

Project Name : Bilsham Road, Yapton
Job No : 19-326
Note Title : Drainage Strategy and MMP
Author : NA
Checked : GG
Approved : GG
Date : November 2020

1.0 INTRODUCTION

1.1 Odyssey has been commissioned by Bilsham Road Development LLP to undertake a surface water and foul drainage strategy as part of a reserved matters application associated with the proposed residential development at Bilsham Road, Yapton.

1.2 A planning application was submitted to Arun District Council (ADC) in December 2017 (reference Y/91/17/OUT) along with a Flood Risk Assessment (FRA) and Drainage Strategy completed by Odyssey. Outline planning permission was granted in April 2019, subject to selected conditions. This drainage statement addresses conditions 9, 10 and 12 relating to surface water drainage, Sustainable Drainage Systems (SuDS) maintenance and foul drainage respectively. The decision notice is provided in **Appendix A**.

2.0 PROPOSED SURFACE WATER DRAINAGE

2.1 As previously agreed with the ADC Drainage Engineer as part of the outline planning approval, the potential utilisation of infiltration has been further investigated to inform the drainage strategy.

2.2 Shallow infiltration testing at the site was undertaken by BRD Environmental in February 2019. The tests were carried out in 18 trial pits across the site at depths between 0.6m below ground level (bgl) and 1.2m bgl. The permeability was too low to calculate a soil infiltration rate in all 18 trial pits. The Soakaway Feasibility Report notes that shallow standing groundwater was recorded at the site during the previous site investigation and in the subsequent groundwater monitoring, and

concludes that the use of infiltration alone cannot dispose all the surface water runoff generated by the development proposals. The Soakaway Feasibility Report is presented in **Appendix B**.

2.3 In accordance with the ADC Drainage Engineer's recommendations, it is proposed that a hybrid approach is adopted where surface water runoff will also be attenuated on site and discharged at the approved Q_{BAR} rate to the watercourse network whilst allowing infiltration in areas where the SuDS features are above recorded groundwater levels. Correspondence with ADC is shown in **Appendix C**.

2.4 Due to the topography, the site has been split into two surface water drainage catchments. Surface water runoff will be attenuated within attenuation basins prior to restricted discharge to the watercourses. Areas of permeable paving are proposed within the private road areas, which will attenuate some of the surface water flows upstream of the attenuation basins. Orifice and vortex flow controls will be utilised to restrict the flows from each SuDS structure. The combined flows at each outfall will achieve the Q_{BAR} rate for the site.

2.5 Any storage structures which can be designed above peak recorded groundwater levels will incorporate permeable liners to make use of any possible infiltration. Any storage structures below the peak groundwater levels will be lined with an impermeable membrane and will be checked against floatation. The proposed surface water attenuation systems have been designed to accommodate the 1 in 100 year plus 40% climate change storm event. An additional 10% impermeable roof area has been included to account for urban creep.

2.6 The proposed surface water drainage strategy is shown on Drawings 19-326/009 and 19-326.010 in **Appendix D**, along with the associated Micro Drainage calculations.

2.7 The onsite drainage system maintenance will be carried out by a private recognised management company through the implementation of an approved maintenance management plan to minimise the residual risk of drainage system blockage. The operation and maintenance requirements for the surface water drainage system are detailed in **Appendix E**.

2.8 Initial comments were received from the Principal Drainage Engineer at Arun District Council. A response to these comments can be found below.

1. The permeable paving has been extended to all parking spaces/property driveways
2. All basins have been designed with at least 300mm freeboard
3. To be checked at detailed design
4. Basin 4 has been kept in its previous position. To move this any closer would result in a clash with the flood plain.
5. To be checked at detailed design.

6. Only minimal flooding of 2.8m³ is registered in two manholes. Overland flow routes ensure the excess surface water is kept away from people and property.
7. Typo in section 2.5 of report has been updated.

3.0 PROPOSED FOUL DRAINAGE

3.1 It is proposed that foul flows from the site will connect into the existing Southern water manhole (ref. 8501) to the east of the site along Bilsham Road.

3.2 Due to the topography of the site, it is not possible to achieve a gravity connection into the existing Southern Water network for the entire site. It is therefore proposed that the majority of foul flows will drain by gravity to a foul pumping station to the south of the site, which will pump flows in an eastern direction towards the existing Southern Water network.

3.3 The proposed foul drainage strategy is also shown in **Appendix D**.

APPENDIX A

Decision Notice



Town & Country Planning Act 1990 (as amended)
Town & country Planning (Development Management
Procedure) (England) Order 2015 - Article 5
Application for Outline Consent
DECISION NOTICE

Application Ref: Y/91/17/OUT

To Addressee

Nexus Planning
 Suite A, 3 Weybridge Business Park
 Addlestone Road
 Weybridge
 Surrey
 KT15 2BW

Site Address

Land at Bilsham Road
 Yapton

Description of Development

Outline application for the development of up to 250 residential dwellings (Class C3), vehicular access, public open space, ancillary works and associated infrastructure. Departure from the Development Plan

In pursuance of their powers under this Act and related Orders and Regulations the Council **PERMIT** this development to be carried out in accordance with the application and plans and subject to compliance with the following conditions and Section 106 Agreement.

- 1 The permission hereby granted is an outline permission under s92 of the Town and Country Planning Act 1990 (as amended) and an application for the approval of the Local Planning Authority to the following matters must be made not later than the expiration of 3 years beginning with the date of this permission:-

- (a) Layout;
- (b) Scale;
- (c) Appearance;
- (d) Landscaping.

Reason: To enable the Local Planning Authority to control the development in detail and to comply with Section 92 of the Town and Country Planning Act 1990 (as amended).

- 2 The development hereby permitted shall be begun before the expiration of 5 years from the date of this permission, or before the expiration of 2 years from the date of the approval of the last of the reserved matters to be approved, whichever is the later.

Reason: To enable the Local Planning Authority to control the development in detail and to comply with Section 92 of the Town and Country Planning Act 1990 (as amended).

- 3 The development hereby permitted shall be carried out in accordance with the following approved plans:

Site Location Plan - 1244G.01

Parameter Plan - 1244G.02

Proposed Site Access B2132 Bilsham Road - 14-111/201 Rev A

Reason: For the avoidance of doubt and in the interests of amenity and the environment in accordance with policy D DM1 of the Arun Local Plan (2011-2031).

- 4 No development shall take place until a detailed scheme of phasing for the construction of the dwellings and associated highways and public areas has been submitted to and approved in writing by the Local Planning Authority. The scheme shall include a schedule identifying the order of anticipated commencement and completion within each phase of construction.

Reason: For the avoidance of doubt and in the interests of amenity and the environment in accordance with Policy D DM1 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition because the phasing of the development needs to be satisfactory before work commences.

- 5 No development in any phase shall be carried out unless and until a schedule of materials and finishes to be used for that phase for external walls and roofs of the proposed buildings has been submitted to and approved by the Local Planning Authority. No development in any phase shall be carried out unless and until a 'statement of detail' for that phase has been submitted to and approved setting out details of proposed windows and doors, the materials and 'statement of details' so approved shall be used in the construction of the buildings.

Reason: To enable the Local Planning Authority to control the development in detail in the interests of amenity by endeavouring to achieve buildings of visual quality in accordance with Policy D DM1 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition because the use of satisfactory external materials goes to the heart of the planning permission.

- 6 Prior to the submission of any reserved matters application a design code masterplan shall be submitted to, and approved in writing, by the Local Planning Authority. This document shall demonstrate how the detailed proposals will reflect the objectives of the;

Illustrative Site Layout Plan - 1244G.03A
Design and Access Statement - 19th October 2018

The design code masterplan will provide further details on matters such as character areas, street hierarchy, building typologies, key buildings, the approach to car parking, structural planting, street furniture, lighting and treatment of the public realm. The development shall be carried out in accordance with the approved design code.

Reason: To enable the Local Planning Authority to control the development in details in the interests of amenity by endeavouring to achieve buildings of visual quality in accordance with Policy D DM1 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition because the design of the scheme goes to the heart of the planning permission.

- 7 The landscaping and layout particulars to be submitted in accordance with Condition 1 shall include:

- i. Details of all existing trees and hedgerows on the land, showing which are to be retained and which removed;
- ii. Details of the positions, height, design, materials and type of boundary treatment to be provided;
- iii. Details of any proposed alterations in existing ground levels, and of the position of any proposed excavation, within the crown spread of any retained tree
- iv. The detailed landscape design for the development including the layout and design of the public realm within the development;
- v. Details of the surfacing, and signage of all footpaths, and a phasing plan for their provision;

No hedge or tree shall be felled, uprooted or otherwise removed before, during or after the construction period except where removal is indicated on a plan approved by the Local Planning Authority.

Reason: In the interests of amenity and of the environment of the development in accordance with Policy ENV DM4 of the Arun Local Plan.

- 8 Prior to the commencement of each phase of the development an Arboricultural Method Statement and Tree Protection Plan shall be submitted for that phase to and approved in writing by the Local Planning Authority and the development shall be undertaken in strict accordance with the details so approved.

Reason: To ensure the retention and maintenance of trees and vegetation which are an important feature of the area in accordance with Policy D DM1 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition as the protection and retention of trees goes to the heart of the planning permission.

9

Prior to the approval of any reserved matter full details of the proposed surface water drainage scheme shall be submitted to and approved in writing by the local planning authority, and shall include;

- Winter groundwater monitoring to established highest annual ground water levels and percolation testing to BRE 365, or similar approved, will be required to support the design of any infiltration drainage.
- Details of any discharge of any flows to watercourses, the culverting or diversion, infilling or obstruction of any watercourses on the site.
- Arrangements for future access and maintenance of any watercourse or culvert (piped watercourse) crossing or abutting the site.

No building shall be occupied in any phase until the complete surface water drainage system serving it has been implemented in accordance with the agreed details and the details so agreed shall be maintained in good working order in perpetuity.

Reason: To ensure that the proposed development is satisfactorily drained in accordance with Policies D DM1, W DM2 and W DM3 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition to ensure that the surface water disposal scheme is agreed before construction commences and to protect existing watercourses prior to the commencement of development.

10

Prior to the occupation of each phase full details of the maintenance and management of the surface water drainage system is set out in a site-specific maintenance manual for that phase and submitted to, and approved in writing, by the Local Planning Authority. The manual is to include details of financial management and arrangements for the replacement of major components at the end of the manufacturer's recommended design life. Upon completed construction of the surface water drainage system, the owner or management company shall strictly adhere to and implement the recommendations contained within the manual.

Reason: To ensure that the proposed development is satisfactorily drained in accordance with Policies D DM1, W DM2 and W DM3 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition to ensure that the future maintenance and funding arrangements for the surface water disposal scheme are agreed before construction commences.

- 11 Prior to any building being occupied in a phase, and after completed construction of the surface water drainage system serving it, the owner or management company shall either provide the local planning authority with an updated copy of the management manual incorporating any changes as a result of construction/implementation or confirm in writing that no changes are required to the manual.
- No further changes shall be made to the approved surface water drainage system Maintenance & Management Plan/Regime including the management company responsible or the financial arrangements between the owners of the dwellings & the management company other than with the written consent of the Local Planning Authority.
- The owner or management company shall thereafter strictly adhere to and implement the recommendations contained within the manual to ensure that the system is maintained in perpetuity.
- Reason: To ensure the efficient maintenance and on-going operation of the surface water drainage system and to ensure the best practice in line with guidance set out in 'The SuDS Manual' CIRIA publication ref: C753 Chapter 32, in accordance with Policies D DM1, W DM2 and W DM3 of the Arun Local Plan.
- 12 Prior to the approval of any reserved matter details of a proposed foul drainage system shall be submitted to and approved in writing by the Local Planning Authority (including details of its siting, design and subsequent management/maintenance, if appropriate) and no dwelling shall be occupied until works for the disposal of sewage relating to that dwelling have been fully implemented in accordance with the approved details.
- Reason: To ensure adequate infrastructure is provided to enable the scheme to be satisfactorily drained in accordance with Policies D DM1, W DM1 and W SP1 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition as the foul drainage system goes to the heart of the planning permission.
- 13 Prior to the commencement of construction works or any preparatory works for any phase an Ecological Management and Mitigation Plan including a Schedule of Works for that phase shall be submitted to the Local Planning Authority for approval. All approved details shall then be implemented in full and in accordance with the agreed timings and details.
- Reason: This condition is necessary to ensure the protection of wildlife and supporting habitat and secure opportunities for the enhancement of the nature conservation value of the site in line with national guidance and Policy ENV SP1 and ENV DM5 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition because of the need ensure measures are in place to protect wildlife and habitats on site prior to any disturbance.

- 14 Prior to the commencement of development the mitigation strategy for reptiles shall be implemented in accordance with the details specified within the 'Detailed Reptile Survey Report (June 2016)'.

Reason: This condition is necessary to ensure the protection of reptiles and supporting habitat in accordance with Policy ENV SP1 and ENV DM5 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition because of the need to ensure measures are in place to protect reptiles and their habitat on site prior to any disturbance.

- 15 Prior to the occupation of any dwelling of a particular phase, a scheme for external lighting for that phase shall be submitted and approved in writing by the Local Planning Authority. The scheme shall ensure that the lighting is sensitive to bats by minimising the lighting of the woodland along the southern and western boundaries and shall comply with Institution of Lighting Engineers Guidance Notes for the Reduction of Obtrusive Light, Obtrusive Light Limitations for Exterior Lighting Installations for Zone E2.

Reason: To control the residential amenities of the local environment in accordance with Policies D DM1 and QE DM2 of the Arun Local Plan.

