated Flood Map for Surface Water) (Figure 4) is a theoretical assessment of potential overland flow paths, ground levels and drainage systems using information from Hampshire County Council as the LLFA to indicate areas that may be susceptible to surface water flooding.

Figure 4: Extract from Environment Agency Surface Water Flood Map (2021)



Contains Environment Agency information © Environment Agency 2021

Key:

- High (Greater than 1:30(3.3%) chance of flooding)
- Medium (Between 1:100(1%) and 1:30(3.3%) chance of flooding)
- Low (Between 1:1000 (0.1%) and 1:100 (1%) chance of flooding)
- Very Low (Less than 1:1000 (0.1%) chance of flooding)

4.13 This map indicates that the majority of the existing site has a 'very low' (less than a 1:1000 or 0.1%) risk of flooding from surface water runoff. There is a small section of southwest of the site that has a 'low' to 'medium' (1:1000 to 1:30) risk of flooding from surface water runoff. This is correlated with the low point on the site.

4.14 The implementation of a sensible layout and robust SuDS scheme to collect, attenuate and convey the surface water runoff from the proposed development will mitigate any residual risk of surface water flooding to the site in its developed state.

4.15 Groundwater

The PFRA, SFRA and the Environment Agency confirm that no recorded events of groundwater flooding have been identified at or within the vicinity of the site.

4.16 Artificial Sources

With reference to the SFRA/PRFA there have been no recorded incidents of flooding to the site or surrounding areas from artificial sources.

4.17 There are no additional artificial sources of flooding, such as that from canals, reservoirs and sewage treatment works within a 1 km radius of the site.

4.18 Overland Flood Flow / Exceedance

The occurrence of overland flooding at the site due to an extreme rainfall event exceeding the design capacity of the drainage system and SuDS, or a failure of the associated flow controls have been considered both during the construction and operational phase of the development.

4.19 If SuDS or the piped drainage system becomes overwhelmed by exceptional rainfall then exceedance routes are proposed to protect people and property by providing unobstructed overland flow routes across the development.

4.20 The design levels of hard paved and landscaped areas will aim to contain and convey flood flows through areas of the site to cause minimum flood risk to properties and residents such as parking areas and low-lying open space.

4.21 All proposed attenuation features within the development are designed to manage the 1 in 100 year return storm (1% chance of occurrence each year) plus an extra allowance of 40% for the potential increase in peak rainfall predicted up to 2115.

4.22 Any residual risk of overland flooding to properties is to be mitigated by the provision of raised property slab levels a minimum of 150mm above surrounding ground level.

4.23 The described protection measures ensure that properties both within the proposed development and any offsite parties and land will not be affected by overland runoff in the event of a reasonably extreme rainfall event exceeding the design storm or a failure or a blockage of the SuDS structures within the system.

4.24 Existing Sewers & Water Mains

The SFRA confirms that for the area in which the site lies, there have been no incidents of flooding from sewers in the last 10 years.

4.25 With reference to the Southern Water flood register; there have been no recorded incidents of flooding from the existing foul and surface water sewers or potable water mains within the vicinity of the development.

4.26 With reference to Southern Water records and engineering drawings for the surrounding development there is a 225mm foul water sewer that runs along Lower Road to the north of the site.

4.27 Southern Water will be consulted to confirm that there is adequate capacity for the proposed development flows. The proposed development will have a 'no detriment' impact on the local foul sewer system and does not create an increase in flood risk.

4.28 Proposed Site Drainage

A Flood Risk Assessment requires that an evaluation of all proposed artificial drainage systems and infrastructure within, or in close proximity to the site is carried out. In the context of this development, the following systems are to be installed which need to be assessed in terms of potential flooding through the capacity of the systems being exceeded or the structural, hydraulic, mechanical or operational failure of the system occurring during the lifetime of the development:

- Piped foul water sewers, manholes and potable water mains.
- SuDS for the temporary conveyance and attenuation of surface water.
- Foul water pumping station and associated rising main.

4.29 All adoptable foul and surface water drains, sewers and manholes will be designed and constructed to the Sewers for Adoption *7th edition* with all private drainage constructed in accordance with *The Building Regulations Part H, BS EN 752 or BS EN 12056-2* as appropriate, ensuring adequate design capacity and robust structural integrity for the

lifetime of the development. This will not only prevent the risk of flooding to both the development and offsite parties, but will avoid the potential contamination of groundwater by preventing the ingress of groundwater into the pipework and egress of sewage into the underlying soils.

4.30 All SuDS within the drainage system will be sized to manage the runoff from the exceptionally rare 1 in 100 storm event (1% AEP), plus an additional 40% allowance for predicted future climate change effects (in accordance with EA recommendations up to the year 2115).

4.31 The new development as a whole must not create or exacerbate existing flood risk elsewhere and in particular to properties, land and highways downstream of the site. During the design of the proposed development careful consideration has been given to the most sustainable method of surface water disposal and strict controls have been imposed to limit the peak rate and volume of runoff generated from the developed site.

4.32 All surface water runoff from impermeable areas on the proposed development will be and safely disposed at a controlled rate to mimic the existing natural runoff regime for the undeveloped greenfield site. This will ensure that the risk of flooding to properties and land downstream of the site will not increase as a result of this proposed development.

4.33 **Sequential Test**

The flood risk technical guidance to the National Planning Policy Framework (NPPF) categorises residential developments as 'More Vulnerable' within the risk classification. 'More vulnerable' developments located within Flood Zone 1 are considered appropriate under the NPPF.

4.34 The NPPF guidance states that planning authorities should complete a risk based 'Sequential Test' at all stages of the planning process, to steer new development to areas with the lowest probability of flooding. Under the requirements of the 'Sequential Test' and as the proposed development is already located within Flood Zone 1 (lowest risk), there are no more suitable, developable and deliverable alternative sites, better located from a flood risk perspective which could accommodate the proposed development.

5 Existing and Proposed Site Runoff

5.1 This section aims to calculate the estimated peak rate and volume of surface water runoff from the existing site. These discharge figures are then used to establish the post-development constraints to inform the preliminary design of the site surface water drainage strategy.

5.2 Catchment Areas

The existing and proposed permeable and impermeable areas are listed in the table below.

Site Catchment	Impermeable	Permeable	Total
Existing Site Area	0 m²	36,709 m²	36,709 m²
Proposed Site Area	9238 m²	27,471 m²	36,709 m²

5.3 This development represents an overall approximate increase of 9238 m² in impermeable area post development.

5.4 Existing Surface Water Runoff Peak Runoff Rate & Volume (Greenfield)

An assessment of the estimated current greenfield runoff rate has been carried out using the Institute of Hydrology Report 124 (QBar) methodology.

Catchment: 0.92ha (FSR)

1 in 1 year	2.8 l/s
QBAR	3.3 l/s
1 in 30 year	7.4 l/s
1 in 100 year	10.5 l/s
Volume 100y 6hr	291.4 m³

5.5 Refer to Appendix D for calculations. A 10% allowance for urban creep has been included in the calculations.

5.6 Post Development Surface Water Runoff Peak Runoff Rate & Volume

The procedure for surface water management in accordance within 'Rainfall runoff management for developments' (DEFRA/EA Report – SC030219 E, 2013) states; *"For the range of annual flow rate probabilities up to and including the 1% (1 in 100 year) annual exceedance probability event including an appropriate allowance for climate change, the post-developed rate of run-off into a watercourse, sewer, or other receiving water body, should be no greater than the existing pre-developed rate of run-off for the same event".*

5.7 The National Planning Policy Framework requires that consideration is given to the effect of climate change on the surface water flows generated by any new development. Table 2 of *the NPPF - Flood Risk Assessments: Climate Change Allowances – Detailed Guidance (Feb 2016)*, specifies that an assessment of a 40% increase in rainfall intensity allowance is made when calculating post development runoff rates for residential developments.

5.8 The additional volume of runoff generated from a site should also be limited to the greenfield runoff volume where possible. Where infiltration cannot be utilised to dispose of the additional volume; *"The limiting discharge for any return period up to the 1% AEP (1 in 100 year) event including climate change, shall not be greater than the mean annual peak rate of runoff for the greenfield site – QBar or 2 l/s/ha, whichever is the greatest".*

5.9 As a result of this development and the increase in impermeable areas, the peak rate and volume of surface water that could potentially runoff the proposed site if not effectively managed, could be greater than in its current undeveloped state.

5.10 To mitigate this potential increase, it is proposed that all surface water runoff from impermeable areas on the proposed residential development will be attenuated on site and discharged via infiltration.

5.11 Where possible permeable paving will be utilised on driveways and shared parking areas. This will function as under-drained, sealed-tank systems and discharge to the positive drainage network. Swales, reed beds and attenuation basins will also serve as additional attenuation and water quality treatment components.

6 Surface Water Drainage Strategy

6.1 The National Planning Policy Framework (NPPF) requires that developments do not exacerbate flood risks both to the development site and to offsite parties and land, which means there is a need to control surface water drainage and overland runoff to ensure there are no increases in peak rates and volumes of runoff as a result of the development.

6.2 Environment Agency guidance and government legislation such as the Flood and Water Management Act (Defra 2010) requires surface water drainage strategies for new developments to be in accordance with the ideals of 'sustainable development' via the provision of Sustainable Drainage Systems (SuDS).

6.3 SuDS are more sustainable than conventional drainage methods because they can mitigate many of the adverse effects of urban stormwater runoff on the environment. This can be achieved through reducing peak runoff rates and volumes to sewer networks and watercourses, reducing the risk of downstream flooding.

6.4 The Building Regulations Document H (2015) details the appropriate hierarchy of potential methods for disposing surface water from a development:

1. A soakaway or some other adequate infiltration system, or where that is not practicable;
2. A watercourse, or where that is not possible;
3. A sewer.

6.5 Soil permeability rates for the superficial clay are insufficient to use conventional infiltration methods to disposing the surface water runoff generated from the proposed development.

6.6 There is a watercourse to the south west of the development site suitable to discharge to.

6.7 This site lies with Southern Water's service region. With reference to sewer records, there are dedicated surface water sewers along the northern boundary of the site but would require pumping to reach them.

6.8 Therefore, it is proposed to utilise a dry detention basin with a discharge to the watercourse to dispose of surface water runoff from the proposed development's hard standing areas including roofs, driveways and roads.

6.9 The surface water network will include swales; a reed bed and an attenuation basin, which will all serve as conveyance, storage, and water quality treatment.

6.10 Drainage from house and garage roofs, driveways and parking courts, carriageways and footways will drain to swales which convey water to reed beds in the southern landscaped area of the site.

6.11 The attenuation basin which will be dry when not receiving storm water and will attenuate large return period storms via restricted outflow. Infiltration to ground will also occur gradually within the swales and base of the attenuation basin. Although no infiltration will be modelled in the surface water calculations.

6.12 Any exceedance overflow will overtop the basin and flow to the southwest at a rate far lower than the predevelopment greenfield run off for a large return period storm.

6.13 A 10% allowance for urban creep has been included in the calculations.

6.14 The total storage requirement provided by the attenuation basins is 955m^3. This will provide storage onsite to manage the 1:100year (1% AEP) storm event, plus an extra allowance of 40% for the predicted potential increase in peak rainfall up to 2115.

6.15 Following the drainage hierarchy, infiltration would be the first method of disposal for the runoff. However, infiltration tests proved insufficient to utilise soakaway features at shallow depths. Deep borehole soakaways are also discouraged. There is a watercourse that lies to the south west corner of the site, but not within the site boundary, which is culverted under the railway line. This watercourse runs north to south. The site naturally drains to this ditch via overland flow and field drains. Discharging the sites' runoff to this ditch would mimic greenfield conditions.

6.16 The ditch is adjacent to the site boundary with various field drains from site outfalling along its length. These perforated plastic drainpipes are 50mm and 75mm diameter which are too small and unsuitable to utilise as part of the onsite drainage system. Therefore, it is proposed to utilise overland flow across a short distance from the site boundary into the ditch, mimicking greenfield conditions. The control chamber following the basin will discharge into a 110m swale leading down to the south west corner of the site. The downstream end of the swale contains a small basin with a permanently wet depth, as well as weir in the form of a 1m wide and 0.2m cut into the bank. This weir allows the maximum discharge of 3.3l/s to spill out and into the ditch.

6.17 All drains and manholes/inspection chambers will be designed and constructed in accordance with the Building Regulations Part H and BS EN 752, ensuring adequate capacity and robust structural integrity for the lifetime of the development. This will ensure that no polluted discharge from the drainage system to ground will take place.

7 Water Quality and Pollution Prevention

7.1 The proposed SuDS scheme has been designed to mitigate against the contamination of the receiving watercourse. The CIRIA SuDS Manual 2015 details an approach for establishing the hazard posed by the intended land use activates and the extent to which the proposed SuDS components can reduce and mitigate the contamination risk to the receiving waterbody.

7.2 Referring to Table 26.2 – 'Pollution hazard indices for different land use classifications' the proposed development and land use results in a low pollution hazard, therefore a 'Simple Index' method can be used to make a qualitative assessment of the proposed SuDS management.

Table 1: Table 26.2 – '*Pollution hazard indices for different land use classifications*' CIRIA C753, 2015

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4

Roof Runoff:

Total SuDS mitigation index ≥ pollution hazard index (for each contaminant type)
For the development site: TSS = 0.2, Metals = 0.2, Hydrocarbons = 0.05

Driveway / Parking / Road Runoff:

Total SuDS mitigation index ≥ pollution hazard index (for each contaminant type)
For the development site: TSS = 0.5, Metals = 0.4, Hydrocarbons = 0.4

Table 2 - Table 26.3 – '*Indicative SuDS mitigation indices for discharge to surface waters*' CIRIA C753, 2015

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Table 3 - Table 26.4 – '*Indicative SuDS mitigation indices for discharge to groundwater*' CIRIA C753, 2015

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater

Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates[1]	**TSS**	**Metals**	**Hydrocarbons**
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.6[4]	0.5	0.6
A soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.8[4]	0.8	0.8
Proprietary treatment systems[5, 6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area.		

7.3 To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type). Where the mitigation index of an individual component is insufficient, two or more components in a series is required, where:

Total SuDS mitigation index = mitigation $index_1$ + 0.5 (mitigation $index_2$)

7.4 The proposed development surface water drainage system consists of the following SuDS component:

Roof Runoff:

Primary Treatment – Swale

Using table 26.3/26.4 – Mitigation Indices
TSS = 0.5 which is > 0.2 therefore ok.
Metals = 0.6 which is > 0.2 therefore ok.
Hydrocarbons = 0.6 which is > 0.05 therefore ok.

+ Secondary Treatment – Detention Basin

Using table 26.3/26.4 – Mitigation Indices
TSS = 0.5+(0.5*0.5) = 0.75 which is > 0.2 therefore ok.
Metals = 0.6+(0.5*0.5) = 0.15 which is > 0.2 therefore ok.
Hydrocarbons = 0.6+(0.6*0.5) = 0.18 which is > 0.05 therefore ok.

Driveway / Parking / Road Runoff:

Primary Treatment – Detention Basin

Using table 26.3/26.4 – Mitigation Indices:
TSS = 0.5 which is ≥ 0.5 therefore ok.
Metals = 0.6 which is > 0.4 therefore ok.
Hydrocarbons = 0.6 which is > 0.4 therefore ok.

7.5 The runoff will also pass through filter trenches and a pond with a reed bed which will add to the mitigation indices. The total combination of SuDS will meet the high water quality and silt removal requirements to discharge via deep borehole soakaways.

7.6 The total mitigation level exceeds the development pollution risk and would be suitable for both medium and high-risk developments. The proposed drainage strategy incorporates measures to far exceed the water quality target requirements within the SuDS Manual and therefore complies with the Water Framework Directives for discharge of runoff into controlled waters.

8 Foul Water Drainage Strategy

8.1 All foul water flows generated from the development will discharge via pumping station and rising main into the Phase 1 foul system located beyond the north eastern boundary of the site.

8.2 A package pumping station will be required.

8.3 The predicted peak foul sewer discharge from the 43 units based on the Sewers for Adoption guidance of 4000 l/dwelling/day will be 2.0 l/s.

8.4 Southern Water will be consulted to confirm that there is adequate capacity for the proposed development flows. The proposed development will have a 'no detriment' impact on the local foul sewer system and does not create an increase in flood risk.

APPENDIX A
SITE LAYOUT

A1

Old Manor Farm

Manor Barn

Post and rail fence with mesh attached on the phase 1 boundary. Managing company have rights to maintain hedge 2 times a year.

