

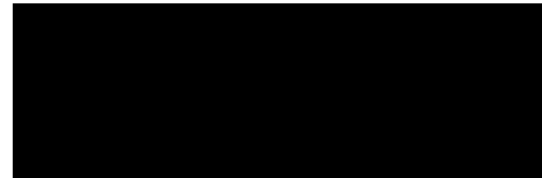
LAND SOUTH OF A259, ANGMERING
FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

REDROW HOMES

25 JUNE 2021



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Executive Summary

A site walkover was conducted in order to establish the location of existing drainage apparatus within and surrounding the development.

An established watercourse on the sites western boundary convey surface water runoff south, from the site, to the downstream established ditch and culvert network, discharging to the Ferring Rife.

The detailed flood map, for fluvial sources, provided by the Environment Agency show that the site area is located wholly within Flood Zone 1. There are no secondary flooding sources identified within the site.

In accordance with PPG ID: 7, the proposed development is classified as 'more vulnerable'. All development types are generally deemed acceptable in terms of flood risk in Flood Zone 1.

Based on the above, the site passes the Sequential Test with respect to NPPF and the Exception Test is not applicable.

The Assessment has considered the potential impact of the development on surface water runoff rates.

The surface water management strategy for the proposed development will manage and reduce the flood risk posed by the surface water runoff from the site.

Site investigation have confirmed infiltration type SuDS may be viable, but they also confirmed high groundwater.

The impermeable area of the proposed development has been calculated for the developed parcel and Urban Creep included, with all discharge rates provided at existing Greenfield discharge rates.

The attenuation requirement for the site could be met by attenuation basins situated in the lower portions of the development. Due to the topography of the site and the low discharge rate, attenuation requirements will be within various basins as opposed to one large one. This would avoid the need to artificially create a fall on site and reduce the quantity of fill material required to develop the site.

Additionally, further SuDS techniques, such as swales and permeable paving, could be introduced over the wider site. Flows will be restricted by use of a control device, such as a Hydrobrake, and the outfall from the attenuation facilities will route flows to the unnamed watercourse located to the west of the site, mimicking existing site conditions

Through the provision of a positive drainage network attributed to the Development, pluvial flooding to offsite receptors will be significantly reduced.

Exceedance flows can be safely accommodated within the Development.

Overall, the Site should not be precluded on flood risk grounds as the Development will not be at risk from existing sources and will not result in an increase in flooding downstream.

1.0 Introduction

Site Context

- 1.1. This report has been prepared by Abley Letchford Partnership Ltd, on behalf of Redrow Homes, in relation to a planning application for the proposed residential development on land located to the south of the A259, Angmering. The location of the site in its local geographical context is shown below.

Site Location Plan



Development Proposals

- 1.2. The proposals will comprise a planning application, for the erection of 76 dwellings, with matters regarding the access, principle internal roads and a first phase of development being considered in detail, with the remainder of the site being in outline and all other matters reserved.

Requirement for a Flood Risk Assessment (FRA)

- 1.3. The requirement for a Flood Risk Assessment is set out in Section 14 of the revised National Planning Policy Framework (NPPF) as revised in February 2019.



- 1.4. The footnote accompanying Paragraph 163 states:

A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

- 1.5. The site is a Greenfield site, extends greater than 1 hectare in total; therefore, a site-specific flood risk assessment is required. To comply with an Outline Planning Application, matters related to flood risk and drainage are addressed within this report.

Report Aim and Formation

- 1.6. The principal aim of this report is to demonstrate the acceptability of the proposed development in respect to flood risk planning policy.
- 1.7. Consideration is given to the risks attributed to both the development itself and the users from all forms of flooding.
- 1.8. The report outlines the impacts the development could have on flood risk in the area by increasing flooding elsewhere resulting from increased surface water runoff, changes in flood routing or loss of flood plain storage and outlines the mitigation systems that will be implemented to minimise this risk.
- 1.9. The presented Drainage Strategy ensures that the guiding principles of Sustainable Drainage Systems (SuDS) are central to the disposal of surface water drainage from the proposed development ensuring a viable robust solution is implementable.
- 1.10. The report finishes by outlining provisions for wastewater disposal.

Report Structure

- 1.11. This report addresses the requirements of NPPF and considers the following aspects:
- Section 2: Policy and Sources of Information – a review of policy relevant to the assessment and sources of information.
 - Section 3: Baseline Environmental Conditions – a description of the site location, its topography, geology and hydrology.
 - Section 4: Flood Risk – the effect of flooding within the existing site layout from all sources.
 - Sections 5 and 6: Drainage Strategy – offer appropriate mitigation measures to protect the site in the post development scenarios for surface and foul water drainage strategies.
 - Section 7: Summary and Conclusions – a review of the suitability of the development proposals in the context of site vulnerability and the requirements of the NPPF.



2.0 Policy and Sources of Information

Introduction

- 2.1. This chapter provides a review of policy relevant to the assessment and sources of information

National Planning Policy

- 2.2. National Planning Policy in relation to Flood Risk is set out in Section 14 of the National Planning Policy Framework (NPPF) and Planning Practice Guidance ID:7 for Flood Risk and Coastal Change (PPG). Flood Risk is discussed in Paragraphs 155-165 of the NPPF.

- 2.3. Paragraphs 157-162 discuss the Sequential approach. Paragraph 158 refers to a Strategic Flood Risk Assessment (SFRA) that would form the basis of applying the Sequential Test for local authorities to allocate development, whilst Paragraphs 159-162 relates to the Exemption Tests.