- 16 Prior to the commencement of development in each phase, including any works of demolition, a Construction Management Plan shall be submitted for approval in writing by the Local Planning Authority. Thereafter the approved Plan shall be implemented and adhered to throughout the entire construction period of that phase. The Plan shall provide details as appropriate but not necessarily be restricted to the following matters:

- The anticipated number, frequency and types of vehicles used during construction,
- The method of access and routing of vehicles during construction,
- Full details of the construction compound,
- Soil resources plan,
- Dust mitigation measures,
- Noise reduction measures,
- The parking of vehicles by site operatives and visitors,
- The loading and unloading of plant, materials and waste,
- The storage of plant and materials used in construction of the development,
- The erection and maintenance of security hoarding,
- The provision of effective wheel washing facilities and other works required to mitigate the impact of construction upon the public highway (including the provision of temporary Traffic Regulation Orders),
- Details of public engagement both prior to and during construction works.

Reason: In the interests of highway safety and the amenities of the area in accordance with Policy D DM1 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition because of the safety and amenity issues that need to be addressed.

- 17 During the construction phase no machinery/vehicles or plant shall be operated on the site, no process shall be carried out and no deliveries taken at or despatched except between the hours of:
- 7.00 a.m. and 6.00 p.m. on Mondays to Fridays inclusive
8.00 a.m. and 1.00 p.m. on Saturday
Not at any time on Sundays or Public Holidays
- Reason: In the interests of amenity in accordance with Policies D DM1 and QE DM1 of the Arun Local Plan.
- 18 No raw materials, finished or unfinished products or parts, crates, packing materials or waste shall be stacked or stored on the site except within the storage areas identified in the Construction Management Plan at any time approved by the Local Planning Authority.
- Reason: To safeguard the amenities of neighbouring properties in accordance with Policy D DM1 of the Arun Local Plan.
- 19 Prior to commencement of development for each phase the applicant shall prepare and submit for approval an Employment and Skills Plan for the construction of each phase of the development. Following approval of the Employment and Skills Plan the developer will implement and promote the objectives of the approved plan.
- Reason: In accordance with Policy SKILLS SP1 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition to as it relates to the construction phase of development.
- 20 No part of the development shall be first occupied until such time as the vehicular access serving the development has been constructed in accordance with the details shown on the drawing titled 'Proposed Site Access B2132 Bilsham Road' and numbered 14-111/201 Rev A.
- Reason: In the interests of amenity and to avoid unacceptable harm to highway safety in accordance with policies T SP1 and D DM1 of the Arun District Local Plan. It is considered necessary for this to be a pre-commencement condition as establishing an access to the site goes to the heart of the planning permission.
- 21 No part of the development shall be first occupied until a Travel Plan has been submitted to and approved in writing by the Local Planning Authority. The Travel Plan once approved shall thereafter be implemented as specified within the approved document. The Travel Plan shall be completed in accordance with the latest guidance and good practice documentation as published by the Department for Transport or as advised by the Highway Authority.
- Reason: To encourage and promote sustainable transport in accordance with Policies D DM1 and T SP1 of the Arun Local Plan.

22

Before development commences on any phase a scheme identifying the principles to be incorporated into detailed building design as the means of energy conservation, together with on-site energy renewable devices for that phase, shall be submitted to and agreed with the Local Planning Authority. Such scheme as is submitted shall seek as a target the provision of on-site renewable energy which will generate an estimated 10% of annual energy requirements of the buildings granted planning permission. In determining the provision of on-site energy generation account will be taken of the impact on the viability of the development. Such scheme as is approved will be implemented in accordance with the scheme for that phase.

Reason: In accordance with Policy ECC SP2 of the Arun Local Plan. It is considered necessary for this be a pre-commencement condition as sustainability goes to the heart of the approval.

23

Prior to the commencement of each phase of the development, a strategy for the provision or facilitation of broadband provision to future occupants of the site in that phase shall be submitted to and approved in writing by the Local Planning Authority. The strategy shall seek to ensure that upon occupation of a dwelling in that phase, either a landline or ducting to facilitate the provision of a broadband service to that dwelling from a site-wide network, is in place and provided as part of the initial highway works and in the construction of frontage thresholds to dwellings that abut the highway. Unless evidence is put forward and agreed in writing by the Local Planning Authority that technological advances for the provision of a broadband service for the majority of potential customers will no longer necessitate below ground infrastructure, the development of the site shall be carried out in accordance with the approved strategy.

Reason: To ensure that the needs of future residents to connect to the internet does not necessarily entail engineering works to an otherwise finished and high quality living environment in accordance with Policy TEL SP1 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition because the provision of broadband needs to be incorporated into the design for the site.

24

No development shall take place until the applicant has secured the implementation of a programme of archaeological work in accordance with a written scheme of investigation which has been submitted by the applicant and approved in writing by the Local Planning Authority.

Reason: The site has the potential to contain unknown remains of archaeological importance therefore in accordance with Policies D DM1 and HER DM6 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition because archaeology can only be investigated before construction commences.

- 25 Prior to the commencement of any phase of development, an Electric Vehicle Charging Strategy will be prepared and submitted to the Local Planning Authority which identifies the nature, form and location of electric charging infrastructure to be provided across the development. The electric vehicle strategy shall then be implemented in accordance with the approved details and maintained in perpetuity.

Reason: New petrol and diesel cars/vans will not be sold beyond 2040, and to mitigate against any potential adverse impact of the development on local air quality, in accordance with Policy D DM1 and Policy QE DM3 (c) of the Arun Local Plan and the NPPF. It is considered necessary for this to be a pre-commencement condition to ensure that the requisite charging infrastructure is designed into the housing development and it is implemented.

- 26 At least twenty-five percent (25%) of all 1, 2 and 3 bedroom dwellings shall be designed and constructed to Lifetime Homes standards or equivalent current standard to be agreed in writing with the Local Planning Authority.

Reason: To ensure that dwellings are adaptable and meet the diverse needs of future occupiers in accordance with policy H3 of the Yapton Neighbourhood Plan, policy D DM1 of the Arun Local Plan and Paragraph 61 of the NPPF.

- 27 No development shall commence on any phase until plans of the site showing details of the existing and proposed ground levels, proposed finished floor levels, levels of any paths, drives, garages and parking areas and the proposed completed height of the development and any retaining walls for that phase have been submitted to, and approved in writing by, the Local Planning Authority. The details shall clearly identify the relationship of the proposed ground levels and proposed completed height with adjacent buildings. The development thereafter shall be carried out in accordance with the approved details for that phase.

Reason: To ensure that a satisfactory relationship results between the new development and adjacent buildings and public areas in accordance with policy D DM1 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition as these details relate to the construction of the development and thus go to the heart of the planning permission.

28

Prior to the commencement of development the following components of a scheme to deal with the risks associated with contamination of the site shall each be submitted to and approved, in writing, by the Local Planning Authority

1. A preliminary risk assessment which has identified:
all previous uses potential contaminants associated with those uses
a conceptual model of the site indicating sources, pathways and receptors
potentially unacceptable risks arising from contamination at the site.
2. A site investigation scheme, based on (1) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.
3. The site investigation results and the detailed risk assessment (2) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.
4. A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in (3) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action.

Any changes to these components require the express consent of the Local Planning Authority. The scheme shall be implemented as approved.

Where demolition is required 1. and 2. above should be submitted prior to demolition. Parts 3. and 4. can take place post demolition if necessary.

Reason: To ensure that the development complies with approved details in the interests of protection of the environment and prevention of harm to human health in accordance with Arun Local Plan policies QE SP1 and QE DM4. This is required to be a pre-commencement condition because these details have to be agreed and in place before any work commences.

29

If during development, contamination not previously identified, is found to be present at the site then no further development (unless otherwise agreed in writing with the Local Planning Authority) shall be carried out until the developer has submitted, and obtained written approval from the Local Planning Authority for, an amendment to the remediation strategy detailing how this unsuspected contamination shall be dealt with.

Reason: To ensure that the development complies with approved details in the interests of protection of the environment and prevention of harm to human health in accordance with Arun Local Plan policies QE SP1 and QE DM4.

- 30 Prior to commencement of development, a verification report demonstrating completion of the works set out in the approved remediation strategy and the effectiveness of the remediation shall be submitted to and approved, in writing, by the Local Planning Authority. The report shall include results of sampling and monitoring carried out in accordance with the approved verification plan to demonstrate that the site remediation criteria have been met. It shall also include any plan (a "long-term monitoring and maintenance plan") for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action, as identified in the verification plan, and for the reporting of this to the Local Planning Authority.

Reason: To protect the environment and prevent harm to human health by ensuring that the remediated site has been reclaimed in an appropriate standard in accordance with Arun Local Plan policies QE SP1 and QE DM4. This is required to be a pre-commencement condition because these details have to be agreed and in place before any work commences.

- 31 No more than 95% of the total dwellings to be provided on this site shall be occupied until such time as the primary route (Residential Street as defined in the DAS dated October 2018) has been constructed linking Main Road with the boundary of the site with Y/92/17/OUT.

Reason: The Burndell Road and Blissham Road mini roundabout has been shown to be approaching capacity in sensitivity tests when the through road has not been constructed and the developments are fully occupied. Therefore, this condition is considered necessary in the interests of highway capacity and safety in accordance with policies T SP1 and D DM1 of the Arun District Local Plan.

INFORMATIVE: The applicant is required to obtain all appropriate consents from West Sussex County Council, as Highway Authority, to cover the off-site highway works. The applicant is requested to contact The Implementation Team Leader (01243 642105) to commence this process. The applicant is advised that it is an offence to undertake any works within the highway prior to the agreement being in place.

INFORMATIVE: The applicant should note that under Part 1 of the Wildlife and Countryside Act 1981, with only a few exceptions, it is an offence for any person to intentionally take, damage or destroy the nest of any wild birds while the nest is in use or being built. Birds nest between March and September and therefore removal of dense bushes, ivy or trees or parts of trees etc. during this period could lead to an offence under the act.

INFORMATIVE: This notice does not give authority to destroy or damage a bat roost or disturb a bat. Bat species are protected under Section 39 of the 1994 Conservation (Natural Habitats etc) Regulations (as amended), the 1981 Wildlife and Countryside Act (as amended) and the 2000 Countryside and Rights of Way Act. It is illegal to damage or destroy any bat roost, whether occupied or not, or disturb or harm a bat. If you are aware that bats roost in a tree(s) for which work is planned, you should take further advice from Natural England (via the Bat Conservation Trust on 0845 1300228) or an ecological consultant before you start. If bats are discovered during the work, you must stop immediately and contact Natural England before continuing.

INFORMATIVE: Statement pursuant to Article 35 of the Town and Country Planning (Development Management Procedure)(England) Order 2015. The Local Planning Authority has acted positively and proactively in determining this application by identifying matters of concern within the application (as originally submitted) and negotiating, with the Applicant, acceptable amendments to the proposal to address those concerns. As a result, the Local Planning Authority has been able to grant planning permission for an acceptable proposal, in accordance with the presumption in favour of sustainable development, as set out within the National Planning Policy Framework.



Neil Crowther
Group Head of Planning

Case Officer: Mr D Easton

Date of Decision:

4 April 2019

Arun District Council
The Arun Civic Centre
Maltravers Road
Littlehampton
West Sussex BN17 5LF

IT IS IMPORTANT THAT YOU READ THE NOTES ATTACHED TO THIS DOCUMENT

APPEALS TO THE SECRETARY OF STATE

If you are aggrieved by the decision of your local planning authority to refuse permission for the proposed development or to grant it subject to conditions, then you can appeal to the Secretary of State under section 78 of the Town and Country Planning Act 1990.

If this is a decision on a planning application relating to the same or substantially the same land and development as is already the subject of an enforcement notice, and you want to appeal against this planning application decision, then you must do so within 28 days of the date of this notice.

If an enforcement notice is served relating to the same or substantially the same land and development as in your application and you want to appeal against this planning application decision, then you must do so within 28 days of the date of service of the enforcement notice, or within 12 weeks of the date of this notice, whichever period expires earlier.

Otherwise, if you want to appeal against this decision then you must do so within 6 months of the date of this notice.

Appeals must be using a form which you can get from the Secretary of State at Temple Quay House, 2 The Square, Temple Quay, Bristol BS1 6PN (Tel: 0303 444 5000) or online at <http://acp.planninginspectorate.gov.uk>

The Secretary of State can allow a longer period for giving notice of an appeal but will not normally be prepared to use this power unless there are special circumstances which excuse the delay in giving notice of appeal.

The Secretary of State need not consider an appeal if it seems to the Secretary of State that the local planning authority could not have granted planning permission for the proposed development or could not have granted it without the conditions they imposed, having regard to the statutory requirements, to the provisions of any development order and to any directions given under a development order.

PURCHASE NOTICES

If either the local planning authority or the Secretary of State refused permission to develop land or grants it subject to conditions, the owner may claim that he can neither put the land to a reasonably beneficial use in its existing state nor render the land capable of a reasonably beneficial use by the carrying out of any development which has been or would be permitted.

In these circumstances, the owner may serve a purchase notice on the Council (that is, where the land is situated in a National Park, the National Park authority for the Park, or in any other case the district council in whose area the land is situated).

This notice will require the Council to purchase the owner's interest in the land in accordance with the provisions of Chapter 1 of Part VI of the Town & Country Planning Act 1990.

Please note that this decision notice only relates to matters under the Planning Acts and does not give consent under any other legislation that may apply to the development. You will need to carry out your own checks to determine whether any other consents or permissions are required. For example, the Building Regulations are likely to apply to most developments, and a Highways Licence may be required from West Sussex County Council for any development within the public highway (including the placing of skips on highway land).