PLAY SPACE (500 sq.m)

ATTENUATION BASIN

F.W PUMP STATION

NETWORK RAIL BUFFER ZONE

A27

A27

Mast (Telecommunication)

Track

SITE LEGEND:

- Application Boundary Line
- Affordable Rent
- Shared Ownership
- Brick Boundary Wall - 1.8m height
- Close Board Fence - 1.8m height
- Post and Rail Fence - 1.2m height
- Estate Railing - 1.2m height
- Parking Bay
- EV Charging Point
- Timber Shed - 1.2x1.8m
- Proposed Tree
- Illustrative Swale

Refer to drawings 2255-TFC-00-00-DR-L-1001 to for detailed landscape proposals.

scale 1:500

0 10m 20m 30m

N

P1	First issue.	22.10.23	CMI	-
P2	Updated to match Client and Engineers comments.	31.01.24	GUR	CMI
P3	Scheme development. Affordable housing tenure corrected.	12.02.24	CMI	
P4	Scheme development. Indicative SUD's detailed.	15.02.24	CMI	
P5	Amended according to the Client's comments.	26.04.24	CH	CMI
P6	Site blocks to plots 14 and 25 updated. Reversing space to plot 26 adjusted and plot repositioned. Southern footpath extended into Phase 1.	16.05.24	CMI	-
P7	Layout development.	23.05.24	CMI	
P8	Garden depths increased to plots 16-19 and 28-29.	24.06.24	CMI	
P9	As Built Survey added.	09.07.24	CH	

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Rev	Description	Date	Au	Ch
P10	Landscape detail added. Red line at phase entrance amended. Visitor parking spaces opposite plots 22 and 27 adjusted.	17.07.24	CMI	-

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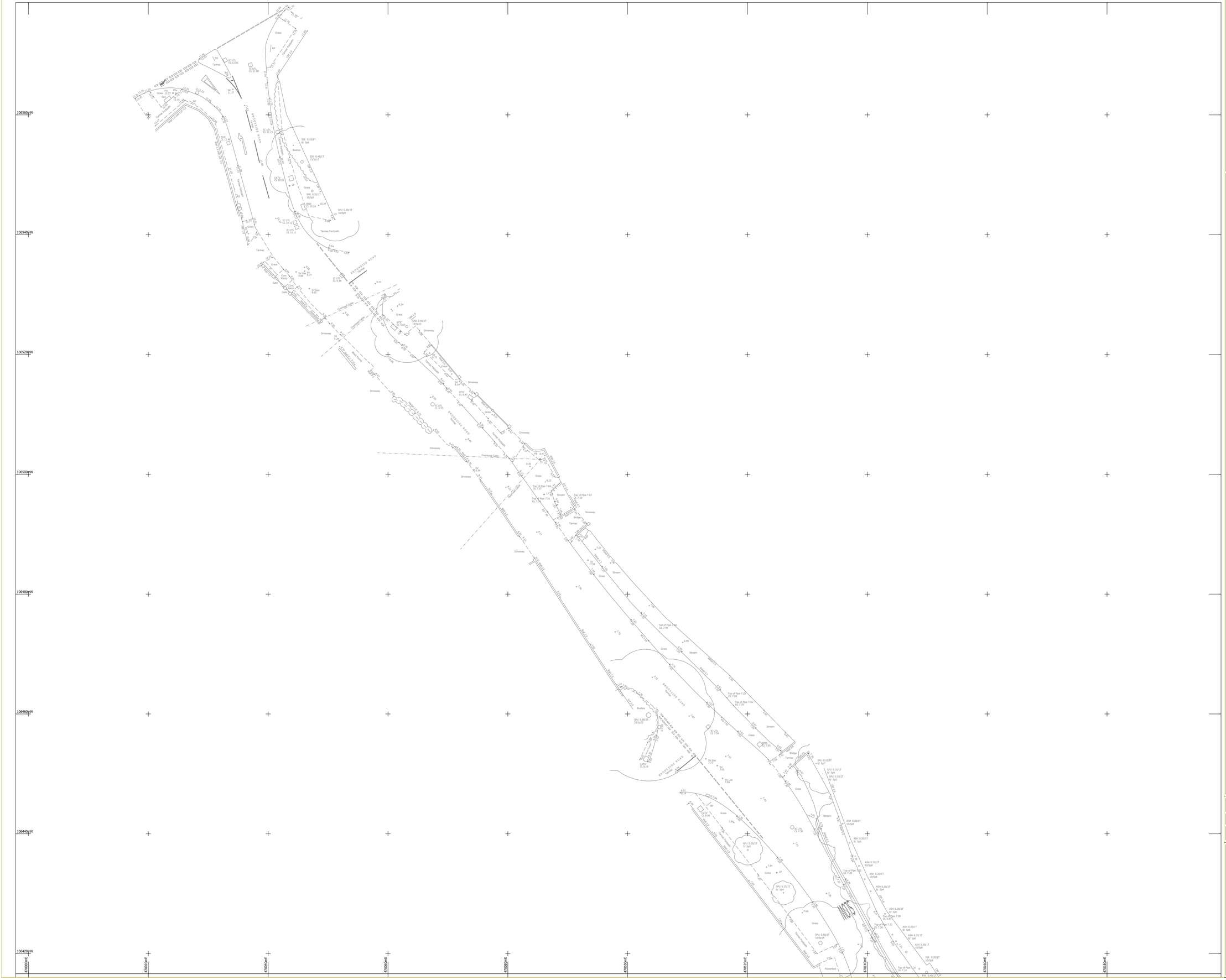
Project	**Manor Farm, Bedhampton. Phase 2**		
Drawing	**Site Layout Phase 2**		
Client	**Bargate Homes**		
Job no.	**BARG230421**	Date	**22.10.23**
Dwg no.	**SL.01**	Revision	**P10**
Author	**CMI**	Checker	
Scale	**1:500 at A1**		
Status	PRELIMINARY	Office	**Romsey**
Client ref.			

thrive. architects

APPENDIX B
TOPOGRAPHICAL SURVEY



NOTES:

Drainage:
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Trees:
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Survey detail obtained and shown is relative to the plotting scale.

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LEGEND

TREE SPECIES INFORMATION

ALDER	ALD	LOCUST	LOC
ASH	ASH	LONDON PLANE	LPN
ASPEN	ASP	MAGNOLIA	MAG
BEECH	BCH	MAPLE	MPL
CEDAR	CED	OAK	OAK
CHERRY	CHY	PINE	PNE
CYPRESS	CYP	POPLAR	POP
ELM	ELM	PRUNUS	PNS
FIR	FIR	RHODODENDRONS	RDN
FRUIT	FRT	ROWAN	RWN
HAWTHORN	HAW	SILVER BIRCH	SIB
HAZEL	HAZ	SORBUS	SOR
HOLLY	HLY	SWEET CHESTNUT	SCH
HORSE CHESTNUT	HCH	SYCAMORE	SYC
HORNBEAM	HBM	WALNUT	WNT
LABURNUM	LBM	WILLOW	WLW
LARCH	LAR	YEW	YEW
LIME	LIM	SPECIES UNKNOWN	SPU
		COPPICED	COP

TREE ANNOTATIONS: Tree Species / Tree Bell Size / No of Bolts
Tree Height / Tree Canopy Spread

FENCE INFORMATION

BARBED WIRE FENCE	BWF
CORRUGATED IRON FENCE	CIF
CLOSE BOARD FENCE	CBF
CHAIN LINK FENCE	CLF
CHESTNUT PALING	CPF
CRASH BARRIER	CBR
HANDRAIL	HDL
IRON RAILINGS	IRF
LARCH LAP FENCE	LLF
MISCELLANEOUS FENCE	MSF
PALISADE FENCE	PSF
PICKET FENCE	PKF
POST AND CHAIN FENCE	PCF
POST AND RAIL FENCE	PRF
POST AND WIRE FENCE	PWF
STOCK WIRE FENCE	SWF
TRELLIS FENCING	TLF

LEVEL INFORMATION

BASEMENT LEVEL	BTL
BED LEVEL	BL
COVER LEVEL	CL
DAMP PROOF COURSE	DPC
FLOOR LEVEL	FL
INVERT LEVEL	IL
OUTFALL LEVEL	OL
THRESHOLD LEVEL	THL
FOUL WATER	FW
SURFACE WATER	SW
UNABLE TO LIFT	UTL
WATER LEVEL	WL

SURFACE INFORMATION

CONCRETE	Conc
BRICK PAVERS	BP
FLOWERBED	FB
PAVING SLABS	PS
RETAINING WALL	RWall
TACTILE PAVING	Tac

FEATURE INFORMATION

BOLLARD	BO	NOTICE BOARD	NB
BRITISH TELECOM BOX	BTB	POST	P
BRITISH TELECOM IC	BTIC	RAIN WATER PIPE	RWP
BUS STOP	BS	RAISED FLOWERBED	RFB
CABLE TELEVISION BOX	CATB	ROAD SIGN	RS
CABLE TELEVISION IC	CATV	RODDING EYE	RE
EARTHING ROD	ER	SERVICE MARKER POST	SMP
ELECTRICITY CABLE PIT	ELCP	SOIL VENT PIPE	SVP
ELECTRICITY CONTROL BOX	ECB	STOP COCK	SC
ELECTRICITY POLE	EP	STOP VALVE	SV
FIRE HYDRANT	FH	TELEGRAPH POLE	TP
INSPECTION COVER	IC	TELEPHONE CALL BOX	TCB
LAMP POST	LP	TRAFFIC SIGNAL	TS
LETTER BOX	LB	TRAFFIC SIGNALS IC	TSIC
LITTER BIN	BIN	WATER METER	WM
KERB OUTLET	KO	WATER TAP	Tap
NAME PLATE	NP		

Level Datum:
Levels are related to OSGB15 derived from the GPS network

Grid:
Grid is related to OSGB15 derived from the GPS network

Northpoint:

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Hampshire SO31 7GA

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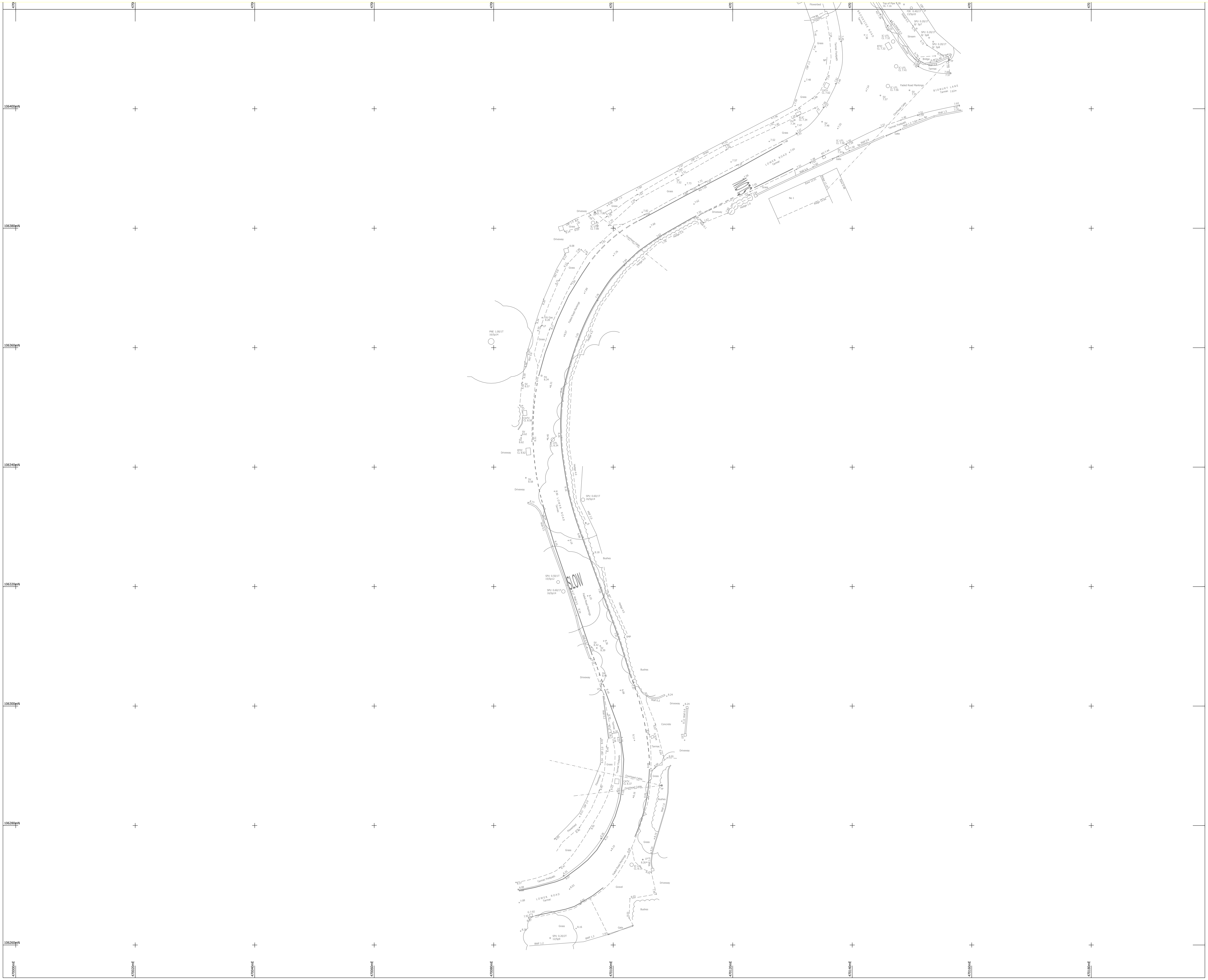
Fax: 023 80697125 Website: encompass-surveys.co.uk

Client:	Bargate Homes		
Survey Location:	Bedhampton P2 Bedhampton Havant		
Survey type:	Topographical	Scale:	1:200@A0
Drawing ref:	ENC/210221/6NN3/To	Date:	March 2021
Drawn/QA:	CH/GL	Revision:	Plot 1 of 6



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FRUIT	FRT	ROWAN	RWN
HAWTHORN	HAW	SILVER BIRCH	SIB
HAZEL	HAZ	SORBUS	SOR
HOLLY	HLY	SWEET CHESTNUT	SCH
HORSE CHESTNUT	HCH	SYCAMORE	SYC
HORNBEAM	HRM	WALNUT	WNT
LABURNUM	LRM	WILLOW	WLW
LARCH	LAR	YEW	YEW
LIME	LIM	SPECIES UNKNOWN	SPU
		COPPICED	COP

TREE ANNOTATIONS: Tree Species / Tree Boll Size / No of Bolls
Tree Height / Tree Canopy Spread

FENCE INFORMATION

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POST AND WIRE FENCE	PWF
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FOUL WATER	FW
SURFACE WATER	SW
UNABLE TO LIFT	UTL
WATER LEVEL	WL

SURFACE INFORMATION

CONCRETE	Conc
BRICK PAVERS	BP
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RETAINING WALL	RWall
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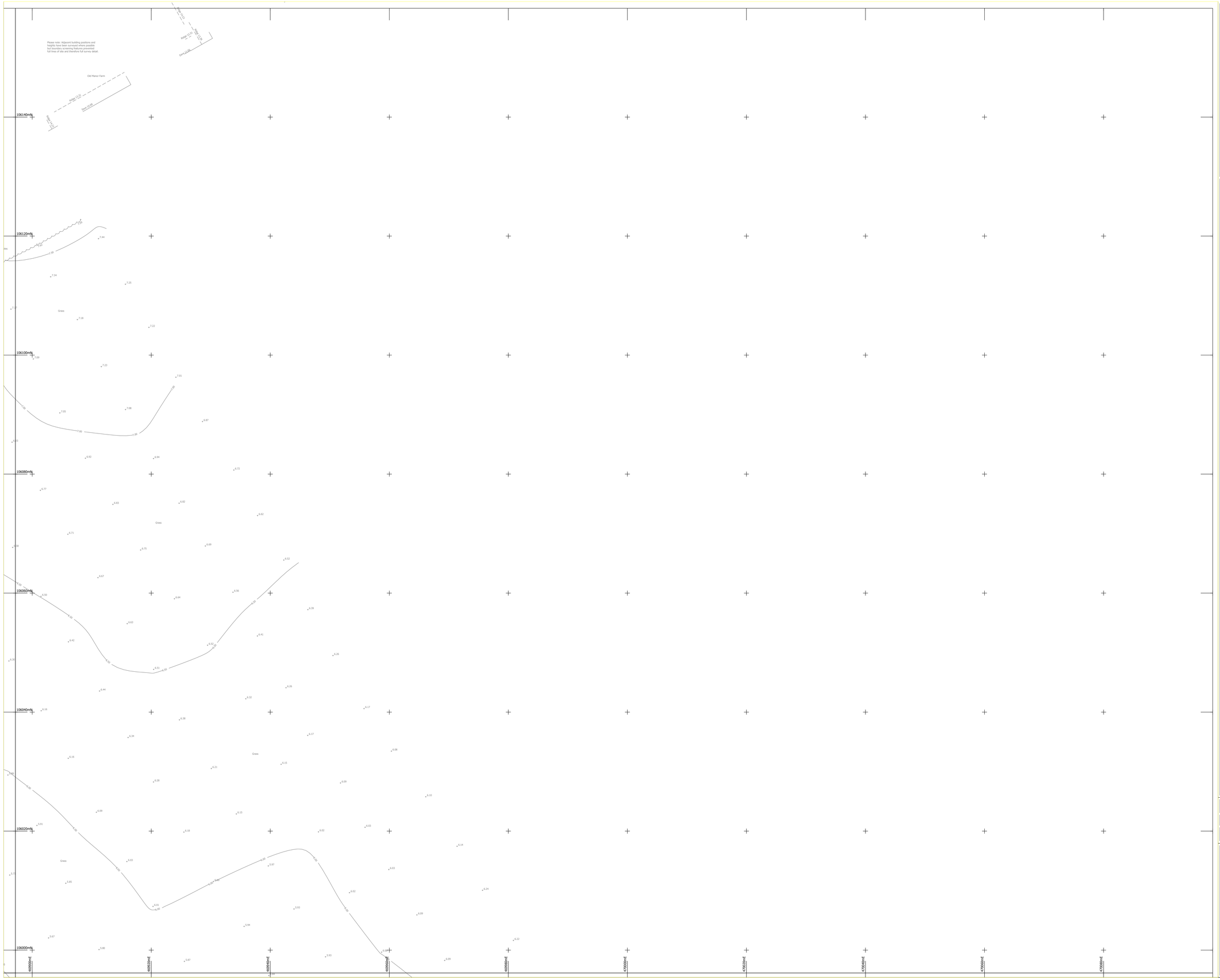