APPENDIX B

Soakaway Feasibility Report

APPENDIX C

Arun District Council Correspondence

Gerald Guma

From: Paul Cann <Paul.Cann@arun.gov.uk>
Sent: 22 July 2020 14:35
To: Gerald Guma
Cc: Natalie Anderson
Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Hi Gerald

Just some initial thoughts;

1. Permeable paving needs to be extended to all parking spaces/property driveways.
2. All basins require min. 300mm freeboard.
3. QBAR rates will need to be checked during detailed design, so supporting calcs will be required. Large open space areas to be omitted from the allowable run off area.
4. Basin 4 – relocate nearer to the point of connection with the culvert to improve the arrangement of incoming/outgoing pipework.
5. During detailed design, please overlay the plans with the peak groundwater levels, so it is easy to see which structures are going to be affected.
6. Any flooding predicted in the calcs should ideally be avoided and water kept below ground level. If this is not possible, then water will need to be contained on site above ground but without detriment to people or property.
7. Item 2.5 in report discusses impermeable liners to be used above peak GWL's. Of course this should be below.

Regards

Paul Cann
Principal Drainage Engineer
Engineering Services

T: 01903 737819
E: paul.cann@arun.gov.uk

Arun District Council, Civic Centre, Maltravers Rd, Littlehampton, West Sussex, BN17 5LF
www.arun.gov.uk



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From: Gerald Guma <[REDACTED]>
Sent: 21 July 2020 16:33
To: Paul Cann <Paul.Cann@arun.gov.uk>

Cc: Natalie Anderson <nanderson@odysseyconsult.co.uk>
Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Hi Paul,

I've instead enclosed the report and the plans in this email.

I hope this helps and should you have any queries, please let us know.

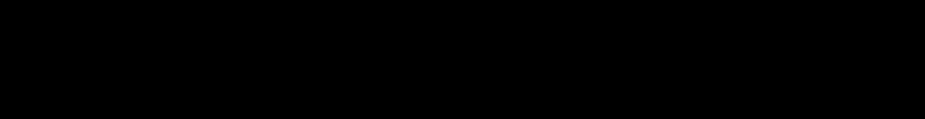
Many thanks

Kind regards



Gerald Guma | Associate Director

BSc (Hons) MSc CEM MCMEM



From: Paul Cann <Paul.Cann@arun.gov.uk>

Sent: 21 July 2020 14:13

To: Gerald Guma <gguma@odysseyconsult.co.uk>

Cc: Natalie Anderson <nanderson@odysseyconsult.co.uk>

Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Hi Gerald

Our IT dept are having trouble downloading the documents – any chance of sending a new link

thx

Paul Cann

Principal Drainage Engineer
Engineering Services

T: 01903 737819

E: paul.cann@arun.gov.uk

Arun District Council, Civic Centre, Maltrovers Rd, Littlehampton, West Sussex, BN17 5LF

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From: Gerald Guma <[REDACTED]>
Sent: 03 July 2020 16:26
To: Paul Cann <Paul.Cann@arun.gov.uk>; Land Drainage <Land.Drainage@arun.gov.uk>
Cc: Natalie Anderson <[REDACTED]>
Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Hi Paul,

Hope all is well with you.

The design code and new layout are close to being agreed for the Bilsham Road, Yapton site.

Please see attached our initial update to the drainage designs to accord with the interim layout. Could we have your initial comments on this before the final layout is issued in the coming weeks?

The soakage test report is quite large and can be downloaded from the link below.

<https://we.0/t-YP1k3IEPN>

Should you have any queries, please do not hesitate to call on the mobile below.

Looking forward to hearing from you.

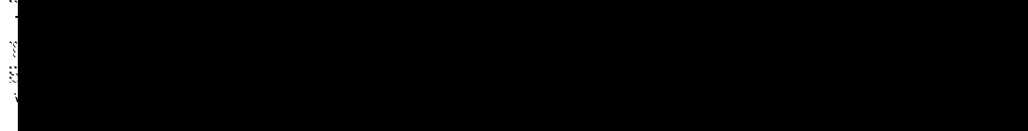
Many thanks

Kind regards



Gerald Guma | Associate Director

01243 810001 | 01243 810002



From: Gerald Guma
Sent: 22 January 2020 09:53
To: 'Paul Cann' <Paul.Cann@arun.gov.uk>; Land Drainage <Land.Drainage@arun.gov.uk>
Cc: d [REDACTED];
Natalie Anderson <[REDACTED]>
Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Hi Paul,

Thanks for the review and response.

We will adopt the hybrid system where possible and restrict flows to QBAR as per your recommendation. We will also now not carryout any more shallow infiltration tests.

Many thanks

Kind regards



Gerald Guma | Associate Director
BSc (Hons) MSc CWM MCWEM

From: Paul Cann <Paul.Cann@arun.gov.uk>

Sent: 21 January 2020 13:05

To: Gerald Guma <[REDACTED]> Land Drainage <Land.Drainage@arun.gov.uk>

Cc: [REDACTED]
Natalie Andersen <[REDACTED]>

Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Hi Gerald

It would appear as you say that infiltration is negligible. My suggestion is to design the drainage system based upon a fully attenuated arrangement with controlled outflows to watercourses (restricting flows to QBar). Any structures including permeable paving that can be designed above peak recorded groundwater levels are to have permeable liners so we can make use of any possible infiltration, no matter how small but do not allow for infiltration in the storage calculations. These structures will of course require connections to the attenuated network.

So essentially it will be a hybrid system relying on watercourse connections but making use of any infiltration potential where possible.

Please note that any storage structures that require an impermeable liner due to peak groundwater levels, will need checking against floatation.

Regards

Paul Cann
Principal Engineer (Drainage)

Paul Cann | Principal Engineer (Drainage), Engineering Services, Arun District Council | Location: First Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF

Internal: 37819 | External: +44 (0) 1903 737819 | Fax: +44 (0) 1903 716019 | E-mail: Paul.Cann@arun.gov.uk

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From: Gerald Guma <[REDACTED]>

Sent: 17 January 2020 10:33

To: Paul Cann <Paul.Cann@arun.gov.uk>; Land Drainage <Land.Drainage@arun.gov.uk>

[REDACTED]

Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Good morning Paul,

Thanks for taking the time to review and update our plan.

On another note, the previous vendor of the site has just notified us that shallow infiltration tests were carried out in February 2019. The test results in all 18No. locations for depths ranging from 0.6m - 1.25m showed negligible soakage as per the attached report. The geology in the shallow depths seems to be clay with no potential to infiltrate and the test locations are evenly spread across the site.

Based on these new findings should we still pursue infiltration at the site?

Thanks

Kind regards



Gerald Guma | Associate Director

BSc (Hons) MSc C.WEM MCWEM

From: Paul Cann <Paul.Cann@arun.gov.uk>

Sent: 16 January 2020 13:20

To: Gerald Guma <[REDACTED]> Land Drainage <Land.Drainage@arun.gov.uk>

Subject: RE: 1791/17/001 - Bisham Road, Tapton - Surface Water Drainage Strategy

Gerald

See attached with some additional location suggestions; a) move TP13, yellow blobs to suit crate soakaways, pink blobs to suit permeable paving.

I will leave it to you to ensure all test pits do not penetrate the peak recorded groundwater levels at those locations and they are at depths to suit the proposed structures.

Regards

Paul Cann
Principal Engineer (Drainage)

[Paul Cann](mailto:Paul.Cann@arun.gov.uk) | Principal Engineer (Drainage), Engineering Services, [Arun District Council](http://www.arun.gov.uk) | Location: First Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF

Internal: 37819 | External: +44 (0) 1903 737819 | Fax: +44 (0) 1903 716019 | E-mail: Paul.Cann@arun.gov.uk

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From: Gerald Guma [REDACTED]
Sent: 16 January 2020 13:00
To: Paul Cann <Paul.Cann@arun.gov.uk>; Land Drainage <Land.Drainage@arun.gov.uk>

[REDACTED] <[REDACTED]@arun.gov.uk>;

Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Hi Paul,

Thanks for reviewing this.

I've updated the plan and added one test location for basin 2, changed the depth for TP9 to 0.5m and added 3 other locations to help inform the design of the permeable paving and crates.

A copy the sketch is attached.

Many thanks

Kind regards



Gerald Guma | Associate Director

BSc (Hons) MSc CEM MOWEM

[REDACTED]

From: Paul Cann <Paul.Cann@arun.gov.uk>

Sent: 16 January 2020 10:17

To: Gerald Guma [REDACTED]; Land Drainage <Land.Drainage@arun.gov.uk>

C [REDACTED]
S [REDACTED]

Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Hi Gerald

Comments;

1. The test locations for the basins are ok, except one needs to be done at basin 2. The depths are ok provided they represent the anticipated base levels of each basin and comply with item 5.
2. Additional test holes are required to capture permeable paving areas and perhaps carry out to a depth of 0.5m.
3. TP9 should be 0.5m deep if permeable paving.
4. Additional test holes required to capture crate soakaway locations.
5. No tests to be carried out deeper than the peak groundwater levels recorded in the vicinity of the proposed test locations. I will leave you to determine this from your groundwater monitoring results.

I would suggest sending a revised plan with the above in mind.

Regards

Paul Cann
Principal Engineer (Drainage)

Paul Cann | Principal Engineer (Drainage), Engineering Services, Arun District Council | Location: First Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF

Internal: 37819 | External: +44 (0) 1903 737819 | Fax: +44 (0) 1903 716019 | E-mail: Paul.Cann@arun.gov.uk

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From: Gerald Guma [REDACTED]
Sent: 16 January 2020 09:58
To: Land Drainage <Land.Drainage@arun.gov.uk>

[REDACTED]
Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Hi Paul,

Could you confirm the locations and depths we specified for the soakage testing are acceptable? We would like to return to site this month.

Thanks

Kind regards



Gerald Guma | Associate Director

BSc (Hons) MSc C.WEM MCWEM

From: Gerald Guma
Sent: 06 January 2020 20:42
To: 'Land Drainage' <Land.Drainage@arun.gov.uk>

[REDACTED]
Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Paul,

Happy New Year.

Thanks for confirming that additional groundwater monitoring is not required.

Please see attached the hand sketch with the indicative location of the soakage testing points and their respective depths.

Could you confirm that this suffices so that we can commission this month?

Many thanks

Kind regards



Gerald Guma | Associate Director
BSc (Hons) MSc C.WEM MCWEM

From: Paul Cann <Paul.Cann@arun.gov.uk> **On Behalf Of** Land Drainage

Sent: 23 December 2019 16:44

To: Gerald Guma

C
S

Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Gerald

Whilst the groundwater monitoring is sparse (irregular, infrequent and doesn't cover some months) and therefore doesn't fully capture the whole winter (ie. October to March), it would appear that groundwater levels in the district peaked in Jan 2018 which was luckily captured in your data. Therefore, further groundwater monitoring is not required.

However, the infiltration testing appears to have been carried out in October 2017 which doesn't meet our requirements. We would expect the testing to be carried out in say January when ground conditions are likely to be at their worst and at depths relative to peak groundwater levels encountered ie. above those recorded levels. I would suggest that you undertake further infiltration testing at agreed locations and depths in January. This can then inform the design.

Regards

Paul Cann
Principal Engineer (Drainage)

Paul Cann | Principal Engineer (Drainage), Engineering Services, Arun District Council | Location: First Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF

Internal: 37819 | External: +44 (0) 1903 737819 | Fax: +44 (0) 1903 716019 | E-mail: Paul.Cann@arun.gov.uk

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From: Gerald Guma

Sent: 10 December 2019 15:52

To: Land Drainage <Land.Drainage@arun.gov.uk>

Sarah Burrow [REDACTED]

Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Paul,

Thanks for getting back to me on this.

We did undertake BRE infiltration tests and a copy of the results is attached. The winter monitoring results are for the 2017/2018 winter and this was a wetter winter with total rainfall over the months of Dec – Feb of 320mm compared to the equivalent period in 2018/2019 of 255mm.

Laura accepted the information we submitted then and hence our query on the requirement stated in the planning condition.

I hope this helps.

Thanks

Kind regards



ODYSSEY

Gerald Guma | Associate Director

BSc (Hons) MSc C.WEM MCWEM

From: Paul Cann <Paul.Cann@arun.gov.uk> **On Behalf Of** Land Drainage

Sent: 06 December 2019 13:39

To: Gerald Guma <[REDACTED]>

Subject: RE: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Gerald

The monitoring seems to be from 2017/18 rather than this year as mentioned in your email. Please advise.

Were BRE 365 infiltration tests carried out?

If you submitted the information to Laura as advised, what was her response?

Regards

Paul Cann

Senior Engineer (Drainage & Coastal)

[Paul.Cann](mailto:Paul.Cann@arun.gov.uk) | Senior Engineer (Drainage & Coastal), Engineering Services, [Arun District Council](http://www.arun.gov.uk) | Location: First Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF

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From: Gerald Guma <[REDACTED]>
Sent: 21 November 2019 00:45
To: Paul Cann <Paul.Cann@arun.gov.uk>
[REDACTED]

Subject: Y/91/17/OUT - Bilsham Road, Yapton - Surface Water Drainage Strategy

Paul,

I trust all is well.

Condition 9 in the enclosed decision notice still stipulates that winter groundwater monitoring is required. We already completed these early this year and submitted copies to Laura. The results are attached for your reference.

Please confirm that further winter groundwater monitoring is not required.

Looking forward to hearing from you.

Thanks

Kind regards



ODYSSEY

Gerald Guma | Associate Director
[REDACTED]

<http://www.arun.gov.uk>

DX 57406 Littlehampton

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APPENDIX D

Proposed Drainage Strategy and Micro Drainage Calculations



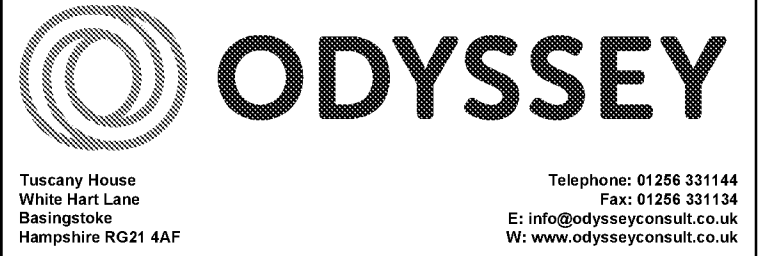
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 - LIGHTING DESIGN IS INDICATIVE AND SUBJECT TO CHANGE AT DETAILED DESIGN.

- LEGEND
- SITE BOUNDARY
 - PROPOSED ROAD CONTOUR
 - PROPOSED STRUCTURAL SLAB LEVEL
 - PROPOSED FOUL SEWER & MANHOLE
 - EXISTING CULVERTED WATERCOURSE
 - PROPOSED SURFACE WATER SEWER & MANHOLE
 - VORTEX FLOW CONTROL
 - PROPOSED RISING MAIN
 - PROPOSED PERMEABLE PAVING
 - PROPOSED HEADWALL
 - INDICATIVE ATTENUATION BASIN
 - BASIN FREEBOARD
 - BASIN EARTHWORKS EXTENT
 - ROOT PROTECTION ZONE
 - SERVICE MARGIN
 - CULVERT
 - PROPOSED STREET LIGHTING COLUMN, REFER TO NOTE 6.

DRAFT

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G	UPDATED TO CLIENT COMMENTS	LS	RM	GG	23.10.20
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E	UPDATED TO CLIENT COMMENTS	JA	NA	GG	07.10.20
D	FEL'S UPDATED	JA	NA	GG	24.09.20
C	NOTE 5 ADDED TO DRAWING	THRAM	GG	13.09.20	
B	UPDATED TO SUIT NEW SITE LAYOUT	KR	AM	GG	03.09.20
A	UPDATED TO CLIENT COMMENTS	NA	GG	30.08.20	
Rev	Amendments	Des	CHK	Appd	Date



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- LEGEND
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 - SERVICE MARGIN
 - CULVERT
 - PROPOSED STREET LIGHTING COLUMN. REFER TO NOTE 6.

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E	UPDATED TO CLIENT COMMENTS	JA	NA	GG	07.10.20
D	PFL'S UPDATED	JA	NA	GG	24.09.20
C	SURFACE WATER STRATEGY UPDATED TO SUIT LEAP CONSTRAINTS	TH	AM	GG	15.09.20
B	UPDATED TO SUIT NEW SITE LAYOUT	NR	AM	GG	03.09.20
A	UPDATED TO CLIENT COMMENTS	NA	GG	GG	30.08.20
Rev	Amendments	Des	CHK	App	Date

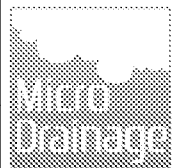


BILSHAM ROAD,
YAPTON

Drawing Title:
PRELIMINARY ENGINEERING
LAYOUT. SHEET 1 OF 2

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BILSHAM ROAD
DEVELOPMENT LLP

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File 2020-10-06 Outfall 2 Ne...	Checked by	
XP Solutions	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	1999
Site Location GB 497050 103400 SU 97050 03400	
C (1km)	-0.025
D1 (1km)	0.395
D2 (1km)	0.244
D3 (1km)	0.395
E (1km)	0.309
F (1km)	2.339
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.275	4-8	0.705	8-12	0.016

Total Area Contributing (ha) = 0.996

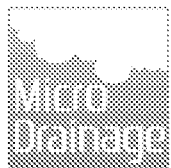
Total Pipe Volume (m³) = 55.872

Network Design Table for Storm

« - Indicates pipe capacity < flow

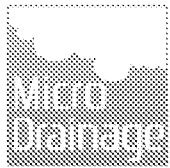
PN Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
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Network Results Table

Odyssey Markides LLP		Page 2
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 09:48	Designed by WindesPC2	
File 2020-10-06 Outfall 2 Ne...	Checked by	
XP Solutions	Network 2020.1	

Network Design Table for Storm

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
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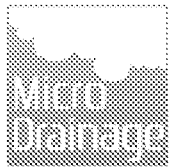
Odyssey Markides LLP		Page 3
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 09:48	Designed by WindesPC2	
File 2020-10-06 Outfall 2 Ne...	Checked by	
XP Solutions	Network 2020.1	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	17.581	0.056	313.0	0.238	4.00	0.0	0.600	o	375	Pipe/Conduit	
1.001	30.508	0.126	242.1	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.000	7.591	0.032	238.0	0.101	4.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	19.313	0.055	350.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.003	63.640	0.143	445.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.000	10.638	0.045	238.0	0.065	4.00	0.0	0.600	o	300	Pipe/Conduit	
3.001	21.671	0.195	111.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.002	12.081	0.100	120.8	0.083	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	19.390	0.260	74.6	0.105	4.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	11.982	0.120	99.9	0.050	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.003	19.710	0.300	65.7	0.032	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.004	21.927	0.105	208.8	0.103	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.004	34.378	0.089	385.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	23.818	0.062	385.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	24.965	0.083	300.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	4.29	5.275	0.238	0.0	0.0	0.0	1.02	112.5	32.2
1.001	50.00	4.68	5.144	0.238	0.0	0.0	0.0	1.30	207.1	32.2
2.000	50.00	4.12	5.200	0.101	0.0	0.0	0.0	1.01	71.7	13.7
1.002	50.00	4.98	5.018	0.339	0.0	0.0	0.0	1.08	171.9	45.9
1.003	50.00	6.08	4.963	0.339	0.0	0.0	0.0	0.96	152.2	45.9
3.000	50.00	4.17	5.640	0.065	0.0	0.0	0.0	1.01	71.7	8.8
3.001	50.00	4.42	5.595	0.065	0.0	0.0	0.0	1.49	105.4	8.8
3.002	50.00	4.56	5.400	0.148	0.0	0.0	0.0	1.43	101.0	20.0
4.000	50.00	4.18	5.680	0.105	0.0	0.0	0.0	1.82	128.8	14.2
4.001	50.00	4.30	5.420	0.155	0.0	0.0	0.0	1.57	111.2	21.0
3.003	50.00	4.70	5.225	0.335	0.0	0.0	0.0	2.24	247.2	45.4
3.004	50.00	5.00	4.925	0.438	0.0	0.0	0.0	1.25	138.1	59.3
1.004	50.00	6.64	4.820	0.777	0.0	0.0	0.0	1.03	163.8	105.2
1.005	50.00	7.03	4.731	0.777	0.0	0.0	0.0	1.03	163.8	105.2
1.006	50.00	7.38	4.669	0.777	0.0	0.0	0.0	1.17	185.8	105.2

Odyssey Markides LLP		Page 4
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 09:48	Designed by WindesPC2	
File 2020-10-06 Outfall 2 Ne...	Checked by	
XP Solutions		Network 2020.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
5.000	15.513	0.140	110.8	0.056	4.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	10.102	0.042	238.0	0.033	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.002	35.257	0.258	136.7	0.046	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.003	21.012	0.164	128.1	0.084	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	19.583	0.065	301.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.008	29.571	0.059	501.2	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.000	50.00	4.17	5.340	0.056	0.0	0.0	0.0	1.49	105.5	7.6
5.001	50.00	4.34	5.200	0.089	0.0	0.0	0.0	1.01	71.7	12.1
5.002	50.00	4.78	5.158	0.135	0.0	0.0	0.0	1.34	94.9	18.3
5.003	50.00	5.03	4.900	0.219	0.0	0.0	0.0	1.39	98.1	29.7
1.007	50.00	7.66	4.586	0.996	0.0	0.0	0.0	1.17	185.4	134.9
1.008	50.00	8.28	4.521	0.996	0.0	0.0	0.0	0.89	88.6	134.9

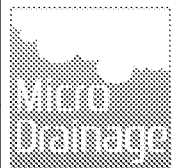
Odyssey Markides LLP		Page 5
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 09:48	Designed by WindesPC2	
File 2020-10-06 Outfall 2 Ne...	Checked by	
XP Solutions		Network 2020.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
43	6.856	1.575	Open Manhole	1350	1.000	5.275	375				
44	6.800	1.256	Open Manhole	1350	1.001	5.144	450	1.000	5.219	375	
45	6.800	1.200	Open Manhole	1200	2.000	5.200	300				
46	6.232	1.214	Open Manhole	1350	1.002	5.018	450	1.001	5.018	450	
								2.000	5.168	300	
47	6.180	1.217	Open Manhole	1350	1.003	4.963	450	1.002	4.963	450	
48	7.140	1.500	Open Manhole	1200	3.000	5.640	300				
49	7.120	1.525	Open Manhole	1200	3.001	5.595	300	3.000	5.595	300	
50	6.800	1.500	Open Manhole	1200	3.002	5.400	300	3.001	5.400	300	
51	7.180	1.500	Open Manhole	1200	4.000	5.680	300				
53	6.920	1.500	Open Manhole	1200	4.001	5.420	300	4.000	5.420	300	
54	6.800	1.575	Open Manhole	1350	3.003	5.225	375	3.002	5.300	300	
								4.001	5.300	300	
55	6.500	1.575	Open Manhole	1350	3.004	4.925	375	3.003	4.925	375	
BASIN 2	6.915	1.195	Open Manhole	1350	1.004	4.820	450	1.003	4.820	450	
								3.004	4.820	375	
56	6.337	1.606	Open Manhole	1350	1.005	4.731	450	1.004	4.731	450	
57	6.369	1.700	Open Manhole	1350	1.006	4.669	450	1.005	4.669	450	
58	6.840	1.500	Open Manhole	1200	5.000	5.340	300				
59	6.700	1.500	Open Manhole	1200	5.001	5.200	300	5.000	5.200	300	
60	6.680	1.522	Open Manhole	1200	5.002	5.158	300	5.001	5.158	300	
61	6.400	1.500	Open Manhole	1200	5.003	4.900	300	5.002	4.900	300	
62	6.031	1.445	Open Manhole	1350	1.007	4.586	450	1.006	4.586	450	
								5.003	4.736	300	
BASIN 3	5.668	1.143	Open Manhole	1350	1.008	4.521	375	1.007	4.521	450	
	5.910	1.048	Open Manhole	0		OUTFALL		1.008	4.462	375	

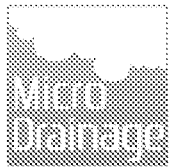
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
43	497341.517	102892.612	497341.517	102892.612	Required	
44	497329.023	102880.244	497329.023	102880.244	Required	
45	497354.643	102861.878	497354.643	102861.878	Required	

Odyssey Markides LLP						Page 6
Tuscany House White Hart Lane Basingstoke RG21 4AF			Designed by WindesPC2 Checked by			
Date 25/11/2020 09:48 File 2020-10-06 Outfall 2 Ne...						
XP Solutions			Network 2020.1			
<u>Manhole Schedules for Storm</u>						
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
46	497348.809	102857.022	497348.809	102857.022	Required	
47	497361.334	102842.322	497361.334	102842.322	Required	
48	497438.881	102887.624	497438.881	102887.624	Required	
49	497434.432	102877.962	497434.432	102877.962	Required	
50	497434.531	102856.291	497434.531	102856.291	Required	
51	497466.708	102845.045	497466.708	102845.045	Required	
53	497447.327	102844.469	497447.327	102844.469	Required	
54	497435.347	102844.237	497435.347	102844.237	Required	
55	497435.267	102824.527	497435.267	102824.527	Required	
BASIN 2	497417.280	102811.988	497417.280	102811.988	Required	
56	497440.390	102786.537	497440.390	102786.537	Required	
57	497460.693	102774.084	497460.693	102774.084	Required	
58	497505.438	102818.775	497505.438	102818.775	Required	
59	497517.882	102809.512	497517.882	102809.512	Required	
60	497525.654	102803.059	497525.654	102803.059	Required	
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Odyssey Markides LLP		Page 7
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 09:48	Designed by WindesPC2	
File 2020-10-06 Outfall 2 Ne...	Checked by	
XP Solutions	Network 2020.1	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
61	497498.970	102780.015	497498.970	102780.015	Required	
62	497484.037	102765.233	497484.037	102765.233	Required	
BASIN 3	497502.328	102758.238	497502.328	102758.238	Required	
	497514.583	102731.327			No Entry	

Odyssey Markides LLP		Page 8
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 09:48	Designed by WindesPC2	
File 2020-10-06 Outfall 2 Ne...	Checked by	
XP Solutions	Network 2020.1	

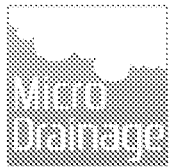
PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	375	43	6.850	5.275	1.200	Open Manhole	1350
1.001	o	450	44	6.400	5.144	0.806	Open Manhole	1350
2.000	o	300	45	6.400	5.200	0.900	Open Manhole	1200
1.002	o	450	46	6.232	5.018	0.764	Open Manhole	1350
1.003	o	450	47	6.180	4.963	0.767	Open Manhole	1350
3.000	o	300	48	7.140	5.640	1.200	Open Manhole	1200
3.001	o	300	49	7.120	5.595	1.225	Open Manhole	1200
3.002	o	300	50	6.900	5.400	1.200	Open Manhole	1200
4.000	o	300	51	7.180	5.680	1.200	Open Manhole	1200
4.001	o	300	53	6.920	5.420	1.200	Open Manhole	1200
3.003	o	375	54	6.800	5.225	1.200	Open Manhole	1350
3.004	o	375	55	6.500	4.925	1.200	Open Manhole	1350
1.004	o	450	BASIN 2	6.015	4.820	0.745	Open Manhole	1350
1.005	o	450	56	6.337	4.731	1.156	Open Manhole	1350
1.006	o	450	57	6.369	4.669	1.250	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	17.581	313.0	44	6.400	5.219	0.806	Open Manhole	1350
1.001	30.508	242.1	46	6.232	5.018	0.764	Open Manhole	1350
2.000	7.591	238.0	46	6.232	5.168	0.764	Open Manhole	1350
1.002	19.313	350.0	47	6.180	4.963	0.767	Open Manhole	1350
1.003	63.640	445.0	BASIN 2	6.015	4.820	0.745	Open Manhole	1350
3.000	10.638	238.0	49	7.120	5.595	1.225	Open Manhole	1200
3.001	21.671	111.1	50	6.900	5.400	1.200	Open Manhole	1200
3.002	12.081	120.8	54	6.800	5.300	1.200	Open Manhole	1350
4.000	19.390	74.6	53	6.920	5.420	1.200	Open Manhole	1200
4.001	11.982	99.9	54	6.800	5.300	1.200	Open Manhole	1350
3.003	19.710	65.7	55	6.500	4.925	1.200	Open Manhole	1350
3.004	21.927	208.8	BASIN 2	6.015	4.820	0.820	Open Manhole	1350
1.004	34.378	385.0	56	6.337	4.731	1.156	Open Manhole	1350
1.005	23.818	385.0	57	6.369	4.669	1.250	Open Manhole	1350
1.006	24.965	300.0	62	6.031	4.586	0.995	Open Manhole	1350