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TREE ANNOTATIONS: Tree Species / Tree Bole Size / No of Bolls
Tree Height / Tree Canopy Spread

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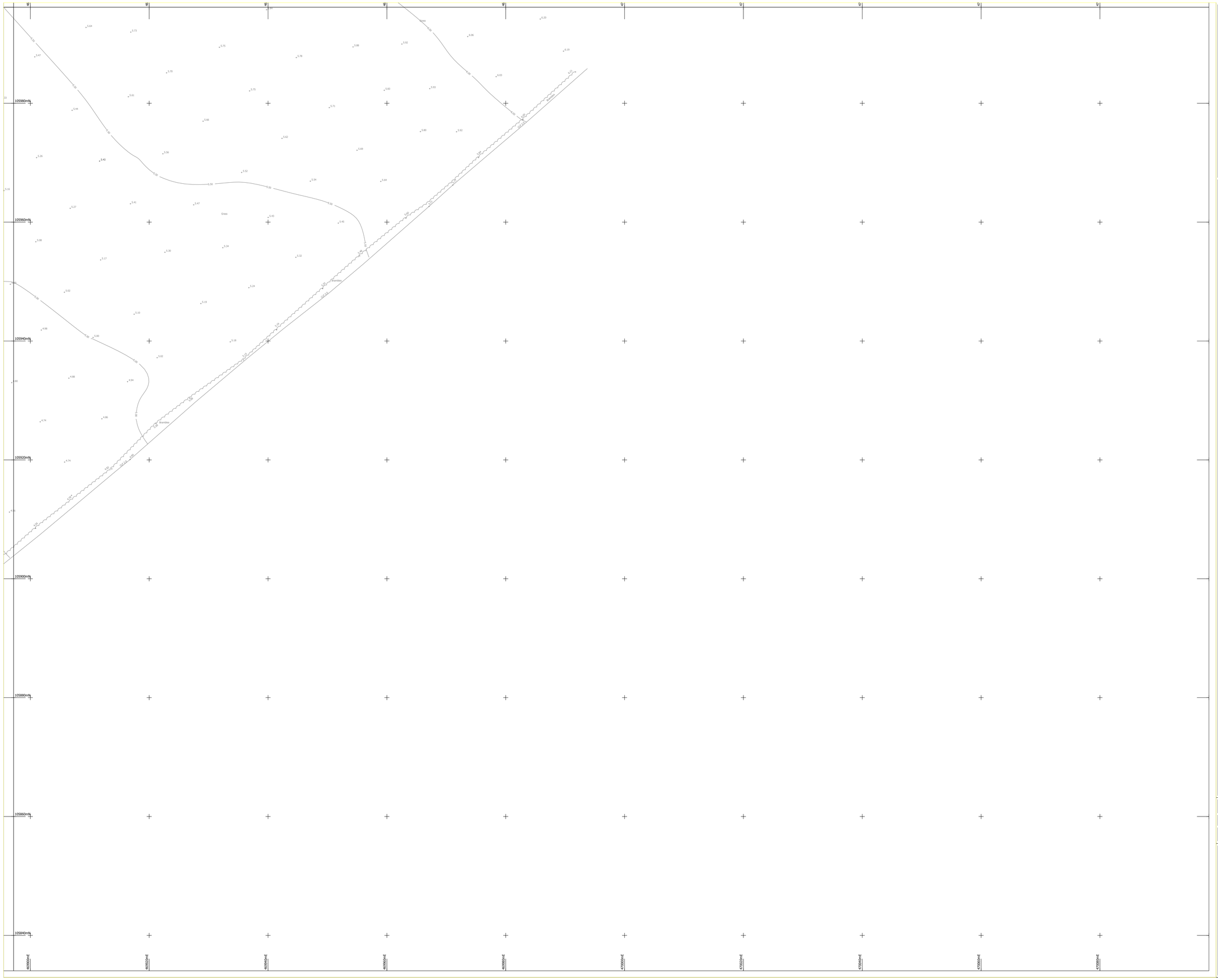

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FIR	FIR	RHODODENDRONS	RDN
FRUIT	FRT	ROWAN	RWN
HAWTHORN	HAW	SILVER BIRCH	SIB
HAZEL	HAZ	SORBUS	SOR
HOLLY	HLY	SWEET CHESTNUT	SCH
HORSE CHESTNUT	HCH	SYCAMORE	SYC
HORNBEAM	HRM	WALNUT	WNT
LABURNUM	LBM	WILLOW	WLW
LARCH	LAR	YEW	YEW
LIME	LIM	SPECIES UNKNOWN	SPU
		COPPICED	COP

TREE ANNOTATIONS: Tree Species / Tree Bole Size / No of Bolls
Tree Height / Tree Canopy Spread

FENCE INFORMATION

BARBED WIRE FENCE	BWF
CORRUGATED IRON FENCE	CIF
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CRASH BARRIER	CBR
HANDRAIL	HDL
IRON RAILINGS	IRF
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MISCELLANEOUS FENCE	MSF
PALISADE FENCE	PSF
PICKET FENCE	PKF
POST AND CHAIN FENCE	PCF
POST AND RAIL FENCE	PRF
POST AND WIRE FENCE	PWF
STOCK WIRE FENCE	SWF
TRELLIS FENCING	TLF

LEVEL INFORMATION

BASEMENT LEVEL	BTL
BED LEVEL	BL
COVER LEVEL	CL
DAMP PROOF COURSE	DPC
FLOOR LEVEL	FL
INVERT LEVEL	IL
OUTFALL LEVEL	OL
THRESHOLD LEVEL	THL
FOUL WATER	FW
SURFACE WATER	SW
UNABLE TO LIFT	UTL
WATER LEVEL	WL

SURFACE INFORMATION

CONCRETE	Conc
BRICK PAVERS	BP
FLOWERBED	FB
PAVING SLABS	PS
RETAINING WALL	RWall
TACTILE PAVING	Tac

FEATURE INFORMATION

BOLLARD	BO	NOTICE BOARD	NB
BRITISH TELECOM BOX	BTB	POST	P
BRITISH TELECOM IC	BTIC	RAIN WATER PIPE	RWP
BUS STOP	BS	RAISED FLOWERBED	RFB
CABLE TELEVISION BOX	CATB	ROAD SIGN	RS
CABLE TELEVISION IC	CATV	RODDING EYE	RE
EARTHING ROD	ER	SERVICE MARKER POST	SMP
ELECTRICITY CABLE PIT	ELCP	SOIL VENT PIPE	SVP
ELECTRICITY CONTROL BOX	ECB	STOP COCK	SC
ELECTRICITY POLE	EP	STOP VALVE	SV
FIRE HYDRANT	FH	TELEGRAPH POLE	TP
INSPECTION COVER	IC	TELEPHONE CALL BOX	TCB
LAMP POST	LP	TRAFFIC SIGNAL	TS
LETTER BOX	LB	TRAFFIC SIGNALS IC	TSIC
LITTER BIN	BIN	WATER METER	WM
KERB OUTLET	KO	WATER TAP	Tap
NAME PLATE	NP		

Level Datum:
Levels are related to OSGB15 derived from the GPS network

Grid:
Grid is related to OSGB15 derived from the GPS network

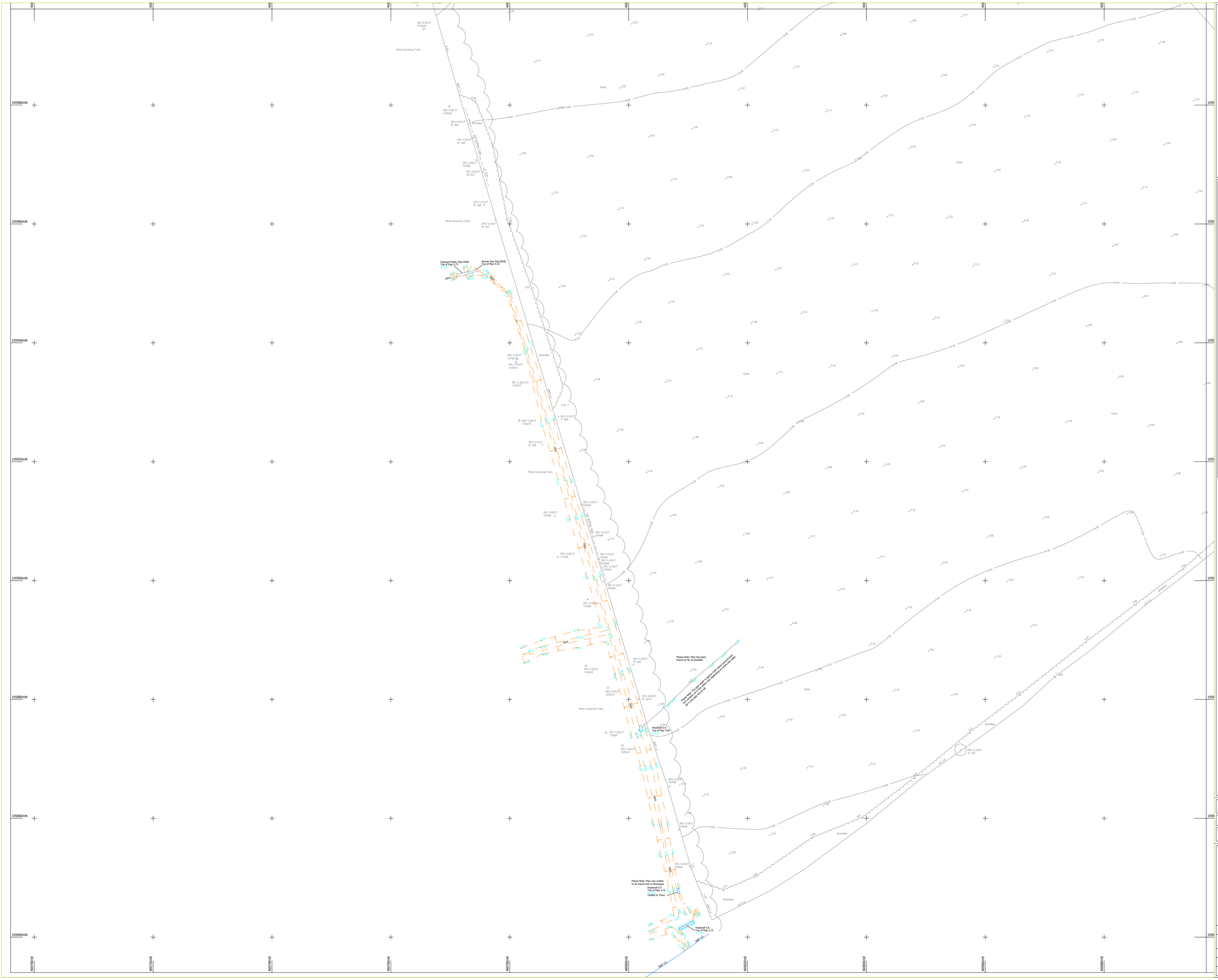
Northpoint:

ENCOMPASS SURVEYS

Encompass Surveys Ltd
Unit 2
Talisman Business Centre
Duncan Road
Park Gate, Southampton
Hampshire SO31 7GA

Tel: 023 80692002 Email: info@encompass-surveys.co.uk
Fax: 023 80697125 Website: encompass-surveys.co.uk

Client:	Bargate Homes		
Survey Location:	Bedhampton P2 Bedhampton Havant		
Survey type:	Topographical	Scale:	1:200@A0
Drawing ref:	ENC/210221/ANN3/To	Date:	March 2021
Drawn/QA:	CH/GL	Revision:	Plot 4 of 6



NOTES:

Drainage:
Inspection Covers are lifted where possible and all drainage invert information has been obtained through visual inspection only, with no entry into manholes. Therefore the complete accuracy cannot be guaranteed. Where drainage is of critical importance we suggest the services of a specialist drainage expert be used.

Trees:
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Survey notes:
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Survey detail obtained and shown is relative to the plotting scale.

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LEGEND

TREE SPECIES INFORMATION

ALDER	ALD	LOCUST	LOC
ASH	ASH	LONDON PLANE	LPN
ASPEN	ASP	MAGNOLIA	MAG
BEECH	BCH	MAPLE	MPL
CEDAR	CED	OAK	OAK
CHERRY	CHY	PINE	PNE
CYPRESS	CYP	POPLAR	POP
ELM	ELM	PRUNUS	PNS
FIR	FIR	RHODODENDRONS	RDN
FIRLET	FRT	ROWAN	RWN
HAWTHORN	HAW	SILVER BIRCH	SBI
HAZEL	HAZ	SORBUS	SOR
HOLLY	HLY	SWEET CHESTNUT	SCH
HORSE CHESTNUT	HCH	SYCAMORE	SYC
HORNBEAM	HBM	WALNUT	WNT
LABURNUM	LBM	WILLOW	WLW
LARCH	LAR	YEW	YEW
LIME	LIM	SPECIES UNKNOWN	SPU
		COPPICED	COP

TREE ANNOTATIONS: Tree Species / Tree Bole Size / No of Bolls
Tree Height / Tree Canopy Spread

FENCE INFORMATION

BARBED WIRE FENCE	BWF
CORRUGATED IRON FENCE	CIF
CLOSE BOARD FENCE	CBF
CHAIN LINK FENCE	CLF
CHESTNUT PALING	CPF
CRASH BARRIER	CBR
HANDRAIL	HDL
IRON RAILINGS	IRF
LARCH LAP FENCE	LLF
MISCELLANEOUS FENCE	MSF
PALISADE FENCE	PDF
PICKET FENCE	PKF
POST AND CHAIN FENCE	PCF
POST AND RAIL FENCE	PRF
POST AND WIRE FENCE	PWF
STOCK WIRE FENCE	SWF
TRELLIS FENCING	TLF

LEVEL INFORMATION

BASEMENT LEVEL	BTL
BED LEVEL	BL
COVER LEVEL	CL
DAMP PROOF COURSE	DPC
FLOOR LEVEL	FL
INVERT LEVEL	IL
OUTFALL LEVEL	OL
THRESHOLD LEVEL	THL
FOUL WATER	FW
SURFACE WATER	SW
UNABLE TO LIFT	UTL
WATER LEVEL	WL

SURFACE INFORMATION

CONCRETE	Conc
BRICK PAVERS	BP
FLOWERBED	FB
PAVING SLABS	PS
RETAINING WALL	RWall
TACTILE PAVING	Tac

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CABLE TELEVISION IC	CATV	RODDING EYE	RE
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LITTER BIN	BIN	WATER METER	WM
KERB OUTLET	KO	WATER TAP	Tap
NAME PLATE	NP		

Level Datum:
Levels are related to previous Encompass Surveys drawing 6NN3

Grid:
Grid is related to previous Encompass Surveys drawing 6NN3

Northpoint:

ENCOMPASS SURVEYS

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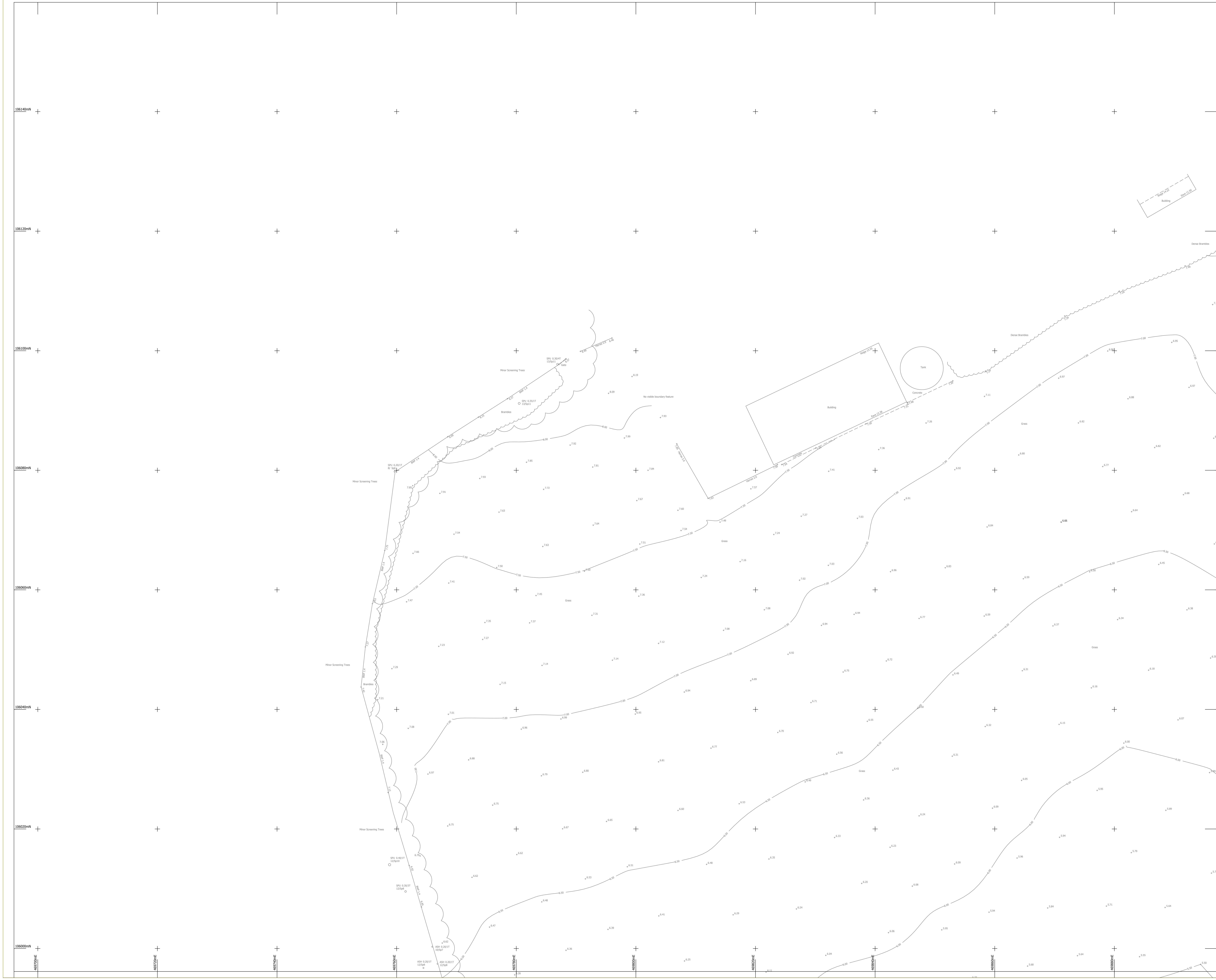
Unit 2
Tailsman Business Centre
Duncan Road
Park Gate, Southampton
Hampshire SO31 7GA

Tel: 023 80692002 Email: info@encompass-surveys.co.uk
Fax: 023 80697125 Website: encompass-surveys.co.uk

Client:	Bargate Homes		
Survey Location:	Manor Farm Lower Road, Bedhampton Havant		
Survey type:	Topographical	Scale:	1:200@A0
Drawing ref:	ENC/021023/6NN3A	Date:	Oct 2023
Drawn/QA:	MH/RMF	Revision:	Plot 5 of 6



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ELM	ELM	PRUNUS	PNS
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FRUIT	FRT	ROWAN	RWN
HAWTHORN	HAW	SILVER BIRCH	SIB
HAZEL	HAZ	SORBUS	SOR
HOLLY	HLY	SWEET CHESTNUT	SCH
HORSE CHESTNUT	HCH	SYCAMORE	SYC
HORNBEAM	HRM	WALNUT	WNT
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Grid:
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Northpoint:

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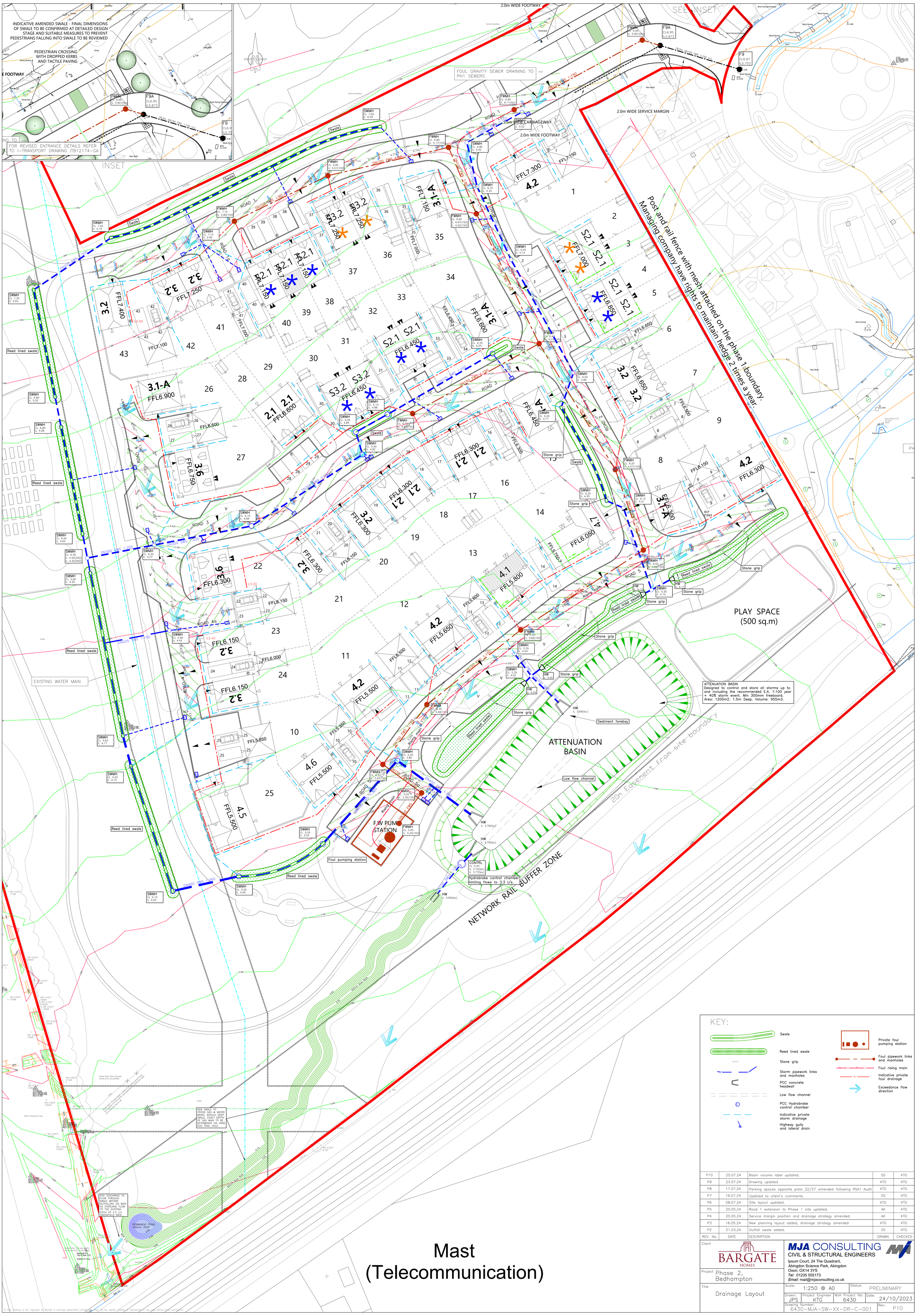
Hampshire SO31 7GA

Tel: 023 80692002 Email: info@encompass-surveys.co.uk
Fax: 023 80697125 Website: encompass-surveys.co.uk

Client:	Bargate Homes		
Survey Location:	Bedhampton P2 Bedhampton Havant		
Survey type:	Topographical	Scale:	1:200@A0
Drawing ref:	ENC/210221/6NN3/To	Date:	March 2021
Drawn/QA:	CH/GL	Revision:	Plot 6 of 6

APPENDIX C
FOUL AND SURFACE WATER DRAINAGE STRATEGY



REV. No.	DATE	DESCRIPTION	DRAWN	CHECKED
P10	25.07.24	Basin volume label updated.	SS	KTG
P9	23.07.24	Drawing updated	KTG	KTG
P8	17.07.24	Parking spaces opposite plots 22/27 amended following RSA1 Audit	KTG	KTG
P7	16.07.24	Updated to client's comments.	SS	KTG
P6	08.07.24	Site layout updated.	KTG	KTG
P5	20.05.24	Road 1 extension to Phase 1 site updated.	AK	KTG
P4	20.05.24	Service margin position and drainage strategy amended.	AK	KTG
P3	16.05.24	New planning layout added, drainage strategy amended	KTG	KTG
P2	21.03.24	Outfall swale added.	SS	KTG

Client: BARGATE HOMES

Project: Phase 2, Bedhampton

Title: Drainage Layout

MJA CONSULTING
CIVIL & STRUCTURAL ENGINEERS
Ipsum Court, 24 The Quadrant,
Abingdon Science Park, Abingdon
Oxon, OX14 3YS
Tel: 01235 555173
Email: mail@mjaconsulting.co.uk

Scale: 1:250 @ A0
Status: PRELIMINARY
Drawn: JPS
Project Engineer: KTG
MJA Project No: 6430
Date: 24/10/2023
Drawing Number: 6430-MJA-SW-XX-DR-C-001
Rev: P10

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Mast
(Telecommunication)

APPENDIX D

PRE / POST DEVELOPMENT RUNOFF AND STORAGE CALCULATIONS

FEH Mean Annual Flood

Input

QMED Method	1999
Site Location GB 470300 105900 SU 70300 05900	
Area (ha)	0.920
SAAR (mm)	780
URBEXT (2000)	0.2408
SPRHOST	44.850
BFIHOST	0.274
FARL	0.992

Results

QMED Rural (l/s) 3.4 QMED Urban (l/s) 4.4

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ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	0.920	Urban	0.000
SAAR (mm)	729	Region Number	Region 7

Results	**l/s**
QBAR Rural	3.3
QBAR Urban	3.3
Q100 years	10.5
Q1 year	2.8
Q30 years	7.4
Q100 years	10.5

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Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	19.500
Ratio R	0.349
Areal Reduction Factor	1.00
Area (ha)	0.920
SAAR (mm)	789
CWI	116.484
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	49.10
Greenfield Runoff Volume (m^3)	291.412

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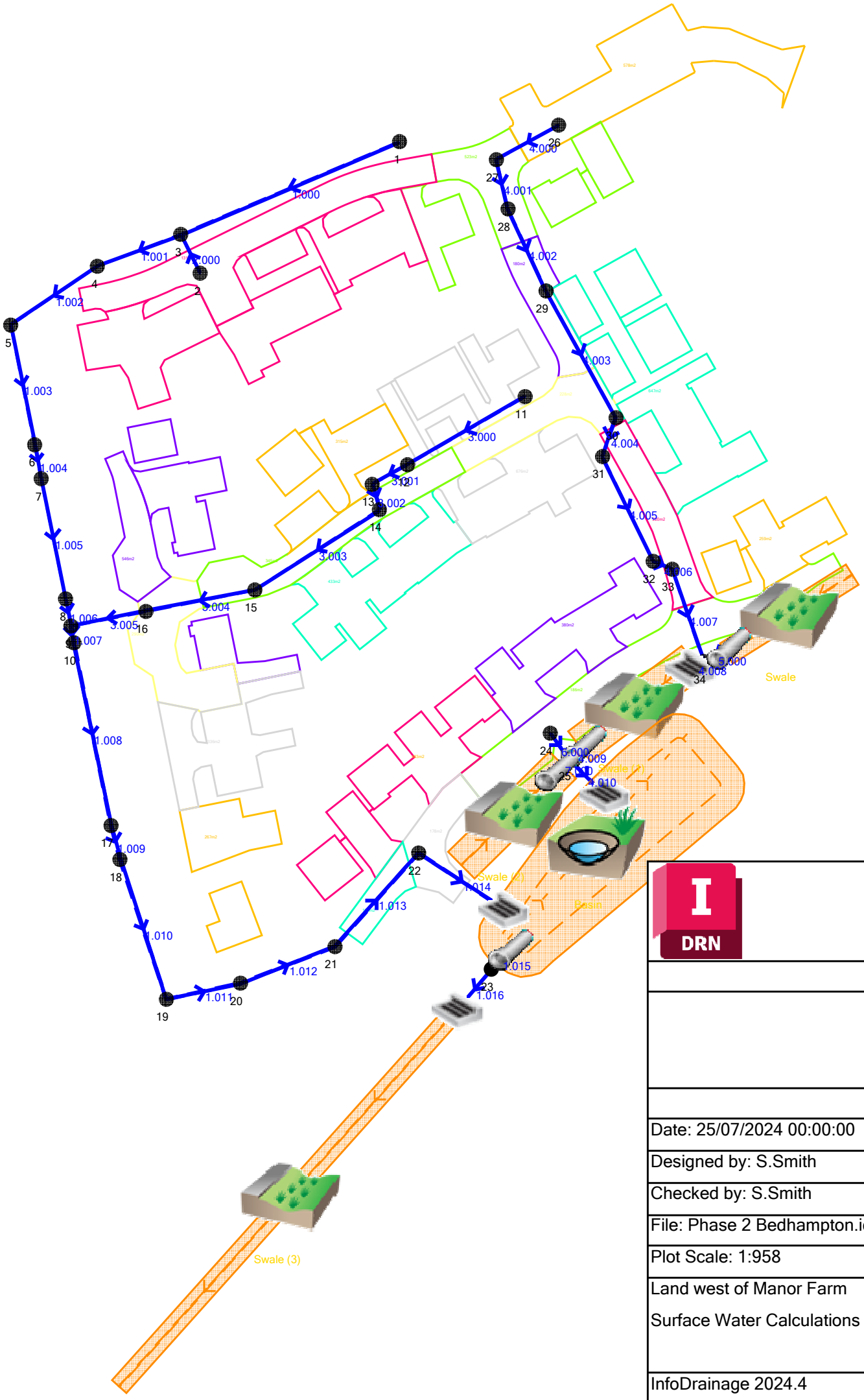

Date: 25/07/2024 00:00:00

Designed by: S.Smith

Checked by: S.Smith

File: Phase 2 Bedhampton.iddx

Plot Scale: 1:958

Land west of Manor Farm

Surface Water Calculations

InfoDrainage 2024.4

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Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by:	Checked by:	Approved By:
	S.Smith	S.Smith	C.Pendle
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address: MJA Consulting		

Basin

Type : Pond

Dimensions

Exceedance Level (m)	5.250
Depth (m)	1.460
Base Level (m)	3.790
Freeboard (mm)	300
Initial Depth (m)	0.000
Porosity (%)	100
Average Slope (1:X)	4.16
Total Volume (m³)	954.778

Depth (m)	Area (m²)	Volume (m³)
0.000	570.00	0.000
0.100	609.00	58.939
0.200	650.00	121.878
0.300	685.00	188.620
0.400	724.00	259.061
0.500	764.00	333.453
0.600	845.00	413.869
0.700	887.00	500.460
0.800	929.00	591.252
0.900	973.00	686.343
1.000	1016.00	785.786
1.100	1060.00	889.578
1.200	1150.00	1000.047
1.300	1196.00	1117.340
1.460	1200.00	1309.020

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	4.010
Bypass Destination	(None)
Capacity Type	No Restriction

Inlet (1)

Inlet Type	Point Inflow
Incoming Item(s)	1.014
Bypass Destination	(None)
Capacity Type	No Restriction

Inlet (2)

Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area (38)
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	1.015
Outlet Type	Free Discharge

Advanced

Perimeter	Circular
Length (m)	61.890
Friction Scheme	Manning's n
n	0.03

Swale

Type : Swale

Swale

Exceedance Level (m)	5.250
Depth (m)	0.750
Base Level (m)	4.500
Top Width (m)	4.660
Side Slope (1:X)	3.00
Base Width (m)	0.160
Freeboard (mm)	300
Length (m)	29.000
Long. Slope (1:X)	300.00
Filtration Rate (m/hr)	0.0
Friction Scheme	Manning's n
n	0.03
Total Volume (m^3)	19.706

Inlets

Inlet (1)

Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area (32)
Bypass Destination	(None)
Inlet Destination	Ponding Area
Capacity Type	No Restriction

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area (33)
Bypass Destination	(None)
Inlet Destination	Ponding Area
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	5.000
Outlet Type	Free Discharge

Advanced

Swale

Porosity (%)	100

Swale (1)

Type : Swale

Swale

Exceedance Level (m)	5.250
Depth (m)	1.200
Base Level (m)	4.050
Top Width (m)	7.360
Side Slope (1:X)	3.00
Base Width (m)	0.160
Freeboard (mm)	300
Length (m)	27.727
Long. Slope (1:X)	300.00
Filtration Rate (m/hr)	0.0
Friction Scheme	Manning's n
n	0.03
Total Volume (m^3)	71.370

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	4.008
Bypass Destination	(None)
Inlet Destination	Ponding Area
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	4.009
Outlet Type	Free Discharge

Advanced

Swale

Porosity (%)	100

Swale (2)