Odyssey Markides LLP		Page 9
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 09:48	Designed by WindesPC2	
File 2020-10-06 Outfall 2 Ne...	Checked by	
XP Solutions		Network 2020.1

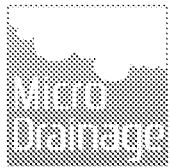
PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
5.000	o	300	58	6.840	5.340	1.200	Open Manhole	1200
5.001	o	300	59	6.700	5.200	1.200	Open Manhole	1200
5.002	o	300	60	6.680	5.158	1.222	Open Manhole	1200
5.003	o	300	61	6.400	4.900	1.200	Open Manhole	1200
1.007	o	450	62	6.031	4.586	0.995	Open Manhole	1350
1.008	o	375	BASIN 3	5.664	4.521	0.768	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
5.000	15.513	110.8	59	6.700	5.200	1.200	Open Manhole	1200
5.001	10.102	238.0	60	6.680	5.158	1.222	Open Manhole	1200
5.002	35.257	136.7	61	6.400	4.900	1.200	Open Manhole	1200
5.003	21.012	128.1	62	6.031	4.736	0.995	Open Manhole	1350
1.007	19.583	301.3	BASIN 3	5.664	4.521	0.693	Open Manhole	1350
1.008	29.571	501.2		5.510	4.462	0.673	Open Manhole	0

Odyssey Markides LLP		Page 10
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 09:48	Designed by WindesPC2	
File 2020-10-06 Outfall 2 Ne...	Checked by	
XP Solutions	Network 2020.1	

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.238	0.238	0.238
1.001	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.101	0.101	0.101
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.065	0.065	0.065
3.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.083	0.083	0.083
4.000	-	-	100	0.105	0.105	0.105
4.001	-	-	100	0.050	0.050	0.050
3.003	-	-	100	0.032	0.032	0.032
3.004	-	-	100	0.103	0.103	0.103
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.056	0.056	0.056
5.001	-	-	100	0.033	0.033	0.033
5.002	-	-	100	0.046	0.046	0.046
5.003	-	-	100	0.084	0.084	0.084
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.996	0.996	0.996

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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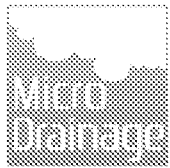
1.008		5.510	4.462	4.410	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model FEH

Odyssey Markides LLP		Page 12
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 09:48	Designed by WindesPC2	
File 2020-10-06 Outfall 2 Ne...	Checked by	
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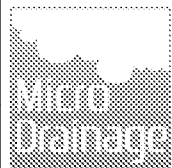
Online Controls for Storm

Orifice Manhole: BASIN 2, DS/PN: 1.004, Volume (m³): 13.9

Diameter (m) 0.116 Discharge Coefficient 0.600 Invert Level (m) 4.820

Orifice Manhole: BASIN 3, DS/PN: 1.008, Volume (m³): 4.5

Diameter (m) 0.095 Discharge Coefficient 0.600 Invert Level (m) 4.521

Odyssey Markides LLP		Page 13
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 09:48	Designed by WindesPC2	
File 2020-10-06 Outfall 2 Ne...	Checked by	
XP Solutions	Network 2020.1	

Storage Structures for Storm

Tank or Pond Manhole: BASIN 2, DS/PN: 1.004

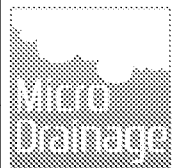
Invert Level (m) 4.820

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	137.0	1.190	457.0

Tank or Pond Manhole: BASIN 3, DS/PN: 1.008

Invert Level (m) 4.521

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	164.0	1.150	481.0

Odyssey Markides LLP		Page 1
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	1999
Site Location GB 497050 103400 SU 97050 03400	
C (1km)	-0.025
D1 (1km)	0.395
D2 (1km)	0.244
D3 (1km)	0.395
E (1km)	0.309
F (1km)	2.339
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.430	4-8	1.310	8-12	1.294	12-16	0.037

Total Area Contributing (ha) = 3.071

Total Pipe Volume (m³) = 229.884

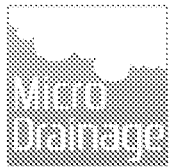
Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length	Fall	Slope	I.Area	T.E.	Base	k	HYD	DIA	Section	Type	Auto
(m)	(m)	(1:X)	(ha)	(mins)	Flow	(l/s)	(mm)	SECT	(mm)			Design

Network Results Table

Odyssey Markides LLP										Page 3	
Tuscany House											
White Hart Lane											
Basingstoke RG21 4AF											
Date 25/11/2020 11:29					Designed by WindesPC2						
File 2020-10-12 Outfall 1 Ne...					Checked by						
XP Solutions					Network 2020.1						
<u>Network Design Table for Storm</u>											
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	29.623	0.182	162.8	0.054	4.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	26.224	0.105	250.0	0.118	4.00	0.0	0.600	o	375	Pipe/Conduit	
2.001	15.003	0.068	220.6	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.001	15.735	0.050	313.0	0.057	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.002	34.637	0.111	313.0	0.032	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	28.730	0.075	385.0	0.082	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.004	27.193	0.200	136.0	0.080	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	16.213	0.108	150.0	0.092	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.000	22.527	0.264	85.3	0.039	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	108.735	0.392	277.4	0.077	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.000	45.600	0.192	238.0	0.063	4.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	5.748	0.024	238.0	0.063	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.002	38.139	0.160	238.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.003	19.007	0.255	74.5	0.120	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.000	42.648	0.179	238.0	0.040	4.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	6.249	0.026	238.0	0.040	0.00	0.0	0.600	o	300	Pipe/Conduit	
<u>Network Results Table</u>											
PN	Rain (mm/hr)	T.C. (mins)	US/IL Σ (m)	I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	
1.000	50.00	4.40	5.469	0.054	0.0	0.0	0.0	1.23	86.9	7.3	
2.000	50.00	4.38	5.385	0.118	0.0	0.0	0.0	1.14	126.1	16.0	
2.001	50.00	4.59	5.280	0.118	0.0	0.0	0.0	1.22	134.3	16.0	
1.001	50.00	4.85	5.212	0.229	0.0	0.0	0.0	1.02	112.5	31.0	
1.002	50.00	5.41	5.162	0.261	0.0	0.0	0.0	1.02	112.5	35.3	
1.003	50.00	5.88	4.976	0.343	0.0	0.0	0.0	1.03	163.8	46.4	
1.004	50.00	6.14	4.901	0.423	0.0	0.0	0.0	1.74	277.0	57.3	
1.005	50.00	6.30	4.701	0.515	0.0	0.0	0.0	1.66	263.6	69.7	
3.000	50.00	4.27	5.082	0.039	0.0	0.0	0.0	1.42	56.3	5.3	
1.006	50.00	7.79	4.589	0.631	0.0	0.0	0.0	1.22	193.4	85.4	
4.000	50.00	4.75	5.800	0.063	0.0	0.0	0.0	1.01	71.7	8.5	
4.001	50.00	4.84	5.608	0.126	0.0	0.0	0.0	1.01	71.7	17.1	
4.002	50.00	5.47	5.584	0.126	0.0	0.0	0.0	1.01	71.7	17.1	
4.003	50.00	5.62	5.349	0.246	0.0	0.0	0.0	2.10	232.0	33.3	
5.000	50.00	4.70	5.500	0.040	0.0	0.0	0.0	1.01	71.7	5.4	
5.001	50.00	4.80	5.321	0.080	0.0	0.0	0.0	1.01	71.7	10.8	
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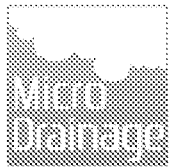
Odyssey Markides LLP		Page 4
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29 File 2020-10-12 Outfall 1 Ne...	Designed by WindesPC2 Checked by	
XP Solutions	Network 2020.1	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
5.002	6.327	0.126	50.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.004	26.102	0.068	385.0	0.024	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.005	27.205	0.146	186.3	0.065	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.000	34.873	0.350	99.6	0.136	4.00	0.0	0.600	o	375	Pipe/Conduit	
6.001	9.832	0.245	40.1	0.135	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.006	24.581	0.150	163.9	0.045	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.007	21.692	0.312	69.5	0.027	0.00	0.0	0.600	o	525	Pipe/Conduit	
7.000	5.325	0.036	147.9	0.046	4.00	0.0	0.600	o	150	Pipe/Conduit	
7.001	9.041	0.193	46.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.008	14.285	0.037	385.0	0.031	0.00	0.0	0.600	o	525	Pipe/Conduit	
8.000	11.091	0.190	58.4	0.027	4.00	0.0	0.600	o	100	Pipe/Conduit	
8.001	3.928	0.258	15.2	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
8.002	18.742	0.197	95.1	0.078	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.009	22.656	0.029	781.2	0.017	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL Σ (m)	I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.002	50.00	4.85	5.295	0.080	0.0	0.0	0.0	2.22	157.2	10.8
4.004	50.00	6.04	5.019	0.350	0.0	0.0	0.0	1.03	163.8	47.4
4.005	50.00	6.35	4.951	0.415	0.0	0.0	0.0	1.49	236.3	56.2
6.000	50.00	4.32	5.475	0.136	0.0	0.0	0.0	1.82	200.5	18.4
6.001	50.00	4.38	5.125	0.271	0.0	0.0	0.0	2.87	316.9	36.7
4.006	50.00	6.58	4.730	0.731	0.0	0.0	0.0	1.75	378.2	99.0
4.007	50.00	6.72	4.580	0.758	0.0	0.0	0.0	2.69	582.4	102.6
7.000	50.00	4.11	4.872	0.046	0.0	0.0	0.0	0.82	14.6	6.2
7.001	50.00	4.21	4.836	0.046	0.0	0.0	0.0	1.48	26.1	6.2
4.008	50.00	6.93	4.268	0.835	0.0	0.0	0.0	1.14	245.8	113.1
8.000	50.00	4.18	5.300	0.027	0.0	0.0	0.0	1.01	7.9	3.7
8.001	50.00	4.22	5.110	0.027	0.0	0.0	0.0	1.99	15.6	3.7
8.002	50.00	4.45	4.727	0.105	0.0	0.0	0.0	1.34	53.3	14.2
4.009	50.00	7.40	4.230	0.957	0.0	0.0	0.0	0.79	171.8	129.6

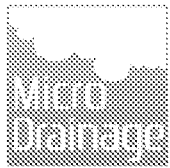
Odyssey Markides LLP		Page 5
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions		Network 2020.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
9.000	11.337	0.103	110.1	0.055	4.00	0.0	0.600	o	300	Pipe/Conduit	⚙️
9.001	37.517	0.120	313.0	0.051	0.00	0.0	0.600	o	375	Pipe/Conduit	⚙️
9.002	33.536	0.107	313.0	0.052	0.00	0.0	0.600	o	375	Pipe/Conduit	⚙️
9.003	31.399	0.100	313.0	0.051	0.00	0.0	0.600	o	375	Pipe/Conduit	⚙️
9.004	16.139	0.149	108.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	⚙️
9.005	16.741	0.053	313.0	0.115	0.00	0.0	0.600	o	375	Pipe/Conduit	⚙️
9.006	38.524	0.368	104.7	0.023	0.00	0.0	0.600	o	375	Pipe/Conduit	⚙️
1.007	41.605	0.068	611.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙️
1.008	5.284	0.014	385.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙️
1.009	30.858	0.080	385.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙️
1.010	14.131	0.037	385.0	0.050	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙️
1.011	9.197	0.024	385.0	0.012	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙️
1.012	11.526	0.030	385.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙️
1.013	32.608	0.323	101.0	0.029	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙️
10.000	40.323	0.241	167.0	0.053	4.00	0.0	0.600	o	225	Pipe/Conduit	⚙️
10.001	5.550	0.033	167.0	0.053	0.00	0.0	0.600	o	225	Pipe/Conduit	⚙️
1.014	29.639	0.077	385.0	0.033	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙️
1.015	33.280	0.086	385.0	0.032	0.00	0.0	0.600	o	450	Pipe/Conduit	⚙️