Type : Swale

Swale

Exceedance Level (m)	5.250
Depth (m)	1.200
Base Level (m)	4.050
Top Width (m)	7.360
Side Slope (1:X)	3.00
Base Width (m)	0.160
Freeboard (mm)	300
Length (m)	27.847
Long. Slope (1:X)	300.00
Filtration Rate (m/hr)	0.0
Friction Scheme	Manning's n
n	0.03
Total Volume (m^3)	71.679

Inlets

Outlets

Outlet

Outgoing Connection	7.000
Outlet Type	Free Discharge

Advanced

Swale

Porosity (%)	100

Swale (3)

Type : Swale

Swale

Exceedance Level (m)	3.950
Depth (m)	0.600
Base Level (m)	3.350
Top Width (m)	3.760
Side Slope (1:X)	3.00
Base Width (m)	0.160
Freeboard (mm)	300
Length (m)	100.112
Long. Slope (1:X)	300.00
Filtration Rate (m/hr)	0.0
Friction Scheme	Manning's n
n	0.03
Total Volume (m^3)	31.836

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	1.016
Bypass Destination	(None)
Inlet Destination	Ponding Area
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	(None)
Outlet Type	Weir
Width (m)	1.000
Coefficient of Discharge	0.544
Crest Level (m)	3.750

Advanced

Swale

Porosity (%)	100

Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by: S.Smith	Checked by: S.Smith	Approved By: C.Pendle
Report Details: Type: Connections Storm Phase: Phase	Company Address: MJA Consulting		

Name	Length (m)	Connection Type	Slope (1:X)	Manning's n	Colebrook-White Roughness (mm)	Diameter / Base Width (mm)	Upstream Cover Level (m)	Upstream Invert Level (m)
1.000	46.436	Pipe	232.181		0.6	225	7.000	6.000
2.000	8.466	Pipe	56.439		0.6	225	7.150	5.950
1.001	17.462	Pipe	291.034		0.6	225	7.000	5.800
1.002	20.458	Pipe	204.578		0.6	225	7.500	5.740
1.003	23.852	Pipe	54.209		0.6	225	7.350	5.640
1.004	6.736	Pipe	56.135		0.6	225	6.800	5.200
1.005	23.967	Pipe	54.471		0.6	225	6.800	5.080
1.006	5.401	Pipe	38.577		0.6	225	6.400	4.640
3.000	26.559	Pipe	221.325		0.6	225	6.350	5.000
3.001	7.906	Pipe	197.645		0.6	225	6.100	4.880
3.002	5.155	Pipe	257.772		0.6	225	6.050	4.840
3.003	28.958	Pipe	160.876		0.6	300	5.950	4.820
3.004	21.695	Pipe	197.230		0.6	300	6.150	4.680
3.005	14.953	Pipe	213.611		0.6	300	6.300	4.570
1.007	3.338	Pipe	66.762		0.6	450	6.300	4.350
1.008	36.432	Pipe	280.247		0.6	450	5.600	4.300
1.009	6.857	Pipe	342.860		0.6	450	5.600	4.170
1.010	28.777	Pipe	287.768		0.6	450	5.500	4.150
1.011	14.815	Pipe	296.296		0.6	450	5.100	4.050
1.012	19.808	Pipe	282.967		0.6	450	5.050	4.000
1.013	24.532	Pipe	306.645		0.6	450	5.000	3.930
4.000	13.912	Pipe	139.118		0.6	225	6.900	5.520
4.001	9.887	Pipe	98.872		0.6	225	6.800	5.420
4.002	17.658	Pipe	98.099		0.6	225	6.700	5.320
4.003	28.317	Pipe	97.644		0.6	225	6.550	5.140
4.004	8.032	Pipe	100.403		0.6	225	6.400	4.850
4.005	22.705	Pipe	103.202		0.6	225	6.500	4.770
4.006	4.039	Pipe	100.975		0.6	300	6.450	4.550
4.007	19.064	Pipe	40.562		0.6	300	6.250	4.510
6.000	6.131	Pipe	-47.160		0.6	300	6.150	4.040
5.000	5.616	Pipe	16.045		0.6	300	5.400	4.500
4.008	2.912	Pipe	145.595		0.6	300	5.350	4.150
4.009	3.866	Pipe	128.864		0.6	300	5.350	4.050
7.000	3.274	Pipe	109.128		0.6	300	5.350	4.050
4.010	9.862	Pipe	328.734		0.6	300	5.350	4.020
1.015	5.355	Pipe	0.000		0.6	450	5.250	3.790
1.016	10.279	Pipe	73.424		0.6	225	5.250	3.790
1.014	19.925	Pipe	332.088		0.6	450	5.250	3.850

Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by: S.Smith	Checked by: S.Smith	Approved By: C.Pendle
Report Details: Type: Connections Storm Phase: Phase	Company Address: MJA Consulting		

Name	Downstream Cover Level (m)	Downstream Invert Level (m)	Lock	Flow Restriction (L/s)
1.000	7.000	5.800	All	
2.000	7.000	5.800	All	
1.001	7.500	5.740	All	
1.002	7.350	5.640	All	
1.003	6.800	5.200	All	
1.004	6.800	5.080	All	
1.005	6.400	4.640	All	
1.006	6.300	4.500	All	
3.000	6.100	4.880	All	
3.001	6.050	4.840	All	
3.002	5.950	4.820	All	
3.003	6.150	4.640	All	
3.004	6.300	4.570	All	
3.005	6.300	4.500	All	
1.007	5.600	4.300	All	
1.008	5.600	4.170	All	
1.009	5.500	4.150	All	
1.010	5.100	4.050	All	
1.011	5.050	4.000	All	
1.012	5.000	3.930	All	
1.013	5.250	3.850	All	
4.000	6.800	5.420	All	
4.001	6.700	5.320	All	
4.002	6.550	5.140	All	
4.003	6.400	4.850	All	
4.004	6.500	4.770	All	
4.005	6.450	4.550	All	
4.006	6.250	4.510	All	
4.007	5.350	4.040	All	
6.000	5.350	4.170	All	
5.000	5.350	4.150	All	
4.008	5.350	4.130	All	
4.009	5.350	4.020	All	
7.000	5.350	4.020	All	
4.010	3.250	3.990	All	
1.015	5.250	3.790	All	
1.016	5.250	3.650	All	3.6
1.014	5.250	3.790	All	

Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by:	Checked by:	Approved By:
	S.Smith	S.Smith	C.Pendle
Report Details: Type: Inflow Summary Storm Phase: Phase	Company Address: MJA Consulting		

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Catchment Area	1		Time of Concentration	0.013	100	10	110	0.014
Catchment Area (1)	29		Time of Concentration	0.018	100	0	100	0.018
Catchment Area (2)	30		Time of Concentration	0.012	100	10	110	0.013
Catchment Area (3)	30		Time of Concentration	0.034	100	10	110	0.037
Catchment Area (4)	33		Time of Concentration	0.022	100	0	100	0.022
Catchment Area (5)	11		Time of Concentration	0.031	100	10	110	0.035
Catchment Area (6)	12		Time of Concentration	0.003	100	0	100	0.003
Catchment Area (7)	11		Time of Concentration	0.033	100	10	110	0.037
Catchment Area (8)	24		Time of Concentration	0.061	100	0	100	0.061
Catchment Area (9)	3		Time of Concentration	0.006	100	10	110	0.007
Catchment Area (10)	14		Time of Concentration	0.007	100	0	100	0.007
Catchment Area (11)	7		Time of Concentration	0.006	100	10	110	0.007
Catchment Area (12)	16		Time of Concentration	0.020	100	10	110	0.022
Catchment Area (13)	8		Time of Concentration	0.017	100	0	100	0.017
Catchment Area (14)	24		Time of Concentration	0.038	100	10	110	0.042
Catchment Area (15)	14		Time of Concentration	0.043	100	10	110	0.048
Catchment Area (16)	30		Time of Concentration	0.023	100	0	100	0.023
Catchment Area (17)	14		Time of Concentration	0.035	100	0	100	0.035
Catchment Area (18)	15		Time of Concentration	0.012	100	0	100	0.012
Catchment Area (19)	16		Time of Concentration	0.029	100	0	100	0.029
Catchment Area (20)	20		Time of Concentration	0.009	100	0	100	0.009
Catchment Area (21)	18		Time of Concentration	0.018	100	0	100	0.018
Catchment Area (22)	17		Time of Concentration	0.034	100	10	110	0.037
Catchment Area (23)	22		Time of Concentration	0.011	100	0	100	0.011
Catchment Area (24)	22		Time of Concentration	0.018	100	0	100	0.018
Catchment Area (25)	26		Time Area Diagram	0.058	100	0	100	0.058
Catchment Area (26)	26		Time of Concentration	0.019	100	10	110	0.020
Catchment Area (27)	27		Time of Concentration	0.023	100	0	100	0.023
Catchment Area (28)	3		Time of Concentration	0.024	100	0	100	0.024
Catchment Area (29)	1		Time of Concentration	0.022	100	10	110	0.024

Catchment Area (30)	2		Time of Concentration	0.086	100	10	110	0.095
Catchment Area (31)	29		Time of Concentration	0.021	100	10	110	0.023
Catchment Area (32)	Swale		Time of Concentration	0.020	100	10	110	0.022
Catchment Area (33)	Swale		Time of Concentration	0.006	100	0	100	0.006
Catchment Area (34)	24		Time of Concentration	0.031	100	10	110	0.034
Catchment Area (35)	22		Time of Concentration	0.010	100	10	110	0.011
Catchment Area (36)	22		Time of Concentration	0.008	100	0	100	0.008
Catchment Area (37)	13		Time of Concentration	0.025	100	10	110	0.027
Catchment Area (38)	Basin		Time of Concentration	0.122	100	0	100	0.122
TOTAL		**0.0**		**1.026**				**1.076**

Outfalls

Outfall	Outfall Type	Fixed Surcharged Level (m)	Level Curve
Swale (3)	Free Discharge		

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Use Catchment Values
Junction Flood Risk Margin (mm)	300
Prefill Manhole Sumps	☐
Perform No Discharge Analysis	☐

Rainfall

FEH

Type: FEH

Site Location	GB 470300 105900 SU 70300 05900
Rainfall Version	1999
C (1km)	-0.029
D1 (1km)	0.459
D2 (1km)	0.300
D3 (1km)	0.375
E (1km)	0.310
F (1km)	2.225
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
1.0	0.000
30.0	0.000
100.0	45.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640

Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by:	Checked by:	Approved By:
	S.Smith	S.Smith	C.Pendle
Report Details:	Company Address:		
Type: Junctions Summary Storm Phase: Phase	MJA Consulting		

FEH: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
1	FEH: 1 years: +0 %: 15 mins: Summer	7.000	6.000	6.048	0.048	3.9	0.054	0.000	3.5	1.680	OK
2	FEH: 1 years: +0 %: 15 mins: Summer	7.150	5.950	6.006	0.056	9.6	0.063	0.000	9.5	4.172	OK
3	FEH: 1 years: +0 %: 15 mins: Summer	7.000	5.800	5.914	0.114	16.0	0.129	0.000	14.1	7.165	OK
4	FEH: 1 years: +0 %: 15 mins: Summer	7.500	5.740	5.837	0.097	14.1	0.110	0.000	13.1	7.143	OK
5	FEH: 1 years: +0 %: 15 mins: Summer	7.350	5.640	5.705	0.065	13.1	0.074	0.000	12.3	7.126	OK
6	FEH: 1 years: +0 %: 15 mins: Summer	6.800	5.200	5.268	0.068	12.3	0.077	0.000	11.7	7.108	OK
7	FEH: 1 years: +0 %: 15 mins: Summer	6.800	5.080	5.144	0.064	12.3	0.072	0.000	11.7	7.384	OK
8	FEH: 1 years: +0 %: 30 mins: Summer	6.400	4.640	4.706	0.066	13.1	0.075	0.000	13.1	11.314	OK
9	FEH: 1 years: +0 %: 15 mins: Summer	6.300	4.350	4.465	0.115	32.5	0.130	0.000	31.9	19.004	OK
10	FEH: 1 years: +0 %: 30 mins: Summer	5.600	4.300	4.424	0.124	30.7	0.140	0.000	30.7	26.412	OK
11	FEH: 1 years: +0 %: 15 mins: Summer	6.350	5.000	5.070	0.070	7.2	0.079	0.000	6.8	3.135	OK
12	FEH: 1 years: +0 %: 15 mins: Summer	6.100	4.880	4.951	0.071	7.1	0.080	0.000	6.5	3.253	OK
13	FEH: 1 years: +0 %: 15 mins: Summer	6.050	4.840	4.932	0.092	9.2	0.104	0.000	8.8	4.447	OK
14	FEH: 1 years: +0 %: 15 mins: Summer	5.950	4.820	4.909	0.089	17.8	0.101	0.000	17.0	8.362	OK
15	FEH: 1 years: +0 %: 15 mins: Summer	6.150	4.640	4.778	0.138	18.1	0.156	0.000	16.6	8.688	OK
16	FEH: 1 years: +0 %: 15 mins: Summer	6.300	4.570	4.682	0.112	21.7	0.127	0.000	19.8	10.887	OK
17	FEH: 1 years: +0 %: 30 mins: Summer	5.600	4.170	4.318	0.148	33.3	0.168	0.000	33.3	28.627	OK
18	FEH: 1 years: +0 %: 30 mins: Summer	5.500	4.150	4.287	0.137	34.5	0.154	0.000	34.4	29.687	OK
19	FEH: 1 years: +0 %: 30 mins: Summer	5.100	4.050	4.193	0.143	34.4	0.161	0.000	34.3	29.647	OK
20	FEH: 1 years: +0 %: 15 mins: Summer	5.050	4.000	4.141	0.141	33.9	0.159	0.000	35.8	21.434	OK
21	FEH: 1 years: +0 %: 1440 mins: Summer	5.000	3.930	4.106	0.176	7.3	0.199	0.000	7.2	161.299	OK
22	FEH: 1 years: +0 %: 1440 mins: Summer	5.250	3.850	4.106	0.256	7.9	0.452	0.000	7.7	176.715	OK
23	FEH: 1 years: +0 %: 1440 mins: Summer	5.250	3.790	4.106	0.316	3.3	0.558	0.000	3.3	322.752	Surcharged
24	FEH: 1 years: +0 %: 15 mins: Summer	6.150	4.040	4.261	0.221	13.9	0.250	0.000	13.4	5.864	OK
25	FEH: 1 years: +0 %: 30 mins: Summer	5.350	4.020	4.165	0.145	27.4	0.164	0.000	26.6	24.629	OK
26	FEH: 1 years: +0 %: 15 mins: Summer	6.900	5.520	5.582	0.062	6.9	0.070	0.000	6.7	3.447	OK
27	FEH: 1 years: +0 %: 15 mins: Summer	6.800	5.420	5.486	0.066	9.0	0.074	0.000	8.6	4.451	OK

28	FEH: 1 years: +0 %: 15 mins: Summer	6.700	5.320	5.382	0.062	8.6	0.070	0.000	8.2	4.440	OK
29	FEH: 1 years: +0 %: 15 mins: Summer	6.550	5.140	5.212	0.072	12.4	0.082	0.000	11.6	6.226	OK
30	FEH: 1 years: +0 %: 15 mins: Summer	6.400	4.850	4.952	0.102	19.0	0.115	0.000	18.1	9.426	OK
31	FEH: 1 years: +0 %: 15 mins: Summer	6.500	4.770	4.865	0.095	18.1	0.108	0.000	17.3	9.409	OK
32	FEH: 1 years: +0 %: 15 mins: Summer	6.450	4.550	4.635	0.085	17.3	0.096	0.000	16.6	9.386	OK
33	FEH: 1 years: +0 %: 15 mins: Summer	6.250	4.510	4.573	0.063	18.8	0.071	0.000	18.4	10.358	OK
34	FEH: 1 years: +0 %: 15 mins: Summer	5.350	4.040	4.278	0.238	20.4	0.269	0.000	19.0	11.168	OK

FEH: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
1	FEH: 30 years: +0 %: 15 mins: Summer	7.000	6.000	6.111	0.111	12.7	0.126	0.000	7.3	5.537	OK
2	FEH: 30 years: +0 %: 15 mins: Summer	7.150	5.950	6.143	0.193	31.5	0.219	0.000	29.5	13.650	OK
3	FEH: 30 years: +0 %: 15 mins: Summer	7.000	5.800	6.107	0.307	47.0	0.347	0.000	43.8	23.509	Surcharged
4	FEH: 30 years: +0 %: 15 mins: Summer	7.500	5.740	5.946	0.206	43.8	0.233	0.000	41.8	23.489	OK
5	FEH: 30 years: +0 %: 15 mins: Summer	7.350	5.640	5.770	0.130	41.8	0.147	0.000	40.6	23.468	OK
6	FEH: 30 years: +0 %: 15 mins: Summer	6.800	5.200	5.344	0.144	40.6	0.163	0.000	39.6	23.445	OK
7	FEH: 30 years: +0 %: 15 mins: Summer	6.800	5.080	5.211	0.131	41.8	0.148	0.000	41.0	24.380	OK
8	FEH: 30 years: +0 %: 15 mins: Summer	6.400	4.640	4.782	0.142	46.8	0.161	0.000	45.4	26.860	OK
9	FEH: 30 years: +0 %: 15 mins: Summer	6.300	4.350	4.612	0.262	113.6	0.296	0.000	112.4	62.920	OK
10	FEH: 30 years: +0 %: 15 mins: Summer	5.600	4.300	4.568	0.268	112.4	0.303	0.000	105.7	62.855	OK
11	FEH: 30 years: +0 %: 15 mins: Summer	6.350	5.000	5.139	0.139	23.6	0.157	0.000	22.6	10.249	OK
12	FEH: 30 years: +0 %: 15 mins: Summer	6.100	4.880	5.062	0.182	23.5	0.206	0.000	21.0	10.657	OK
13	FEH: 30 years: +0 %: 15 mins: Summer	6.050	4.840	5.044	0.204	30.1	0.231	0.000	29.0	14.570	OK
14	FEH: 30 years: +0 %: 15 mins: Summer	5.950	4.820	5.011	0.191	58.5	0.216	0.000	56.1	27.359	OK
15	FEH: 30 years: +0 %: 15 mins: Summer	6.150	4.640	4.897	0.257	59.9	0.291	0.000	55.7	28.826	OK
16	FEH: 30 years: +0 %: 15 mins: Summer	6.300	4.570	4.814	0.244	72.5	0.276	0.000	68.1	36.079	OK
17	FEH: 30 years: +0 %: 15 mins: Summer	5.600	4.170	4.473	0.303	118.0	0.342	0.000	109.6	68.080	OK
18	FEH: 30 years: +0 %: 960 mins: Winter	5.500	4.150	4.462	0.312	13.4	0.352	0.000	13.3	303.832	OK
19	FEH: 30 years: +0 %: 960 mins: Winter	5.100	4.050	4.462	0.412	13.3	0.465	0.000	13.0	301.872	OK
20	FEH: 30 years: +0 %: 960 mins: Winter	5.050	4.000	4.462	0.462	13.3	0.522	0.000	13.0	305.345	Surcharged
21	FEH: 30 years: +0 %: 960 mins: Winter	5.000	3.930	4.462	0.532	13.0	0.601	0.000	12.7	302.062	Surcharged
22	FEH: 30 years: +0 %: 960 mins: Winter	5.250	3.850	4.462	0.612	14.0	1.081	0.000	13.7	327.624	Surcharged
23	FEH: 30 years: +0 %: 960 mins: Winter	5.250	3.790	4.461	0.671	3.4	1.187	0.000	3.3	319.668	Surcharged
24	FEH: 30 years: +0 %: 960 mins: Winter	6.150	4.040	4.462	0.422	3.7	0.477	0.000	3.7	84.564	Surcharged
25	FEH: 30 years: +0 %: 960 mins: Winter	5.350	4.020	4.462	0.442	10.4	0.499	0.000	9.7	252.581	Surcharged
26	FEH: 30 years: +0 %: 15 mins: Summer	6.900	5.520	5.646	0.126	22.6	0.142	0.000	22.0	11.296	OK
27	FEH: 30 years: +0 %: 15 mins: Summer	6.800	5.420	5.555	0.135	29.6	0.152	0.000	28.6	14.585	OK

28	FEH: 30 years: +0 %: 15 mins: Summer	6.700	5.320	5.448	0.128	28.6	0.145	0.000	27.5	14.564	OK
29	FEH: 30 years: +0 %: 15 mins: Summer	6.550	5.140	5.293	0.153	41.1	0.173	0.000	35.6	20.431	OK
30	FEH: 30 years: +0 %: 15 mins: Summer	6.400	4.850	5.170	0.320	59.9	0.362	0.000	57.6	30.927	Surcharged
31	FEH: 30 years: +0 %: 15 mins: Summer	6.500	4.770	5.028	0.258	57.6	0.291	0.000	54.9	30.910	Surcharged
32	FEH: 30 years: +0 %: 15 mins: Summer	6.450	4.550	4.713	0.163	54.9	0.184	0.000	53.5	30.880	OK
33	FEH: 30 years: +0 %: 15 mins: Summer	6.250	4.510	4.629	0.119	60.8	0.135	0.000	60.0	34.048	OK
34	FEH: 30 years: +0 %: 960 mins: Winter	5.350	4.040	4.462	0.422	7.2	0.477	0.000	7.2	163.132	Surcharged

Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by:	Checked by:	Approved By:
	S.Smith	S.Smith	C.Pendle
Report Details:	Company Address:		
Type: Junctions Summary Storm Phase: Phase	MJA Consulting		

FEH: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
1	FEH: 100 years: +45 %: 15 mins: Summer	7.000	6.000	7.005	1.005	28.3	5.727	4.596	11.7	12.418	Flood
2	FEH: 100 years: +45 %: 15 mins: Summer	7.150	5.950	7.150	1.200	69.9	1.597	0.240	59.2	30.336	Flood
3	FEH: 100 years: +45 %: 15 mins: Summer	7.000	5.800	7.000	1.200	90.5	1.749	0.392	74.6	52.382	Flood
4	FEH: 100 years: +45 %: 30 mins: Summer	7.500	5.740	6.657	0.917	67.8	1.037	0.000	67.2	65.559	Surcharged
5	FEH: 100 years: +45 %: 15 mins: Summer	7.350	5.640	6.320	0.680	72.0	0.770	0.000	67.3	52.315	Surcharged
6	FEH: 100 years: +45 %: 15 mins: Summer	6.800	5.200	5.886	0.686	67.3	0.776	0.000	68.0	52.339	Surcharged
7	FEH: 100 years: +45 %: 15 mins: Summer	6.800	5.080	5.704	0.624	69.1	0.706	0.000	71.4	54.496	Surcharged
8	FEH: 100 years: +45 %: 30 mins: Summer	6.400	4.640	5.212	0.572	74.9	0.647	0.000	74.1	75.189	Surcharged
9	FEH: 100 years: +45 %: 15 mins: Summer	6.300	4.350	5.037	0.687	198.5	0.777	0.000	192.6	140.543	Surcharged
10	FEH: 100 years: +45 %: 15 mins: Summer	5.600	4.300	4.989	0.689	192.6	0.779	0.000	185.8	140.486	Surcharged
11	FEH: 100 years: +45 %: 15 mins: Summer	6.350	5.000	6.171	1.171	52.5	1.324	0.000	42.2	22.823	Flood Risk
12	FEH: 100 years: +45 %: 15 mins: Summer	6.100	4.880	5.979	1.099	44.4	1.243	0.000	35.0	23.787	Flood Risk
13	FEH: 100 years: +45 %: 15 mins: Summer	6.050	4.840	5.927	1.087	55.1	1.229	0.000	48.2	32.538	Flood Risk
14	FEH: 100 years: +45 %: 15 mins: Summer	5.950	4.820	5.858	1.038	111.2	1.174	0.000	102.0	60.932	Flood Risk
15	FEH: 100 years: +45 %: 15 mins: Summer	6.150	4.640	5.569	0.929	110.5	1.050	0.000	102.2	64.475	Surcharged
16	FEH: 100 years: +45 %: 15 mins: Summer	6.300	4.570	5.335	0.765	139.5	0.865	0.000	132.3	80.277	Surcharged
17	FEH: 100 years: +45 %: 1440 mins: Winter	5.600	4.170	4.941	0.771	17.3	0.873	0.000	17.0	593.170	Surcharged
18	FEH: 100 years: +45 %: 1440 mins: Winter	5.500	4.150	4.941	0.791	17.6	0.895	0.000	17.4	611.786	Surcharged
19	FEH: 100 years: +45 %: 1440 mins: Winter	5.100	4.050	4.941	0.891	17.4	1.008	0.000	17.3	607.262	Flood Risk
20	FEH: 100 years: +45 %: 1440 mins: Winter	5.050	4.000	4.941	0.941	17.7	1.065	0.000	17.6	614.976	Flood Risk
21	FEH: 100 years: +45 %: 1440 mins: Winter	5.000	3.930	4.941	1.011	17.6	1.144	0.000	17.5	610.260	Flood Risk
22	FEH: 100 years: +45 %: 1440 mins: Winter	5.250	3.850	4.941	1.091	19.3	1.928	0.000	19.3	665.956	Surcharged
23	FEH: 100 years: +45 %: 1440 mins: Winter	5.250	3.790	4.941	1.151	3.4	2.034	0.000	3.3	492.213	Surcharged
24	FEH: 100 years: +45 %: 1440 mins: Winter	6.150	4.040	4.941	0.901	5.1	1.019	0.000	5.0	173.305	Surcharged
25	FEH: 100 years: +45 %: 1440 mins: Winter	5.350	4.020	4.941	0.921	12.4	1.042	0.000	10.0	483.347	Surcharged
26	FEH: 100 years: +45 %: 15 mins: Summer	6.900	5.520	6.735	1.215	50.0	1.374	0.000	38.7	25.131	Flood Risk
27	FEH: 100 years: +45 %: 15 mins: Summer	6.800	5.420	6.734	1.314	55.6	1.486	0.000	44.8	32.480	Flood Risk

28	FEH: 100 years: +45 %: 15 mins: Summer	6.700	5.320	6.700	1.380	44.8	1.648	0.088	45.5	32.494	Flood
29	FEH: 100 years: +45 %: 15 mins: Summer	6.550	5.140	6.551	1.411	64.6	2.093	0.498	73.5	45.612	Flood
30	FEH: 100 years: +45 %: 15 mins: Summer	6.400	4.850	6.094	1.244	108.5	1.407	0.000	100.4	68.940	Surcharged
31	FEH: 100 years: +45 %: 15 mins: Summer	6.500	4.770	5.671	0.901	100.4	1.019	0.000	94.4	68.920	Surcharged
32	FEH: 100 years: +45 %: 1440 mins: Winter	6.450	4.550	4.941	0.391	8.0	0.443	0.000	8.0	271.793	Surcharged
33	FEH: 100 years: +45 %: 1440 mins: Winter	6.250	4.510	4.941	0.431	8.8	0.488	0.000	8.8	298.882	Surcharged
34	FEH: 100 years: +45 %: 1440 mins: Winter	5.350	4.040	4.941	0.901	9.8	1.019	0.000	9.8	329.091	Surcharged

Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by: S.Smith	Checked by: S.Smith	Approved By: C.Pendle
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address: MJA Consulting		

FEH: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. Avg. Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Avg. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)
Swale	FEH: 1 years: +0 %: 15 mins: Summer	4.643	4.517	4.540	0.047	0.017	0.040	2.8	0.344	0.000	0.000	2.0	1.220	4
Swale (1)	FEH: 1 years: +0 %: 30 mins: Summer	4.258	4.175	4.168	0.116	0.125	0.118	18.2	1.683	0.000	0.000	17.8	15.655	2
Swale (2)	FEH: 1 years: +0 %: 30 mins: Summer	4.165	4.165	4.118	0.022	0.115	0.068	2.1	0.792	0.000	0.000	2.0	0.809	
Swale (3)	FEH: 1 years: +0 %: 1440 mins: Summer	3.767	3.765	3.599	0.083	0.415	0.249	3.3	26.770	0.000	0.000	3.3	297.957	138
Basin	FEH: 1 years: +0 %: 1440 mins: Summer	4.106	4.106	4.106	0.316	0.316	0.316	15.3	199.376	0.000	0.000	3.3	322.874	551

Percentage Available (%)	Status
98.253	OK
97.642	OK
98.895	OK
15.913	Flood Risk
79.118	OK

Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by: S.Smith	Checked by: S.Smith	Approved By: C.Pendle
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address: MJA Consulting		

FEH: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. Avg. Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Avg. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)
Swale	FEH: 30 years: +0 %: 15 mins: Summer	4.679	4.532	4.571	0.082	0.032	0.071	9.3	0.813	0.000	0.000	7.7	4.022	2
Swale (1)	FEH: 30 years: +0 %: 960 mins: Winter	4.462	4.462	4.415	0.320	0.412	0.365	7.2	12.818	0.000	0.000	6.7	159.599	19
Swale (2)	FEH: 30 years: +0 %: 960 mins: Winter	4.461	4.462	4.415	0.319	0.412	0.365	0.9	12.859	0.000	0.000	0.4	9.329	
Swale (3)	FEH: 30 years: +0 %: 1440 mins: Summer	3.767	3.766	3.599	0.084	0.416	0.249	3.3	26.786	0.000	0.000	3.3	455.519	135
Basin	FEH: 30 years: +0 %: 960 mins: Winter	4.462	4.462	4.462	0.672	0.672	0.672	26.6	475.354	0.000	0.000	3.4	320.959	1193

Percentage Available (%)	Status
95.874	OK
82.039	OK
82.060	OK
15.861	Flood Risk
50.213	OK

Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by: S.Smith	Checked by: S.Smith	Approved By: C.Pendle
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address: MJA Consulting		

FEH: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. Avg. Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Avg. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)
Swale	FEH: 100 years: +45 %: 1440 mins: Winter	4.941	4.941	4.893	0.344	0.441	0.393	1.0	15.377	0.000	0.000	1.0	32.430	287
Swale (1)	FEH: 100 years: +45 %: 1440 mins: Winter	4.942	4.941	4.895	0.799	0.891	0.845	9.8	63.250	0.000	0.000	7.3	289.267	86
Swale (2)	FEH: 100 years: +45 %: 1440 mins: Winter	4.941	4.941	4.895	0.798	0.891	0.845	2.7	63.488	0.000	0.000	0.6	25.216	
Swale (3)	FEH: 100 years: +45 %: 2160 mins: Winter	3.767	3.766	3.599	0.084	0.416	0.249	3.3	26.786	0.000	0.000	3.3	701.274	140
Basin	FEH: 100 years: +45 %: 1440 mins: Winter	4.941	4.941	4.941	1.151	1.151	1.151	33.5	945.034	0.000	0.000	3.4	494.415	2457

Percentage Available (%)	Status
21.968	OK
11.378	OK
11.427	OK
15.861	Flood Risk
1.021	OK

Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by: S.Smith	Checked by: S.Smith	Approved By: C.Pendle
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address: MJA Consulting		

FEH: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.000	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	1	3	7.000	6.048	0.081	1.680	0.3	0.1	3.5	OK
2.000	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	2	3	7.150	6.006	0.085	4.172	0.7	0.14	9.5	OK
1.001	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	3	4	7.000	5.914	0.106	7.165	0.8	0.46	14.1	OK
1.002	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	4	5	7.500	5.837	0.081	7.143	1.0	0.36	13.1	OK
1.003	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	5	6	7.350	5.705	0.067	7.126	1.2	0.17	12.3	OK
1.004	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	6	7	6.800	5.268	0.066	7.108	1.2	0.17	11.7	OK
1.005	FEH: 1 years: +0 %: 30 mins: Summer	Pipe	7	8	6.800	5.144	0.065	10.265	1.2	0.17	11.9	OK
1.006	FEH: 1 years: +0 %: 30 mins: Summer	Pipe	8	9	6.400	4.706	0.063	11.314	1.4	0.16	13.1	OK
3.000	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	11	12	6.350	5.070	0.070	3.135	0.6	0.2	6.8	OK
3.001	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	12	13	6.100	4.951	0.081	3.253	0.5	0.18	6.5	OK
3.002	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	13	14	6.050	4.932	0.090	4.447	0.6	0.27	8.8	OK
3.003	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	14	15	5.950	4.909	0.114	8.362	0.7	0.19	17.0	OK
3.004	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	15	16	6.150	4.778	0.105	8.688	0.7	0.21	16.6	OK
3.005	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	16	9	6.300	4.682	0.108	10.887	0.9	0.26	19.8	OK
1.007	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	9	10	6.300	4.465	0.119	19.004	0.9	0.08	31.9	OK
1.008	FEH: 1 years: +0 %: 30 mins: Summer	Pipe	10	17	5.600	4.424	0.136	26.412	0.8	0.16	30.7	OK
1.009	FEH: 1 years: +0 %: 30 mins: Summer	Pipe	17	18	5.600	4.318	0.142	28.627	0.8	0.19	33.3	OK