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
9.000	50.00	4.13	5.277	0.055	0.0	0.0	0.0	1.50	105.9	7.4
9.001	50.00	4.74	5.099	0.106	0.0	0.0	0.0	1.02	112.5	14.4
9.002	50.00	5.29	4.979	0.158	0.0	0.0	0.0	1.02	112.5	21.4
9.003	50.00	5.80	4.872	0.209	0.0	0.0	0.0	1.02	112.5	28.3
9.004	50.00	5.96	4.772	0.209	0.0	0.0	0.0	1.74	192.2	28.3
9.005	50.00	6.23	4.623	0.324	0.0	0.0	0.0	1.02	112.5	43.9
9.006	50.00	6.59	4.569	0.347	0.0	0.0	0.0	1.77	195.6	47.0
1.007	50.00	8.64	4.201	1.935	0.0	0.0	0.0	0.81	129.6	262.0
1.008	50.00	8.73	4.133	1.935	0.0	0.0	0.0	1.03	163.8	262.0
1.009	50.00	9.23	4.119	1.935	0.0	0.0	0.0	1.03	163.8	262.0
1.010	50.00	9.46	4.039	1.985	0.0	0.0	0.0	1.03	163.8	268.8
1.011	50.00	9.60	4.002	1.997	0.0	0.0	0.0	1.03	163.8	270.4
1.012	50.00	9.79	3.976	1.997	0.0	0.0	0.0	1.03	163.8	270.4
1.013	50.00	10.06	3.848	2.026	0.0	0.0	0.0	2.02	321.8	274.3
10.000	50.00	4.67	4.125	0.053	0.0	0.0	0.0	1.01	40.1	7.2
10.001	50.00	4.76	3.884	0.106	0.0	0.0	0.0	1.01	40.1	14.4
1.014	50.00	10.54	3.625	2.165	0.0	0.0	0.0	1.03	163.8	293.2
1.015	50.00	11.08	3.548	2.197	0.0	0.0	0.0	1.03	163.8	297.5

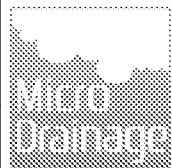
Odyssey Markides LLP		Page 6
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions		Network 2020.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
11.000	40.766	0.244	167.0	0.025	4.00	0.0	0.600	o	225	Pipe/Conduit	
11.001	6.269	0.344	18.2	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.016	16.777	0.037	455.0	0.059	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.017	51.369	0.101	508.6	0.008	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.018	58.152	0.765	76.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
12.000	27.788	0.139	200.0	0.053	4.00	0.0	0.600	o	450	Pipe/Conduit	
13.000	52.581	0.351	149.8	0.067	4.00	0.0	0.600	o	375	Pipe/Conduit	
13.001	5.924	0.181	32.7	0.066	0.00	0.0	0.600	o	375	Pipe/Conduit	
12.001	55.215	0.143	385.0	0.016	0.00	0.0	0.600	o	450	Pipe/Conduit	
12.002	13.627	0.056	243.3	0.074	0.00	0.0	0.600	o	450	Pipe/Conduit	
14.000	50.753	1.015	50.0	0.055	4.00	0.0	0.600	o	300	Pipe/Conduit	
14.001	3.921	0.016	238.0	0.055	0.00	0.0	0.600	o	300	Pipe/Conduit	
12.003	52.036	0.135	385.0	0.012	0.00	0.0	0.600	o	450	Pipe/Conduit	
15.000	32.342	0.647	50.0	0.045	4.00	0.0	0.600	o	225	Pipe/Conduit	
15.001	4.998	0.119	42.0	0.044	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
11.000	50.00	4.67	4.275	0.025	0.0	0.0	0.0	1.01	40.1	3.4
11.001	50.00	4.71	4.031	0.050	0.0	0.0	0.0	3.08	122.5	6.8
1.016	50.00	11.35	3.387	2.306	0.0	0.0	0.0	1.04	235.3	312.3
1.017	50.00	12.21	3.359	2.314	0.0	0.0	0.0	0.99	213.5	313.3
1.018	50.00	12.59	3.249	2.314	0.0	0.0	0.0	2.57	556.6	313.3
12.000	50.00	4.32	4.407	0.053	0.0	0.0	0.0	1.43	228.1	7.2
13.000	50.00	4.59	4.875	0.067	0.0	0.0	0.0	1.48	163.2	9.1
13.001	50.00	4.62	4.524	0.133	0.0	0.0	0.0	3.18	350.9	18.0
12.001	50.00	5.52	4.268	0.202	0.0	0.0	0.0	1.03	163.8	27.4
12.002	50.00	5.69	4.125	0.276	0.0	0.0	0.0	1.30	206.6	37.4
14.000	50.00	4.38	5.250	0.055	0.0	0.0	0.0	2.23	157.5	7.4
14.001	50.00	4.44	4.235	0.110	0.0	0.0	0.0	1.01	71.7	14.9
12.003	50.00	6.53	4.069	0.398	0.0	0.0	0.0	1.03	163.8	53.9
15.000	50.00	4.29	4.925	0.045	0.0	0.0	0.0	1.85	73.7	6.1
15.001	50.00	4.33	4.278	0.089	0.0	0.0	0.0	2.02	80.5	12.1

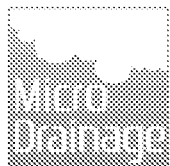
Odyssey Markides LLP		Page 7
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
12.004	13.665	0.035	385.0	0.075	0.00	0.0	0.600	o	450	Pipe/Conduit	
12.005	49.152	0.128	385.0	0.040	0.00	0.0	0.600	o	450	Pipe/Conduit	
12.006	27.544	0.072	385.0	0.101	0.00	0.0	0.600	o	450	Pipe/Conduit	
12.007	18.709	0.311	60.2	0.054	0.00	0.0	0.600	o	450	Pipe/Conduit	
12.008	20.031	0.829	24.2	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.019	10.643	0.025	425.7	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
12.004	50.00	6.76	3.934	0.562	0.0	0.0	0.0	1.03	163.8	76.1
12.005	50.00	7.55	3.898	0.602	0.0	0.0	0.0	1.03	163.8	81.5
12.006	50.00	8.00	3.771	0.703	0.0	0.0	0.0	1.03	163.8	95.2
12.007	50.00	8.12	3.699	0.757	0.0	0.0	0.0	2.63	417.5	102.5
12.008	50.00	8.20	3.388	0.757	0.0	0.0	0.0	4.15	659.9	102.5
1.019	50.00	12.74	2.409	3.071	0.0	0.0	0.0	1.17	333.9	415.9

Odyssey Markides LLP								Page 8		
Tuscany House White Hart Lane Basingstoke RG21 4AF										
Date 25/11/2020 11:29 File 2020-10-12 Outfall 1 Ne...				Designed by WindesPC2 Checked by						
XP Solutions				Network 2020.1						
<u>Manhole Schedules for Storm</u>										
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)
1	6.969	1.500	Open Manhole	1200	1.000	5.469	300			
2	6.860	1.275	Open Manhole	1350	2.000	5.385	375			
3	6.850	1.570	Open Manhole	1350	2.001	5.280	375	2.000	5.280	375
4	6.929	1.717	Open Manhole	1350	1.001	5.212	375	1.000	5.287	300
								2.001	5.212	375
5	6.846	1.684	Open Manhole	1350	1.002	5.162	375	1.001	5.162	375
6	6.563	1.587	Open Manhole	1350	1.003	4.976	450	1.002	5.051	375
7	6.314	1.413	Open Manhole	1350	1.004	4.901	450	1.003	4.901	450
8	6.051	1.350	Open Manhole	1350	1.005	4.701	450	1.004	4.701	450
9	6.307	1.225	Open Manhole	1200	3.000	5.682	225			
10	5.984	1.391	Open Manhole	1350	1.006	4.593	450	1.005	4.593	450
								3.000	4.818	225
11	7.000	1.200	Open Manhole	1200	4.000	5.800	300			
12	7.250	1.642	Open Manhole	1200	4.001	5.608	300	4.000	5.608	300
13	7.066	1.482	Open Manhole	1200	4.002	5.584	300	4.001	5.584	300
14	6.762	1.413	Open Manhole	1350	4.003	5.349	375	4.002	5.424	300
15	6.700	1.200	Open Manhole	1200	5.000	5.300	300			
16	6.800	1.479	Open Manhole	1200	5.001	5.321	300	5.000	5.321	300
17	6.750	1.455	Open Manhole	1200	5.002	5.295	300	5.001	5.295	300
18	6.567	1.548	Open Manhole	1350	4.004	5.019	450	4.003	5.094	375
								5.002	5.169	300
19	6.374	1.423	Open Manhole	1350	4.005	4.951	450	4.004	4.951	450
20	6.750	1.275	Open Manhole	1350	6.000	5.475	375			
21	6.400	1.275	Open Manhole	1350	6.001	5.125	375	6.000	5.125	375
22	6.155	1.425	Open Manhole	1500	4.006	4.730	525	4.005	4.805	450
								6.001	4.880	375
23	6.005	1.425	Open Manhole	1500	4.007	4.580	525	4.006	4.580	525
24	5.872	1.000	Open Manhole	1200	7.000	4.872	150			
25	5.801	0.965	Open Manhole	1200	7.001	4.836	150	7.000	4.836	150
26	5.834	1.566	Open Manhole	1500	4.008	4.268	525	4.007	4.268	525
								7.001	4.643	150
27	6.300	1.000	Open Manhole	1200	8.000	5.300	100			
28	6.300	1.190	Open Manhole	1200	8.001	5.110	100	8.000	5.110	100
29	5.952	1.225	Open Manhole	1200	8.002	4.727	225	8.001	4.852	100
30	5.755	1.525	Open Manhole	1500	4.009	4.230	525	4.008	4.230	525
								8.002	4.530	225
31	6.777	1.500	Open Manhole	1200	9.000	5.277	300			
32	6.674	1.575	Open Manhole	1350	9.001	5.099	375	9.000	5.174	300
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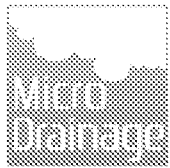
Odyssey Markides LLP								Page 9	
Tuscany House White Hart Lane Basingstoke RG21 4AF									
Date 25/11/2020 11:29				Designed by WindesPC2					
File 2020-10-12 Outfall 1 Ne...				Checked by					
XP Solutions				Network 2020.1					
<u>Manhole Schedules for Storm</u>									
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)
33	7.054	2.075	Open Manhole	1350	9.002	4.979	375	9.001	4.979
34	6.721	1.849	Open Manhole	1350	9.003	4.872	375	9.002	4.872
35	6.362	1.590	Open Manhole	1350	9.004	4.772	375	9.003	4.772
36	6.198	1.575	Open Manhole	1350	9.005	4.623	375	9.004	4.623
37	6.237	1.668	Open Manhole	1350	9.006	4.569	375	9.005	4.569
BASIN 1	5.987	1.786	Open Manhole	1500	1.007	4.201	450	1.006	4.201
								4.009	4.201
								9.006	4.201
38	6.242	2.109	Open Manhole	1350	1.008	4.133	450	1.007	4.133
39	6.472	2.353	Open Manhole	1350	1.009	4.119	450	1.008	4.119
40	6.318	2.279	Open Manhole	1350	1.010	4.039	450	1.009	4.039
41	6.174	2.172	Open Manhole	1350	1.011	4.002	450	1.010	4.002
42	6.077	2.099	Open Manhole	1350	1.012	3.978	450	1.011	3.978
43	5.967	2.019	Open Manhole	1350	1.013	3.948	450	1.012	3.948
44	5.259	1.125	Open Manhole	1200	10.000	4.125	225		
45	5.750	1.866	Open Manhole	1200	10.001	3.884	225	10.000	3.884
46	5.687	2.062	Open Manhole	1350	1.014	3.625	450	1.013	3.625
								10.001	3.850
47	5.372	1.824	Open Manhole	1350	1.015	3.548	450	1.014	3.548
48	5.400	1.125	Open Manhole	1200	11.000	4.275	225		
49	5.100	1.069	Open Manhole	1200	11.001	4.031	225	11.000	4.031
50	5.054	1.667	Open Manhole	1500	1.016	3.687	525	1.015	3.462
								11.001	3.687
51	4.912	1.562	Open Manhole	1500	1.017	3.350	525	1.016	3.350
BASIN 4	5.000	1.751	Open Manhole	1500	1.018	3.249	525	1.017	3.249
	5.757	1.350	Open Manhole	1350	12.000	4.407	450		
	6.150	1.275	Open Manhole	1350	13.000	4.875	375		
54	6.300	1.776	Open Manhole	1350	13.001	4.524	375	13.000	4.524
55	6.248	1.980	Open Manhole	1350	12.001	4.268	450	12.000	4.268
								13.001	4.343
56	6.822	2.697	Open Manhole	1350	12.002	4.125	450	12.001	4.125
57	6.450	1.200	Open Manhole	1200	14.000	5.250	300		
58	6.800	2.565	Open Manhole	1200	14.001	4.235	300	14.000	4.235
59	6.689	2.620	Open Manhole	1350	12.003	4.069	450	12.002	4.069
								14.001	4.219
60	6.350	1.425	Open Manhole	1200	15.000	4.925	225		
61	6.300	2.022	Open Manhole	1200	15.001	4.278	225	15.000	4.278
62	6.169	2.235	Open Manhole	1350	12.004	3.934	450	12.003	3.934
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Odyssey Markides LLP		Page 10
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions		Network 2020.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
63	6.029	2.131	Open Manhole	1350	12.005	3.898	450	15.001	4.159	225	
64	5.537	1.766	Open Manhole	1350	12.006	3.771	450	12.004	3.898	450	
65	5.269	1.570	Open Manhole	1350	12.007	3.699	450	12.005	3.771	450	
BASIN 5	5.179	1.791	Open Manhole	1350	12.008	3.388	450	12.006	3.699	450	
66	4.758	2.349	Open Manhole	1500	1.019	2.408	600	12.007	3.388	450	
								1.018	2.484	525	
								12.008	2.559	450	
	4.829	2.445	Open Manhole	0		OUTFALL		1.019	2.384	600	