1.010	FEH: 1 years: +0 %: 30 mins: Summer	Pipe	18	19	5.500	4.287	0.140	29.687	0.8	0.18	34.4	OK
1.011	FEH: 1 years: +0 %: 30 mins: Summer	Pipe	19	20	5.100	4.193	0.141	29.647	0.8	0.18	34.3	OK
1.012	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	20	21	5.050	4.141	0.143	21.434	0.8	0.19	35.8	OK
1.013	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	21	22	5.000	4.075	0.141	21.294	0.9	0.21	37.8	OK
4.000	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	26	27	6.900	5.582	0.064	3.447	0.7	0.15	6.7	OK
4.001	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	27	28	6.800	5.486	0.064	4.451	0.9	0.16	8.6	OK
4.002	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	28	29	6.700	5.382	0.067	4.440	0.8	0.16	8.2	OK
4.003	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	29	30	6.550	5.212	0.087	6.226	0.8	0.22	11.6	OK
4.004	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	30	31	6.400	4.952	0.099	9.426	1.1	0.35	18.1	OK
4.005	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	31	32	6.500	4.865	0.090	9.409	1.2	0.34	17.3	OK
4.006	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	32	33	6.450	4.635	0.074	9.386	1.2	0.15	16.6	OK
4.007	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	33	34	6.250	4.573	0.150	10.358	0.5	0.1	18.4	OK
6.000	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	24	25	6.150	4.261	0.140	0.000	0.4	0.25	13.4	OK
5.000	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	Swale	34	5.400	4.540	0.072	1.220	0.2	0.01	2.0	OK
4.008	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	34	Swale (1)	5.350	4.278	0.121	11.168	0.7	0.21	19.0	OK
4.009	FEH: 1 years: +0 %: 30 mins: Summer	Pipe	Swale (1)	25	5.350	4.168	0.135	15.641	0.6	0.18	17.8	OK
7.000	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	Swale (2)	25	5.350	4.116	0.126	0.002	0.1	0.03	3.0	OK
4.010	FEH: 1 years: +0 %: 30 mins: Summer	Pipe	25	Basin	5.350	4.165	0.134	23.670	0.9	0.44	26.6	OK
1.015	FEH: 1 years: +0 %: 1440 mins: Summer	Pipe	Basin	23	5.250	4.106	0.316	322.835	0.1	0.03	3.3	OK
1.016	FEH: 1 years: +0 %: 1440 mins: Summer	Pipe	23	Swale (3)	5.250	4.106	0.060	322.738	0.5	0.05	3.3	Surcharged
1.014	FEH: 1 years: +0 %: 15 mins: Summer	Pipe	22	Basin	5.250	3.988	0.104	23.306	1.5	0.23	40.6	OK

Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by: S.Smith	Checked by: S.Smith	Approved By: C.Pendle
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address: MJA Consulting		

FEH: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.000	FEH: 30 years: +0 %: 30 mins: Summer	Pipe	1	3	7.000	6.074	0.147	7.106	0.3	0.24	8.2	OK
2.000	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	2	3	7.150	6.143	0.225	13.650	0.7	0.43	29.5	OK
1.001	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	3	4	7.000	6.107	0.225	23.509	1.1	1.45	43.8	Surcharged
1.002	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	4	5	7.500	5.946	0.168	23.489	1.3	1.15	41.8	OK
1.003	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	5	6	7.350	5.770	0.137	23.468	1.6	0.57	40.6	OK
1.004	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	6	7	6.800	5.344	0.138	23.445	1.6	0.57	39.6	OK
1.005	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	7	8	6.800	5.211	0.137	24.380	1.6	0.58	41.0	OK
1.006	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	8	9	6.400	4.782	0.130	26.860	1.9	0.54	45.4	OK
3.000	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	11	12	6.350	5.139	0.160	10.249	0.7	0.65	22.6	OK
3.001	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	12	13	6.100	5.062	0.193	10.657	0.6	0.57	21.0	OK
3.002	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	13	14	6.050	5.044	0.197	14.570	0.8	0.9	29.0	OK
3.003	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	14	15	5.950	5.011	0.224	27.359	1.0	0.64	56.1	OK
3.004	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	15	16	6.150	4.897	0.230	28.826	1.0	0.71	55.7	OK
3.005	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	16	9	6.300	4.814	0.224	36.079	1.2	0.9	68.1	OK
1.007	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	9	10	6.300	4.612	0.265	62.920	1.2	0.28	112.4	OK
1.008	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	10	17	5.600	4.568	0.286	62.855	1.0	0.55	105.7	OK
1.009	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	17	18	5.600	4.473	0.289	68.080	1.0	0.63	109.6	OK

1.010	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	18	19	5.500	4.426	0.274	70.565	1.1	0.57	108.6	OK
1.011	FEH: 30 years: +0 %: 30 mins: Summer	Pipe	19	20	5.100	4.335	0.280	91.078	1.0	0.56	104.9	OK
1.012	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	20	21	5.050	4.280	0.278	71.644	1.1	0.57	108.9	OK
1.013	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	21	22	5.000	4.206	0.261	70.946	1.2	0.63	114.9	OK
4.000	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	26	27	6.900	5.646	0.130	11.296	0.9	0.5	22.0	OK
4.001	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	27	28	6.800	5.555	0.132	14.585	1.2	0.55	28.6	OK
4.002	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	28	29	6.700	5.448	0.141	14.564	1.1	0.52	27.5	OK
4.003	FEH: 30 years: +0 %: 15 mins: Winter	Pipe	29	30	6.550	5.281	0.217	20.427	0.9	0.71	37.2	OK
4.004	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	30	31	6.400	5.170	0.225	30.927	1.4	1.11	57.6	Surcharged
4.005	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	31	32	6.500	5.028	0.210	30.910	1.4	1.07	54.9	Surcharged
4.006	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	32	33	6.450	4.713	0.141	30.880	1.6	0.48	53.5	OK
4.007	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	33	34	6.250	4.629	0.237	34.048	1.0	0.34	60.0	OK
6.000	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	24	25	6.150	4.358	0.213	0.000	0.8	0.85	45.0	Surcharged
5.000	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	Swale	34	5.400	4.571	0.138	4.022	0.2	0.03	7.7	OK
4.008	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	34	Swale (1)	5.350	4.395	0.223	37.639	1.2	0.72	66.2	OK
4.009	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	Swale (1)	25	5.350	4.302	0.294	37.523	0.8	0.6	58.2	OK
7.000	FEH: 30 years: +0 %: 30 mins: Summer	Pipe	Swale (2)	25	5.350	4.252	0.264	0.000	0.2	0.11	11.3	OK
4.010	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	25	Basin	5.350	4.316	0.258	56.921	1.2	1.32	80.5	OK
1.015	FEH: 30 years: +0 %: 2880 mins: Winter	Pipe	Basin	23	5.250	4.396	0.450	811.476	0.1	0.04	4.3	Surcharged
1.016	FEH: 30 years: +0 %: 480 mins: Winter	Pipe	23	Swale (3)	5.250	4.409	0.060	158.765	0.6	0.05	3.3	Surcharged
1.014	FEH: 30 years: +0 %: 15 mins: Summer	Pipe	22	Basin	5.250	4.097	0.208	76.318	2.0	0.68	120.7	OK

Project:	Date:		
Land west of Manor Farm Surface Water Calculations	25/07/2024		
	Designed by: S.Smith	Checked by: S.Smith	Approved By: C.Pendle
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address: MJA Consulting		

FEH: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Flow

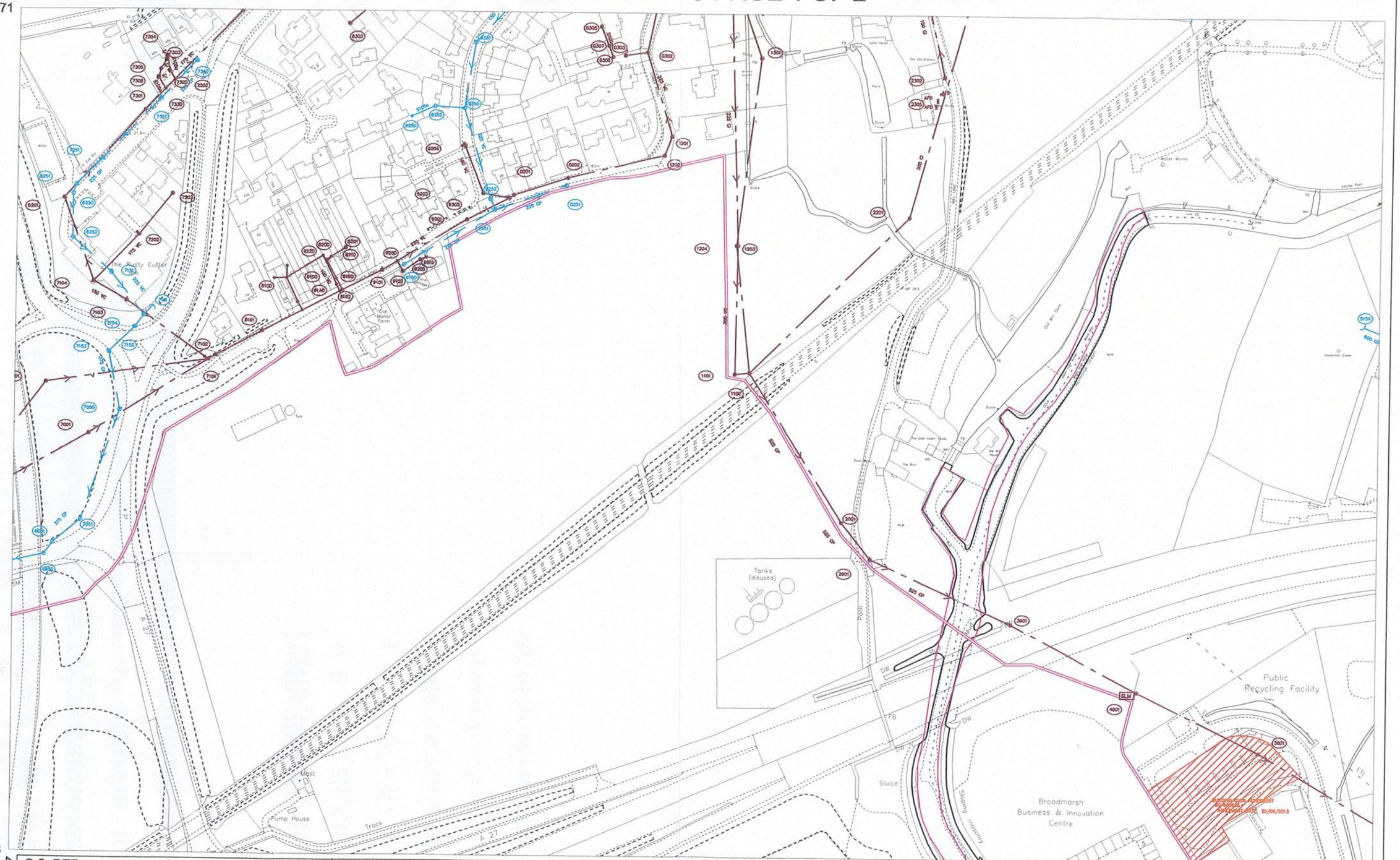
Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.000	FEH: 100 years: +45 %: 15 mins: Winter	Pipe	1	3	7.000	7.004	0.225	12.416	0.7	0.86	29.3	Flood
2.000	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	2	3	7.150	7.150	0.225	30.336	1.5	0.85	59.2	Flood
1.001	FEH: 100 years: +45 %: 15 mins: Winter	Pipe	3	4	7.000	7.000	0.225	52.369	1.9	2.52	76.3	Flood
1.002	FEH: 100 years: +45 %: 15 mins: Winter	Pipe	4	5	7.500	6.583	0.225	52.336	1.8	2.02	73.2	Surcharged
1.003	FEH: 100 years: +45 %: 15 mins: Winter	Pipe	5	6	7.350	6.241	0.225	52.299	1.7	0.95	67.3	Surcharged
1.004	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	6	7	6.800	5.886	0.225	52.339	1.7	0.98	68.0	Surcharged
1.005	FEH: 100 years: +45 %: 15 mins: Winter	Pipe	7	8	6.800	5.662	0.225	54.477	1.8	1.01	71.6	Surcharged
1.006	FEH: 100 years: +45 %: 15 mins: Winter	Pipe	8	9	6.400	5.147	0.225	60.019	2.0	0.93	78.2	Surcharged
3.000	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	11	12	6.350	6.171	0.225	22.823	1.1	1.21	42.2	Flood Risk
3.001	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	12	13	6.100	5.979	0.225	23.787	0.9	0.95	35.0	Flood Risk
3.002	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	13	14	6.050	5.927	0.225	32.538	1.2	1.5	48.2	Flood Risk
3.003	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	14	15	5.950	5.858	0.300	60.932	1.4	1.17	102.0	Flood Risk
3.004	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	15	16	6.150	5.569	0.300	64.475	1.4	1.3	102.2	Surcharged
3.005	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	16	9	6.300	5.335	0.300	80.277	1.9	1.75	132.3	Surcharged
1.007	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	9	10	6.300	5.037	0.450	140.543	1.2	0.49	192.6	Surcharged
1.008	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	10	17	5.600	4.989	0.450	140.486	1.2	0.97	185.8	Surcharged
1.009	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	17	18	5.600	4.830	0.450	151.745	1.3	1.19	207.0	Surcharged

1.010	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	18	19	5.500	4.760	0.450	156.713	1.3	1.13	213.8	Surcharged
1.011	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	19	20	5.100	4.613	0.450	154.877	1.3	1.11	206.8	Surcharged
1.012	FEH: 100 years: +45 %: 30 mins: Summer	Pipe	20	21	5.050	4.516	0.450	192.693	1.3	1.09	209.4	Surcharged
1.013	FEH: 100 years: +45 %: 30 mins: Summer	Pipe	21	22	5.000	4.392	0.450	188.696	1.3	1.13	208.1	Surcharged
4.000	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	26	27	6.900	6.735	0.225	25.131	1.0	0.88	38.7	Flood Risk
4.001	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	27	28	6.800	6.734	0.225	32.480	1.1	0.86	44.8	Flood Risk
4.002	FEH: 100 years: +45 %: 15 mins: Winter	Pipe	28	29	6.700	6.555	0.225	32.531	1.2	0.92	48.5	Flood Risk
4.003	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	29	30	6.550	6.551	0.225	45.612	1.8	1.4	73.5	Flood
4.004	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	30	31	6.400	6.094	0.225	68.940	2.5	1.93	100.4	Surcharged
4.005	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	31	32	6.500	5.671	0.225	68.920	2.4	1.85	94.4	Surcharged
4.006	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	32	33	6.450	4.891	0.300	68.893	1.5	0.83	91.8	Surcharged
4.007	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	33	34	6.250	4.827	0.300	75.876	1.4	0.58	101.9	Surcharged
6.000	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	24	25	6.150	4.540	0.300	0.000	1.4	1.88	99.9	Surcharged
5.000	FEH: 100 years: +45 %: 15 mins: Winter	Pipe	Swale	34	5.400	4.611	0.300	8.962	0.3	0.05	14.9	OK
4.008	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	34	Swale (1)	5.350	4.655	0.300	84.010	1.6	1.25	114.8	Surcharged
4.009	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	Swale (1)	25	5.350	4.532	0.300	80.827	1.4	1.02	100.2	Surcharged
7.000	FEH: 100 years: +45 %: 15 mins: Winter	Pipe	Swale (2)	25	5.350	4.447	0.300	0.000	0.4	0.24	25.8	Surcharged
4.010	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	25	Basin	5.350	4.496	0.300	119.758	1.9	2.15	131.1	Surcharged
1.015	FEH: 100 years: +45 %: 15 mins: Summer	Pipe	Basin	23	5.250	4.269	0.450	5.136	0.4	0.09	10.2	Surcharged
1.016	FEH: 100 years: +45 %: 480 mins: Winter	Pipe	23	Swale (3)	5.250	4.841	0.059	158.522	0.6	0.05	3.3	Surcharged
1.014	FEH: 100 years: +45 %: 30 mins: Summer	Pipe	22	Basin	5.250	4.361	0.450	203.574	2.1	1.27	224.6	Surcharged

APPENDIX E
PUBLIC SEWER RECORDS

SEWER RECORDS PAGE 1 OF 2

106371



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469656

470601

O.S. REF. SU7006SW	Drawn by: mondaln	The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determnined on site.
	Scale: 1:2500	WARNING: BAC pipes are constructed of Bonded Asbestos Cement WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement
Title: Land at Manor Farm Lower Road	Date: 23/06/2015	Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.