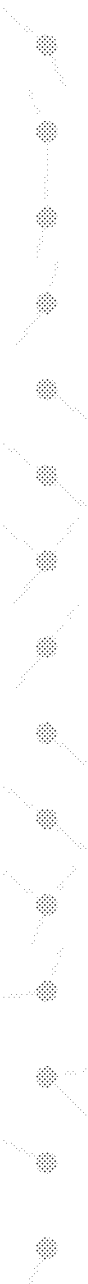
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	497552.231	103029.538	497552.231	103029.538	Required	
2	497539.610	103077.088	497539.610	103077.088	Required	
3	497559.350	103059.824	497559.350	103059.824	Required	
4	497571.935	103051.657	497571.935	103051.657	Required	
5	497585.164	103043.136	497585.164	103043.136	Required	
6	497612.241	103021.537	497612.241	103021.537	Required	
7	497635.255	103004.339	497635.255	103004.339	Required	
8	497655.721	102986.433	497655.721	102986.433	Required	
9	497641.332	102952.267	497641.332	102952.267	Required	
10	497654.913	102970.239	497654.913	102970.239	Required	

Odyssey Markides LLP		Page 11
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29 File 2020-10-12 Outfall 1 Ne...	Designed by WindesPC2 Checked by	
XP Solutions	Network 2020.1	

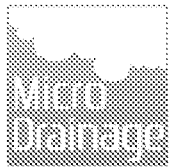
Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
11	497495.757	103042.229	497495.757	103042.229	Required	
12	497527.635	103009.624	497527.635	103009.624	Required	
13	497531.966	103005.845	497531.966	103005.845	Required	
14	497513.640	102972.397	497513.640	102972.397	Required	
15	497462.430	102993.458	497462.430	102993.458	Required	
16	497494.352	102965.176	497494.352	102965.176	Required	
17	497499.391	102961.481	497499.391	102961.481	Required	
18	497503.260	102956.475	497503.260	102956.475	Required	
19	497523.608	102940.127	497523.608	102940.127	Required	
20	497571.251	102960.030	497571.251	102960.030	Required	
21	497551.443	102931.329	497551.443	102931.329	Required	
22	497545.274	102923.674	497545.274	102923.674	Required	
23	497564.994	102908.999	497564.994	102908.999	Required	
24	497575.731	102884.683	497575.731	102884.683	Required	
25	497578.874	102888.982	497578.874	102888.982	Required	

Odyssey Markides LLP						Page 12
Tuscany House White Hart Lane Basingstoke RG21 4AF			Designed by WindesPC2 Checked by XP Solutions			
Date 25/11/2020 11:29 File 2020-10-12 Outfall 1 Ne...						
XP Solutions			Network 2020.1			
<u>Manhole Schedules for Storm</u>						
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
26	497583.062	102896.995	497583.062	102896.995	Required	
27	497600.002	102921.890	497600.002	102921.890	Required	
28	497608.025	102914.232	497608.025	102914.232	Required	
29	497610.535	102911.211	497610.535	102911.211	Required	
30	497597.317	102897.924	497597.317	102897.924	Required	
31	497477.276	102928.909	497477.276	102928.909	Required	
32	497470.178	102920.070	497470.178	102920.070	Required	
33	497499.441	102896.593	497499.441	102896.593	Required	
34	497526.695	102877.052	497526.695	102877.052	Required	
35	497551.262	102857.498	497551.262	102857.498	Required	
36	497566.357	102851.788	497566.357	102851.788	Required	
37	497580.671	102843.107	497580.671	102843.107	Required	
BASIN 1	497601.326	102875.626	497601.326	102875.626	Required	
38	497602.108	102834.028	497602.108	102834.028	Required	
39	497598.771	102829.931	497598.771	102829.931	Required	
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Odyssey Markides LLP					Page 13	
Tuscany House White Hart Lane Basingstoke RG21 4AF						
Date 25/11/2020 11:29 File 2020-10-12 Outfall 1 Ne...						
XP Solutions			Designed by WindesPC2 Checked by Network 2020.1			
<u>Manhole Schedules for Storm</u>						
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
40	497622.499	102810.202	497622.499	102810.202	Required	
41	497628.078	102797.219	497628.078	102797.219	Required	
42	497628.354	102788.026	497628.354	102788.026	Required	
43	497625.563	102776.844	497625.563	102776.844	Required	
44	497569.454	102777.724	497569.454	102777.724	Required	
45	497602.044	102753.979	497602.044	102753.979	Required	
46	497606.360	102750.490	497606.360	102750.490	Required	
47	497588.701	102726.686	497588.701	102726.686	Required	
48	497531.441	102728.920	497531.441	102728.920	Required	
49	497563.681	102703.971	497563.681	102703.971	Required	
50	497568.638	102700.133	497568.638	102700.133	Required	
51	497562.977	102684.340	497562.977	102684.340	Required	
BASIN 4	497512.163	102676.808	497512.163	102676.808	Required	
52	497780.981	102515.024	497780.981	102515.024	Required	
53	497782.737	102580.091	497782.737	102580.091	Required	
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Odyssey Markides LLP						Page 14
Tuscany House White Hart Lane Basingstoke RG21 4AF						
Date 25/11/2020 11:29 File 2020-10-12 Outfall 1 Ne...						
XP Solutions			Designed by WindesPC2 Checked by Network 2020.1			
<u>Manhole Schedules for Storm</u>						
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
54	497759.191	102533.077	497759.191	102533.077	Required	
55	497756.347	102527.881	497756.347	102527.881	Required	
56	497707.687	102553.975	497707.687	102553.975	Required	
57	497731.662	102604.217	497731.662	102604.217	Required	
58	497701.246	102563.587	497701.246	102563.587	Required	
59	497697.387	102562.897	497697.387	102562.897	Required	
60	497687.331	102631.709	497687.331	102631.709	Required	
61	497667.683	102606.019	497667.683	102606.019	Required	
62	497663.914	102602.737	497663.914	102602.737	Required	
63	497653.393	102611.458	497653.393	102611.458	Required	
64	497609.405	102633.387	497609.405	102633.387	Required	
65	497585.202	102646.535	497585.202	102646.535	Required	
BASIN 5	497573.800	102631.702	497573.800	102631.702	Required	
66	497554.454	102636.894	497554.454	102636.894	Required	
	497549.020	102627.742			No Entry	
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Odyssey Markides LLP		Page 15
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions		Network 2020.1

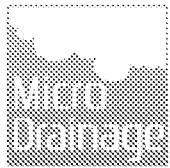
PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	300	1	6.969	5.469	1.200	Open Manhole	1200
2.000	o	375	2	6.660	5.365	0.900	Open Manhole	1350
2.001	o	375	3	6.850	5.280	1.195	Open Manhole	1350
1.001	o	375	4	6.929	5.212	1.342	Open Manhole	1350
1.002	o	375	5	6.846	5.162	1.309	Open Manhole	1350
1.003	o	450	6	6.563	4.976	1.137	Open Manhole	1350
1.004	o	450	7	6.314	4.901	0.963	Open Manhole	1350
1.005	o	450	8	6.051	4.701	0.900	Open Manhole	1350
3.000	o	225	9	6.307	5.082	1.000	Open Manhole	1200
1.006	o	450	10	5.984	4.593	0.941	Open Manhole	1350
4.000	o	300	11	7.000	5.800	0.900	Open Manhole	1200
4.001	o	300	12	7.250	5.608	1.342	Open Manhole	1200
4.002	o	300	13	7.066	5.584	1.182	Open Manhole	1200
4.003	o	375	14	6.762	5.349	1.038	Open Manhole	1350
5.000	o	300	15	6.700	5.500	0.900	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	29.623	162.8	4	6.929	5.287	1.342	Open Manhole	1350
2.000	26.224	250.0	3	6.850	5.280	1.195	Open Manhole	1350
2.001	15.003	220.6	4	6.929	5.212	1.342	Open Manhole	1350
1.001	15.735	313.0	5	6.846	5.162	1.309	Open Manhole	1350
1.002	34.637	313.0	6	6.563	5.051	1.137	Open Manhole	1350
1.003	28.730	385.0	7	6.314	4.901	0.963	Open Manhole	1350
1.004	27.193	136.0	8	6.051	4.701	0.900	Open Manhole	1350
1.005	16.213	150.0	10	5.984	4.593	0.941	Open Manhole	1350
3.000	22.527	85.3	10	5.984	4.818	0.941	Open Manhole	1350
1.006	108.735	277.4	BASIN 1	5.987	4.201	1.336	Open Manhole	1500
4.000	45.600	238.0	12	7.250	5.608	1.342	Open Manhole	1200
4.001	5.748	238.0	13	7.066	5.584	1.182	Open Manhole	1200
4.002	38.139	238.0	14	6.762	5.424	1.038	Open Manhole	1350
4.003	19.007	74.5	18	6.567	5.094	1.098	Open Manhole	1350
5.000	42.648	238.0	16	6.800	5.321	1.179	Open Manhole	1200

Odyssey Markides LLP		Page 16
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
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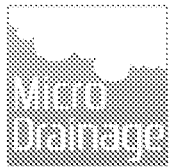
PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
5.001	o	300	16	6.800	5.321	1.179	Open Manhole	1200
5.002	o	300	17	6.750	5.295	1.155	Open Manhole	1200
4.004	o	450	18	6.567	5.019	1.098	Open Manhole	1350
4.005	o	450	19	6.374	4.951	0.973	Open Manhole	1350
6.000	o	375	20	6.750	5.475	0.900	Open Manhole	1350
6.001	o	375	21	6.400	5.125	0.900	Open Manhole	1350
4.006	o	525	22	6.155	4.730	0.900	Open Manhole	1500
4.007	o	525	23	6.005	4.580	0.900	Open Manhole	1500
7.000	o	150	24	5.872	4.872	0.850	Open Manhole	1200
7.001	o	150	25	5.801	4.836	0.815	Open Manhole	1200
4.008	o	525	26	5.834	4.268	1.041	Open Manhole	1500
8.000	o	100	27	6.300	5.300	0.900	Open Manhole	1200
8.001	o	100	28	6.300	5.110	1.090	Open Manhole	1200
8.002	o	225	29	5.952	4.727	1.000	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
5.001	6.249	238.0	17	6.750	5.295	1.155	Open Manhole	1200
5.002	6.327	50.2	18	6.567	5.169	1.098	Open Manhole	1350
4.004	26.102	385.0	19	6.374	4.951	0.973	Open Manhole	1350
4.005	27.205	186.3	22	6.155	4.805	0.900	Open Manhole	1500
6.000	34.873	99.6	21	6.400	5.125	0.900	Open Manhole	1350
6.001	9.832	40.1	22	6.155	4.880	0.900	Open Manhole	1500
4.006	24.581	163.9	23	6.005	4.580	0.900	Open Manhole	1500
4.007	21.692	69.5	26	5.834	4.268	1.041	Open Manhole	1500
7.000	5.325	147.9	25	5.801	4.836	0.815	Open Manhole	1200
7.001	9.041	46.7	26	5.834	4.643	1.041	Open Manhole	1500
4.008	14.285	385.0	30	5.755	4.230	1.000	Open Manhole	1500
8.000	11.091	58.4	28	6.300	5.110	1.090	Open Manhole	1200
8.001	3.928	15.2	29	5.952	4.852	1.000	Open Manhole	1200
8.002	18.742	95.1	30	5.755	4.530	1.000	Open Manhole	1500

Odyssey Markides LLP		Page 17
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions	Network 2020.1	

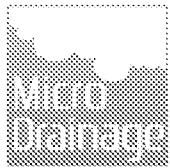
PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.009	o	525	30	5.755	4.230	1.000	Open Manhole	1500
9.000	o	300	31	6.777	5.277	1.200	Open Manhole	1200
9.001	o	375	32	6.674	5.099	1.200	Open Manhole	1350
9.002	o	375	33	7.054	4.979	1.700	Open Manhole	1350
9.003	o	375	34	6.721	4.872	1.474	Open Manhole	1350
9.004	o	375	35	6.362	4.772	1.215	Open Manhole	1350
9.005	o	375	36	6.198	4.623	1.200	Open Manhole	1350
9.006	o	375	37	6.237	4.569	1.293	Open Manhole	1350
1.007	o	450	BASIN 1	5.987	4.201	1.336	Open Manhole	1500
1.008	o	450	38	6.242	4.133	1.659	Open Manhole	1350
1.009	o	450	39	6.472	4.119	1.903	Open Manhole	1350
1.010	o	450	40	6.318	4.039	1.829	Open Manhole	1350
1.011	o	450	41	6.174	4.002	1.722	Open Manhole	1350
1.012	o	450	42	6.077	3.978	1.649	Open Manhole	1350
1.013	o	450	43	5.967	3.948	1.569	Open Manhole	1350
10.000	o	225	44	5.250	4.125	0.900	Open Manhole	1200
10.001	o	225	45	5.750	3.884	1.641	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.009	22.656	781.2	BASIN 1	5.987	4.201	1.261	Open Manhole	1500
9.000	11.337	110.1	32	6.674	5.174	1.200	Open Manhole	1350
9.001	37.517	313.0	33	7.054	4.979	1.700	Open Manhole	1350
9.002	33.536	313.0	34	6.721	4.872	1.474	Open Manhole	1350
9.003	31.399	313.0	35	6.362	4.772	1.215	Open Manhole	1350
9.004	16.139	108.3	36	6.198	4.623	1.200	Open Manhole	1350
9.005	16.741	313.0	37	6.237	4.569	1.293	Open Manhole	1350
9.006	38.524	104.7	BASIN 1	5.987	4.201	1.411	Open Manhole	1500
1.007	41.605	611.8	38	6.242	4.133	1.659	Open Manhole	1350
1.008	5.284	385.0	39	6.472	4.119	1.903	Open Manhole	1350
1.009	30.858	385.0	40	6.318	4.039	1.829	Open Manhole	1350
1.010	14.131	385.0	41	6.174	4.002	1.722	Open Manhole	1350
1.011	9.197	385.0	42	6.077	3.978	1.649	Open Manhole	1350
1.012	11.526	385.0	43	5.967	3.948	1.569	Open Manhole	1350
1.013	32.608	101.0	46	5.687	3.625	1.612	Open Manhole	1350
10.000	40.323	167.0	45	5.750	3.884	1.641	Open Manhole	1200
10.001	5.550	167.0	46	5.687	3.850	1.612	Open Manhole	1350