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Southern Water

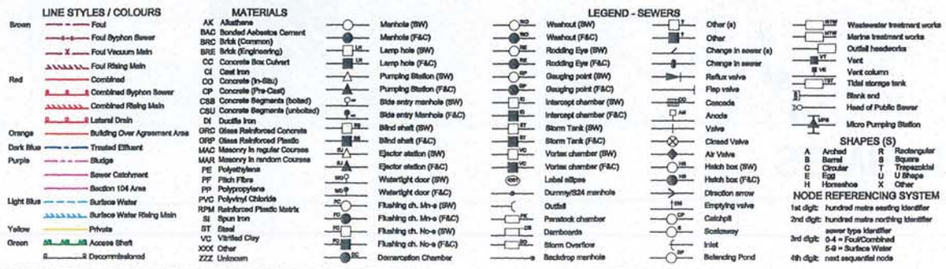
SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	
0201X	9.3	6.73	225	VC	CIRC	
0202X	8.89		UNK	UNK	CIRC	
0251X	8.8	8.29	150	CI	CIRC	
0302X	8.37	6.16	225	VC	CIRC	
0303X			UNK	UNK	UNK	
0305X			UNK	UNK	CIRC	
0307X			UNK	UNK	CIRC	
1101X	6.99	3.87	300	VC	CIRC	
1102X	6.86	3.08	525	CP	CIRC	
1201X	8.25	6.28	225	VC	CIRC	
1202X	8.14		UNK	UNK	CIRC	
1203X	7.28	4.05	300	VC	CIRC	
1204X	6.84		UNK	UNK	CIRC	
1301X	6.66		UNK	UNK	CIRC	
2001X	4.7	2.63	525	CP	CIRC	
2201X	4.28		UNK	UNK	CIRC	
2302X	7.06	6.54	150	CI	CIRC	
2901X	3.65	2.48	525	CP	CIRC	
3901X	3.25		OTHER	CP	CIRC	
4901X	2.84		UNK	UNK	CIRC	
5801X	3.01	0.11	OTHER	CP	CIRC	
6051X	10.09	7.8	375	CP	CIRC	
6101X	18.76	7.93	300	CP	CIRC	
6201X	20.65		175	VC	CIRC	
6250X	20.69	19.83	225	VC	CIRC	
6251X	20.78	19.86	225	CP	CIRC	
6252X	19.34	18.1	225	VC	CIRC	
7950X	10.05		UNK	UNK	UNK	
7001X	14.16	7.84	225	VC	CIRC	
7050X	12.62	9.73	375	CP	CIRC	
7051X	10.52	8.88	375	CP	CIRC	
7101X	12.76	7.55	225	VC	CIRC	
7102X	12.99	7.51	225	VC	CIRC	
7103X	14.66	11.26	150	VC	CIRC	
7104X	16.7	14.14	150	VC	CIRC	*
7104Y	16.7		UNK	UNK	CIRC	*
7151X	16.53	15.05	225	VC	CIRC	
7152X	13.08	11.13	225	VC	CIRC	
7153X	13.23	10.63	375	CP	CIRC	
7154X	13.12	11.58	225	VC	CIRC	
7151X	11.16		225	VC	CIRC	
7202X	16.59	14.87	175	VC	CIRC	
7203X			UNK	UNK	CIRC	
7251X	21.57	20.75	225	CP	CIRC	
7301X	22.4	21.21	175	VC	CIRC	
7302X			UNK	UNK	CIRC	
7303X			UNK	UNK	CIRC	*
7303Y			UNK	UNK	CIRC	*
7304X			UNK	UNK	CIRC	
7305X			UNK	UNK	CIRC	
7306X			UNK	UNK	CIRC	
732DX			175	VC	CIRC	
733DX			175	VC	CIRC	
7350X	23.11	21.89	225	CP	CIRC	
7351X	22.19	21.35	225	CP	CIRC	
8101X	10.86		225	VC	CIRC	
8102X			225	VC	CIRC	
810DX			UNK	UNK	CIRC	
811DX			UNK	UNK	CIRC	
812DX			UNK	UNK	CIRC	
813DY			225	VC	CIRC	*
813DX			UNK	UNK	CIRC	*
814DX			225	VC	CIRC	
81ADX	10.32	8.85	100	VC	CIRC	
81BDX	10.35		100	VC	CIRC	

Node	Cover	Invert	Size	Material	Shape	
81CDX	11.035		UNK	UNK	CIRC	
81DDX	10.67	9.37	100	VC	CIRC	*
81DDY	10.67		UNK	UNK	CIRC	*
8201X	10.92	10.43	100	VC	CIRC	
820DX	10.62	9.36	100	VC	CIRC	
821DX	10.81	9.68	100	VC	CIRC	
822DX	10.91	10.91	UNK	VC	CIRC	
8302X	18.89		UNK	UNK	CIRC	
9101X	9.19	7.13	225	VC	CIRC	
9102X			UNK	UNK	CIRC	
9150X	9.06	8.45	225	CP	CIRC	
9201X	9.22	6.95	225	VC	CIRC	
9202X	9.81	8.07	150	VC	CIRC	
9203X	9.22	6.79	225	VC	CIRC	
9204X	11.56	8.76	150	VC	CIRC	
9205X			UNK	UNK	CIRC	
920DX			225	VC	CIRC	
921DX			UNK	UNK	CIRC	
9251X	9.37	8.86	225	CP	CIRC	
9252X	9.57	8.86	225	VC	CIRC	
925DX			UNK	UNK	CIRC	
9350X	12.67	11.36	225	VC	CIRC	
9351X	14.01	12.08	150	VC	CIRC	
9352X			UNK	UNK	CIRC	

Node	Cover	Invert	Size	Material	Shape

Node	Cover	Invert	Size	Material	Shape



Drawn by: mondaln	Southern Water
Title: Land at Manor Farm Lower Road	
Date: 23/06/2015	

APPENDIX F
SUDS COMPATIBILITY MATRIX

SuDS Type	Description	Suitable for this site	Comments
Green Roofs	Green roofs comprise a multi-layered system that covers the roof of a building with vegetation cover over a drainage layer. They are designed to intercept and retain rainfall, reducing the volume of runoff and attenuating	✗	Living Roofs would not be technically feasible at this develoment due to factors such as loadings, steep roof pitch of proposed dwellings, visual impact and high maintenance burden to homeowners.
Rainwater Harvesting	Re-using rainwater for non-potable purposes such as irrigation and toilet flushing.	✗	Rainwater harvesting cannot be relied upon to guarantee a reduction in the volume of water leaving the site as it relies upon tanks having available capacity. During intense/prolonged periods of rainfall it is likely that the tanks will be full and will overflow into the system. These systems can also be a high maintenance burden for residential home owners. Cost benifit of system is not recoverd unitl 10-15years.
Soakaways	Soakaways provide stormwater attenuation, stormwater treatment and groundwater recharge.	✓	Onsite infiltration via soakaways is not feasble in the superfical and upper chalk geology. However deep borehole soakaways could be used in this instance where infiltration rates are 1x10-4 m/s about 15m below ground level.
Filter Strip / Trenches / Swales	Filter strips are linear grassed or vegetated strips of land / channels designed to accept runoff as overland sheet flow from impermeable surfaces usually located adjacent road or parking areas and used to treat infiltrated or convey runoff.	✓	Potentially viable on this site.
Permeable Paving	Pervious pavements provide a pavement suitable for pedestrian and vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored before infiltration to the ground, reuse, or discharge to a watercourse or other drainage system.	✓	Potentially on private drives / parking areas/ roads . This would improve water quality into the ground and subsiquent aquifer/river.
Bio Retention	Bioretention areas are shallow landscaped depressions which are typically under-drained and rely on engineered soils and enhanced vegetation and filtration to remove pollution and reduce runoff downstream. They are aimed at managing and treating runoff from frequent rainfall events.	✓	A bio retention pond could be utilised at this development if the receiving waterbody is considered sensitive and additional treatment is required. Although likely not required.
Ponds / Basins	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.	✓	A pond / basin can be utilised at this development to provide attenuation and improvements in water quality. There is sufficent open space.
Underground Storage	Underground large diameter Concrete pipes or Geocellular Tanks to reduce and attenuate peak flows	✓	Underground storage tanks can be utilised at this development if required.

Appendix G

SUDS MANAGEMENT AND MAINTENANCE PLAN

MJA CONSULTING
Civil & Structural Engineers

PROPOSED RESIDENTIAL DEVELOPMENT
LAND SOUTH OF, LOWER ROAD, AND WEST OF OLD MANOR FARM,
HAVANT,
HAMPSHIRE

SUDS MANAGEMENT & MAINTENANCE PLAN

BARGATE HOMES LTD

REVISION B
JULY 2024
REF: SS/21/0433/6430

DOCUMENT CONTROL RECORD

Document Issue:

Rev	Date	Issue Status	Prepared by	Checked by
-	24.09.21	First Issue	S. Smith	C. Pendle
A	22.07.24	Updated to current design	S. Smith	C. Pendle
B	30.07.24	Updated to client's comments	S. Smith	C. Pendle

References:

The SUDS manual – CIRIA C753 (2015) ISBN 9780-86017-760-9

National Planning Policy Framework (NPPF) – Communities and Local Government
Technical Guidance - Flood Risk & Coastal Change (March 2012)

1 Introduction

1.1 This document sets out the principles for the long term management and maintenance of the proposed surface water Sustainable Drainage Systems (SuDS) installed at the residential development at land adjacent to Lower Road, Bedhampton.

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

1.3 The activities listed in this document are generic to the relative SuDS types and represent the minimum maintenance and inspection requirements, however additional tasks or varied maintenance frequency may be instructed by the maintenance company as required. Specific maintenance needs of the SuDS elements should be monitored and maintenance schedules adjusted to suit requirements.

1.4 The installed SuDS system at this development are the initial responsibility of Bargate Homes. Following installation and after an initial period (TBC) of operation, all SuDS are to be transferred to an appointed Management Company. An agreement shall be set up by Bargate Homes, who shall confirm in writing to the Principle Planning Officer at Hampshire County Council when the maintenance agreement is completed and is operative.

1.5 The Management Company will then be responsible for maintaining the surface water system including all SuDS in perpetuity. All property owners should be advised that an annual management fee will need to be paid to the management company for this service.

1.6 All those responsible for maintenance should follow relevant Health and Safety legislation (Health and Safety at Work Regulations, 1999) for all activities listed within this report including lone working, if relevant) and risk assessments should always be undertaken.

1.7 Any contractor employed by the Management Company shall carry out periodic maintenance of all such SuDS in accordance with the schedules listed in this report. Inspection checks shall be carried out by a qualified and competent person, at the minimum intervals listed within the schedules and the appropriate work carried out.

1.8 This report is to read in conjunction with MJA drawing *'001 Drainage Strategy'* for the location of all SuDS elements present within the development. Reference should also be made to the detailed landscape proposals for the proposed treatment / maintenance regime for all landscape features. The operations contained within this plan shall (where feasible) be in conjunction with routine grounds maintenance operations to the surrounding landscape.

2 SuDS Layout & Design

2.1 The storm water drainage strategy for the proposed development is to utilise a range of SuDS features to attenuate all surface water runoff from impermeable areas, with a restricted discharge via a flow control into ditch via overland flow.

2.2 The proposed storm water system consists of the following drainage and SuDS components:

- Attenuation Basin
- Storm water pipe work and road gullies
- Permeable block paving
- Flow control chambers
- Overland Overflow Outfall Pond

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

- **Regular maintenance** (including inspections and monitoring).
  Consists of basic tasks done on a frequent and predictable schedule, including vegetation management, litter and debris removal, and inspections.
- **Occasional maintenance**
  Comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example).
- **Remedial maintenance**
  Comprises intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design.
  Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.

2.4 It is also important that measures are taken to protect and ensure continued operation of drainage features during the construction phase. All road gullies will be blocked until the site is complete. Mesh will be placed over the outfalls and swales to prevent construction silts clogging up the drainage system and basins.

3 SUDS Management & Maintenance

3.1 Storm water pipe work and road gullies

3.2 The key maintenance requirement for the upstream surface water drainage system includes the removal of sediments and debris from the system as required.

3.3 All storm water pipe work should be visually inspected a minimum of monthly for the first three months after installation and then a minimum of once year. As road gullies are the first on the treatment train and susceptible to higher silt loadings, these will need to be inspected a minimum of monthly for the first three months after installation and then a minimum of every four months.

3.4 During this inspection identify any gully pots or pipes that require remedial maintenance such removal of sediment, debris, leaves and litter as required. This involves the removal all protective covers and grids and the cleaning out of channels or gully pots by hand or with suitable jetting equipment.

3.5 During the inspections the general operation and structural integrity of all components should be recorded and repaired as required.

3.6 Flow Control Chamber

3.7 The key maintenance requirement for the flow control chamber will be the inspection of the units for blockages of the vortex flow control unit and silt removal from sump of chamber.

3.8 The hydraulic vortex flow control unit has no moving parts and is self-activating, requiring minimal maintenance. After initial installation, it is recommended that the unit be inspected monthly for three months.

3.9 Thereafter the manhole chamber and control device should be inspected at least every six months to verify the condition and operation of the unit and check for blockages within the inlet of the chamber and of the flow control device. During these inspections, accumulated silts should be removed and the sump cleaned out using a conventional sump vacuum cleaner. Flow Controls are fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur.

3.10 Overland Overflow Outfall Pond and Swales

3.11 The outfall pond and swales should be visually inspected a minimum of monthly for the first three months after installation and then a minimum of twice a year. Accumulated sediments, debris and any overgrown vegetative material should be removed. Any reeds should be maintained in line with the landscape management plan.

3.12 Attenuation Basins

Key Maintenance Requirements:

- Litter/trash removal
- Inlet/outlet headwall inspection and cleaning
- Vegetation management
- Sediment monitoring and removal when required

3.13 Regular inspection and maintenance is important for the effective operation of the attenuation basin. The basin will be subject to a routine monitoring and maintenance schedule as part of the general site management. This will be carried out at intervals detailed below, and shall comprise of the following operations:
Collection and removal of all litter/large debris from the attenuation pond, inlets, outflows, and water margins once a month.
Monthly inspection of the attenuation ponds to check the following, and repair as necessary:
1. Any failure in the operation of the inlet and outlet headwalls unless adopted by others in which case they will be notified of any observed defect.
2. Any damage or erosion to the perimeter edges and slopes of the attenuation ponds.

3.14 Please see landscape management plan for further details of planting and management.

3.15 An annual check carried out by a suitably qualified person, to assess the condition and operation of the attenuation basin inlet and outflow, and the accumulation of silt/sediment.

3.16 A record of maintenance visits and remedial operations shall be maintained.

3.17 **Desilting of Attenuation Basins**
In addition to regular routine items, SuDS maintenance will be carried out which may include de-silting the attenuation ponds, usually on a 10-15 year cycle depending on the on-going silt level checking. This can be an intrusive operation when carried out within housing areas and prior to any planned desilting or dredging, consultation will be undertaken with both the LLFA and the Environment Agency.

3.18 Before any desilting operations are carried out, residents and members of the public in the general area will be informed and those in the immediate vicinity will be notified in writing well in advance of commencement of works.

3.19 The desilting work will be carried out under the supervision of consulting engineers and to a pre-agreed method statement. Such a method statement should be submitted in writing to the local authority and agreed in advance of the commencement of the works.

3.20 Prior to desilting works commencing, a suitably qualified ecologist shall be appointed to undertake an assessment of the ecological interest within the pond and its margins. In the event that the attenuation ponds develop particular ecological interest, then careful consideration will be given to the timing of this operation.

3.21 Permeable Block Paving

3.22 Note: Loose materials such as sand, cement soil or other loose substances should not be stored directly on top of the permeable blocks without the use of an impenetrable sheet.

3.23 To ensure the continual optimal performance of the permeable paving, it is recommended that the following maintenance should be carried out. The following guidelines are offered as an initial regime, but maybe either increased or decreased by the management company depending on the local environment and any external contributing factors.

3.24 Permeable pavements should be visually inspected a minimum of monthly for the first three months after installation and then a minimum of three times a year, preferably during and after heavy rainfall to check effective operation and identify areas of ponding. These inspections should occur close to the end of winter (March), mid-summer (July) and after the autumn (November).

3.25 During this inspection identify any areas that require remedial maintenance such as topping up of jointing grit or removal of vegetation, weeds, silts and sediments that may be clogging the joints between the blocks. Small areas such as driveways can be swept with a hand bristle broom, for larger areas such as parking courts a lorry mounted rotary brush and vacuum sweeper device can be used. Weeds can be removed from the surface through the controlled application of proprietary non-persistent contact herbicides. Those containing Glyphosate are the most suitable.

3.26 Care should be taken to ensure that only the detritus is removed from the joints and avoid removal of the jointing material. If required, joints should be replenished with aggregate material to lip of paver using specific 6-2mm single size grit using a stiff brush to sweep the material in ensuring joints are filled. Do not replace the jointing grit with sand as this will stop the permeable system from working.

3.27 For winter maintenance, the controlled use of de-icing may be used without causing significant detrimental effects towards the permeable pavements performance. When used carefully, the use of these chlorides will not result in an increase in the chloride levels in the local ground.

3.28 Contamination of the permeable block paving from routine landscape maintenance such as grass clippings from mowing, hedge trimming, mulching plant beds etc. should be prevented. If contamination occurs the debris should be immediately swept, collected and removed by the homeowner or landscape operative.

3.29 Depending on the amount of usage and the environment the permeable pavement has received and been exposed to, the sub base laying course material including geotextile membranes/ grids may require either replacement or cleaning after a 25 to 30 year period. This would be evident if the infiltration rate of the paving became prolonged, allowing ponding to develop. Should this occur, the uplifting and cleaning or replacing of the laying course maybe considered. The laying course material, jointing and blocks can be reused once cleaned, minimising costs.

3.30 Replacement sub-base material to be used should be a clean 4/20mm coarse graded aggregate to BS EN13242:2002. Jointing material between the blocks should be 6-2mm single size grit to the joints. Refer to MJA Consulting construction detail drawings for type of geotextile membrane/ geogrids to be used.

3.31 Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

Permeable Paving Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Brushing and vacuuming.	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site-specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weed.	As required.
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required.
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required.
	Rehabilitation of surface and upper sub-structure.	As required (if infiltration performance is reduced as a result of significant clogging).
Monitoring	Initial inspection.	Monthly for 3 months after installation
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action.	3-monthly, 48 h after large storms.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspection chambers.	Annually.

4 Contact Information

For further information on the management and maintenance of SuDS on the development please contact:

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