Odyssey Markides LLP		Page 18
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions		Network 2020.1

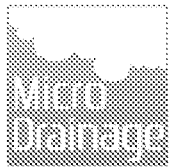
PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.014	o	450	46	5.687	3.625	1.612	Open Manhole	1350
1.015	o	450	47	5.372	3.548	1.374	Open Manhole	1350
11.000	o	225	48	5.400	4.275	0.900	Open Manhole	1200
11.001	o	225	49	5.100	4.031	0.844	Open Manhole	1200
1.016	o	525	50	5.054	3.387	1.142	Open Manhole	1500
1.017	o	525	51	4.912	3.350	1.037	Open Manhole	1500
1.018	o	525	BASIN 4	5.000	3.249	1.226	Open Manhole	1500
12.000	o	450	52	5.757	4.407	0.900	Open Manhole	1350
13.000	o	375	53	6.150	4.575	0.900	Open Manhole	1350
13.001	o	375	54	6.300	4.524	1.401	Open Manhole	1350
12.001	o	450	55	6.248	4.268	1.530	Open Manhole	1350
12.002	o	450	56	6.822	4.125	2.247	Open Manhole	1350
14.000	o	300	57	6.450	5.250	0.900	Open Manhole	1200
14.001	o	300	58	6.800	4.235	2.265	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.014	29.639	385.0	47	5.372	3.548	1.374	Open Manhole	1350
1.015	33.280	385.0	50	5.054	3.462	1.142	Open Manhole	1500
11.000	40.766	167.0	49	5.100	4.031	0.844	Open Manhole	1200
11.001	6.269	18.2	50	5.054	3.687	1.142	Open Manhole	1500
1.016	16.777	455.0	51	4.912	3.350	1.037	Open Manhole	1500
1.017	51.369	508.6	BASIN 4	5.000	3.249	1.226	Open Manhole	1500
1.018	58.152	76.0	66	4.758	2.484	1.749	Open Manhole	1500
12.000	27.788	200.0	55	6.248	4.268	1.530	Open Manhole	1350
13.000	52.581	149.8	54	6.300	4.524	1.401	Open Manhole	1350
13.001	5.924	32.7	55	6.248	4.343	1.530	Open Manhole	1350
12.001	55.215	385.0	56	6.822	4.125	2.247	Open Manhole	1350
12.002	13.627	243.3	59	6.689	4.069	2.170	Open Manhole	1350
14.000	50.753	50.0	58	6.800	4.235	2.265	Open Manhole	1200
14.001	3.921	238.0	59	6.689	4.219	2.170	Open Manhole	1350

Odyssey Markides LLP		Page 19
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions		Network 2020.1

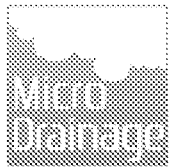
PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
12.003	o	450	59	6.689	4.069	2.170	Open Manhole	1350
15.000	o	225	60	6.350	4.925	1.200	Open Manhole	1200
15.001	o	225	61	6.300	4.278	1.797	Open Manhole	1200
12.004	o	450	62	6.169	3.934	1.785	Open Manhole	1350
12.005	o	450	63	6.029	3.898	1.681	Open Manhole	1350
12.006	o	450	64	5.537	3.771	1.316	Open Manhole	1350
12.007	o	450	65	5.269	3.699	1.120	Open Manhole	1350
12.008	o	450	BASIN 5	5.179	3.388	1.341	Open Manhole	1350
1.019	o	600	66	4.758	2.409	1.749	Open Manhole	1500

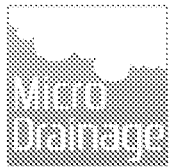
Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
12.003	52.036	385.0	62	6.169	3.934	1.785	Open Manhole	1350
15.000	32.342	50.0	61	6.300	4.278	1.797	Open Manhole	1200
15.001	4.998	42.0	62	6.169	4.159	1.785	Open Manhole	1350
12.004	13.665	385.0	63	6.029	3.898	1.681	Open Manhole	1350
12.005	49.152	385.0	64	5.537	3.771	1.316	Open Manhole	1350
12.006	27.544	385.0	65	5.269	3.699	1.120	Open Manhole	1350
12.007	18.709	60.2	BASIN 5	5.179	3.388	1.341	Open Manhole	1350
12.008	20.031	24.2	66	4.758	2.559	1.749	Open Manhole	1500
1.019	10.643	425.7		4.829	2.384	1.845	Open Manhole	0

Odyssey Markides LLP		Page 20
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions		Network 2020.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.054	0.054	0.054
2.000	-	-	100	0.118	0.118	0.118
2.001	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.057	0.057	0.057
1.002	-	-	100	0.032	0.032	0.032
1.003	-	-	100	0.082	0.082	0.082
1.004	-	-	100	0.080	0.080	0.080
1.005	-	-	100	0.092	0.092	0.092
3.000	-	-	100	0.039	0.039	0.039
1.006	-	-	100	0.077	0.077	0.077
4.000	-	-	100	0.063	0.063	0.063
4.001	-	-	100	0.063	0.063	0.063
4.002	-	-	100	0.000	0.000	0.000
4.003	-	-	100	0.120	0.120	0.120
5.000	-	-	100	0.040	0.040	0.040
5.001	-	-	100	0.040	0.040	0.040
5.002	-	-	100	0.000	0.000	0.000
4.004	-	-	100	0.024	0.024	0.024
4.005	-	-	100	0.065	0.065	0.065
6.000	-	-	100	0.136	0.136	0.136
6.001	-	-	100	0.135	0.135	0.135
4.006	-	-	100	0.045	0.045	0.045
4.007	-	-	100	0.027	0.027	0.027
7.000	-	-	100	0.046	0.046	0.046
7.001	-	-	100	0.000	0.000	0.000
4.008	-	-	100	0.031	0.031	0.031
8.000	-	-	100	0.027	0.027	0.027
8.001	-	-	100	0.000	0.000	0.000
8.002	-	-	100	0.078	0.078	0.078
4.009	-	-	100	0.017	0.017	0.017
9.000	-	-	100	0.055	0.055	0.055
9.001	-	-	100	0.051	0.051	0.051
9.002	-	-	100	0.052	0.052	0.052
9.003	-	-	100	0.051	0.051	0.051
9.004	-	-	100	0.000	0.000	0.000
9.005	-	-	100	0.115	0.115	0.115
9.006	-	-	100	0.023	0.023	0.023
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.050	0.050	0.050
1.011	-	-	100	0.012	0.012	0.012
1.012	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.029	0.029	0.029
10.000	-	-	100	0.053	0.053	0.053
10.001	-	-	100	0.053	0.053	0.053
1.014	-	-	100	0.033	0.033	0.033
1.015	-	-	100	0.032	0.032	0.032
11.000	-	-	100	0.025	0.025	0.025
11.001	-	-	100	0.025	0.025	0.025
1.016	-	-	100	0.059	0.059	0.059

Odyssey Markides LLP		Page 21
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions		Network 2020.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.017	-	-	100	0.008	0.008	0.008
1.018	-	-	100	0.000	0.000	0.000
12.000	-	-	100	0.053	0.053	0.053
13.000	-	-	100	0.067	0.067	0.067
13.001	-	-	100	0.066	0.066	0.066
12.001	-	-	100	0.016	0.016	0.016
12.002	-	-	100	0.074	0.074	0.074
14.000	-	-	100	0.055	0.055	0.055
14.001	-	-	100	0.055	0.055	0.055
12.003	-	-	100	0.012	0.012	0.012
15.000	-	-	100	0.045	0.045	0.045
15.001	-	-	100	0.044	0.044	0.044
12.004	-	-	100	0.075	0.075	0.075
12.005	-	-	100	0.040	0.040	0.040
12.006	-	-	100	0.101	0.101	0.101
12.007	-	-	100	0.054	0.054	0.054
12.008	-	-	100	0.000	0.000	0.000
1.019	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				3.071	3.071	3.071

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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1.019		4.829	2.384	0.000	0	0
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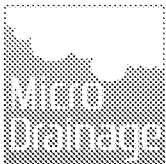
Simulation Criteria for Storm

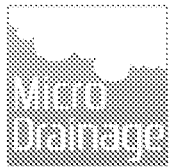
Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	5
Number of Online Controls	5	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 497050 103400 SU 97050 03400

Odyssey Markides LLP		Page 22
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions	Network 2020.1	
Synthetic Rainfall Details C (1km) -0.025 D1 (1km) 0.395 D2 (1km) 0.244 D3 (1km) 0.395 E (1km) 0.309 F (1km) 2.339 Summer Storms Yes Winter Storms Yes Cv (Summer) 0.750 Cv (Winter) 0.840 Storm Duration (mins) 30		
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Odyssey Markides LLP		Page 23
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
XP Solutions	Network 2020.1	

Online Controls for Storm

Orifice Manhole: 25, DS/PN: 7.001, Volume (m³): 1.2

Diameter (m) 0.024 Discharge Coefficient 0.600 Invert Level (m) 4.836

Orifice Manhole: 28, DS/PN: 8.001, Volume (m³): 1.4

Diameter (m) 0.020 Discharge Coefficient 0.600 Invert Level (m) 5.110

Hydro-Brake® Optimum Manhole: BASIN 1, DS/PN: 1.007, Volume (m³): 28.9

Unit Reference	MD-SHE-0146-1200-1800-1200
Design Head (m)	1.800
Design Flow (l/s)	12.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	146
Invert Level (m)	4.201
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	12.0
Flush-Flo™	0.524	12.0
Kick-Flo®	1.098	9.5
Mean Flow over Head Range	-	10.5

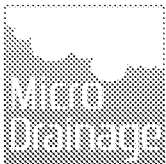
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

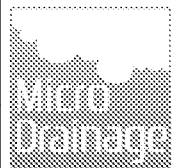
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.3	1.200	9.9	3.000	15.3	7.000	22.9
0.200	10.3	1.400	10.7	3.500	16.4	7.500	23.7
0.300	11.4	1.600	11.3	4.000	17.5	8.000	24.4
0.400	11.8	1.800	12.0	4.500	18.5	8.500	25.2
0.500	12.0	2.000	12.6	5.000	19.5	9.000	25.9
0.600	11.9	2.200	13.2	5.500	20.4	9.500	26.6
0.800	11.5	2.400	13.7	6.000	21.3		
1.000	10.5	2.600	14.3	6.500	22.1		

Hydro-Brake® Optimum Manhole: BASIN 4, DS/PN: 1.018, Volume (m³): 13.9

Unit Reference	MD-SHE-0173-1680-1750-1680
Design Head (m)	1.750
Design Flow (l/s)	16.8

Odyssey Markides LLP		Page 24																																																																								
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<table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>1.750</td><td>16.8</td></tr><tr><td>Flush-Flo™</td><td>0.512</td><td>16.8</td></tr><tr><td>Kick-Flo®</td><td>1.093</td><td>13.4</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>14.6</td></tr></table>			Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.750	16.8	Flush-Flo™	0.512	16.8	Kick-Flo®	1.093	13.4	Mean Flow over Head Range	-	14.6																																																									
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Odyssey Markides LLP		Page 26
Tuscany House White Hart Lane Basingstoke RG21 4AF		
Date 25/11/2020 11:29	Designed by WindesPC2	
File 2020-10-12 Outfall 1 Ne...	Checked by	
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Storage Structures for Storm

Porous Car Park Manhole: 24, DS/PN: 7.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	9.0
Membrane Percolation (mm/hr)	1000	Length (m)	25.0
Max Percolation (l/s)	62.5	Slope (1:X)	79.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	4.872	Membrane Depth (mm)	0

Porous Car Park Manhole: 27, DS/PN: 8.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	70.0
Max Percolation (l/s)	97.2	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.300	Membrane Depth (mm)	0

Tank or Pond Manhole: BASIN 1, DS/PN: 1.007

Invert Level (m) 4.201

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	523.6	1.800	2374.9

Tank or Pond Manhole: BASIN 4, DS/PN: 1.018

Invert Level (m) 3.249

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	20.3	1.750	299.5

Tank or Pond Manhole: BASIN 5, DS/PN: 12.008

Invert Level (m) 3.388

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	106.1	1.800	878.6

APPENDIX E

Operation and Maintenance Requirements for SuDS Features

TABLE 20.15 Operation and maintenance requirements for pervious pavements

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

Many of the specific maintenance activities for pervious pavements can be undertaken as part of a general site cleaning contract (many car parks or roads are swept to remove litter and for visual reasons to keep them tidy) and therefore, if litter management is already required at site, this should have marginal cost implications.

Generally, pervious pavements require less frequent gritting in winter to prevent ice formation. There is also less risk of ice formation after snow melt, as the melt water drains directly into the underlying sub-base and does not have chance to refreeze. A slight frost may occur more frequently on the surface of pervious pavements compared to adjacent impermeable surfaces, but this is only likely to last for a few hours. It does not happen in all installations and, if necessary, this can be dealt with by application of salt. It is not likely to pose a hazard to vehicle movements.

► Generic health and safety guidance is presented in Chapter 36.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

TABLE 22.1 Operation and maintenance requirements for detention basins

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseedling or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

22.13 REFERENCE

KENNARD, M F, HOSKINS, C G and FLETCHER, M (1996) Small embankment reservoirs, R161, CIRIA, London, UK (ISBN: 978-0-86017-461-5). Go to: www.ciria.org

Statutes

Reservoir Act 1975 (c.23)

Health and Safety at Work (etc) Act 1974 (c.37)

Building Act 1984 (c.55)

Flood and Water Management Act 2010 (c.29)

Construction (Design and Management) Regulations (CDM) 2015