- 2.4. Paragraph 163 discusses the determination of planning applications stating:

When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood risk assessment. Development should only be allowed in areas at risk of flooding where, in light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;*
- b) the development is appropriately flood resilient and resilient;*
- c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- d) any residual risk can be safely managed; and*
- e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.*

- 2.5. The development would be classed as Major Development providing more than 10 homes and the site is greater than 0.5 hectares. Paragraph 165 states:

Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

- a) Take account of advice from the lead local flood authority (LLFA);*
- b) Have appropriate proposed minimum operational standards;*
- c) Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and*
- d) Where possible, provide multifunctional benefits.*



The Sequential Test, Exception Test and Sequential Approach

- 2.6. The sequential test is an approach used to enable new developments to be designed in areas at lower risk of flooding in preference to sites at higher risk. All opportunities to direct development to reasonably available areas with little or no flood risk should be explored prior to deciding to build in higher flood risk areas. For strategic sites, this is applied by the Local Planning Authority by means of a Strategic Flood Risk Assessment (SFRA).
- 2.7. Dependent upon the type of development under consideration, there may be a subsequent requirement to carry out the Exception Test as depicted within Figure 1 below. The Exception Test ensures that any new developments implemented within areas of flood risk will only occur where flood risk is clearly outweighed by other sustainability drivers and it will ensure that the development can be made safe from flooding and not increase the flood risk elsewhere. The test considers the vulnerability of the new development to flood risk and in order to 'pass', must demonstrate that:
- The development provides wider sustainability benefits to the community that outweigh the flood risk;
 - The development is sited on previously developed land, or if this is not the case, there are no other reasonable alternative sites; and
 - The development is safe, does not increase flood risk elsewhere and where possible will reduce flood risk overall.

Figure 1 – Flood Risk Vulnerability Classification Table 3 PPG ID 7

Flood Risk Vulnerability classification (see Table 1 PPG ID: 7)	Essential infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1 Low Probability	Yes	Yes	Yes	Yes	Yes
Zone 2 Medium Probability	Yes	Exception test required	Yes	Yes	Yes
Zone 3a High Probability	Exception test required	No	Exception test required	Yes	Yes
Zone 3b Functional Floodplain	Exception test required	No	No	No	Yes

Key: Yes: Development is appropriate, No: Development should not be permitted.

Climate Change

- 2.8. National Planning Policy (NPPF and PPG) make it a requirement to account for climate change within any proposed development proposal. Research has shown that expected climate change will increase the peak rainfall intensity and river flow, which could result in more frequent and severe flood events.
- 2.9. PPG ID:7 for Flood Risk and Coastal Change Table 2 sets out anticipated changes in peak rainfall intensity in small catchments (less than 5km²), or urbanised drainage catchment (as found within towns and cities. This is depicted below as Figure 2.



Figure 2 – Peak rainfall intensity allowance in small catchments or urban drainage

(Table 2 PPG ID 7)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

- 2.10. Underlying text supporting Table 2 states that Upper End climate change allowances should be used within the drainage design of all development types.

Environment Agency / GOV.UK

- 2.11. The Flood and Water Management Act 2010 provides the Environment Agency a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas. The Environment Agency is a statutory consultee with regards to flood risk and planning dependent upon criteria.
- 2.12. Environment Agency Standing Advice has been consulted and reviewed within this assessment.
- 2.13. The GOV.UK Flood Map for Planning, Long Term Flood Risk and Catchment Data Explorer websites have been interrogated in respect to flood risk extents and sources.

Local Authorities

- 2.14. The Site lies within the administrative area of West Sussex County Council and Arun District Council.
- 2.15. West Sussex County Council (WSCC) became a Lead Local Flood Authority (LLFA) under the Flood and Water Management Act 2010 and provide guidance to assess, manage and inform flood risk.
- 2.16. Planning guidance published by WSCC regarding flood risk was consulted to assess the mitigation policies in place. This includes the "West Sussex LLFA Policy for the Management of Surface water (November 2018)" which sets out the drainage strategies and surface water management provisions by which applications for development will be assessed. Furthermore, the document provides links to wider special strategy and flood risk documents and these have been consulted in preparation of this assessment. These include, but are not restricted to:
- Water. People. Places. A guide for master planning sustainable drainage into developments.
 - West Sussex Local Flood Risk Management Strategy Report.
 - West Sussex Preliminary Flood Risk Assessment.
- 2.17. The Arun Local Plan was adopted on the 18th July 2018 and sets out a spatial vision, objectives and a sustainable strategy for delivering the needed growth of the District over the period 2011- 2031.
- 2.18. Chapter 18 of the Local Plan deals with Water within Arun. The strategic objectives set out are to:
- Plan for climate change and work in harmony with the environment.



- Ensure water supply and quality are considered alongside wastewater.
 - Avoid increasing (and where possible reduce) risks of, or from, all forms of flooding.
 - Identify opportunities to include Sustainable Drainage Systems.
- 2.19. Having reviewed the key policies in the local plan the development site is considered to align with these primary objectives.
- 2.20. Aruns Supplementary Requirements for Surface Water Drainage Proposals set out local requirements for flooding and drainage including the Surface Water Proposals Checklist. These requirements have been included throughout the FRA and drainage proposals with the checklist provided as an appendix.

Southern Water

- 2.21. Southern Water is responsible for the disposal of waste water within the local area, and for the supply of clean water.
- 2.22. Information with regards to sewer and water main flooding contained within the SFRA has been consulted as part of this assessment. All Water Companies have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register.

Other Sources of Information

- 2.23. A desktop study of the Site was carried out using the following websites to ascertain local features, hydrology and soil characteristics:
- DEFRA's MAGIC portal,
 - British Geological Survey (BGS) and
 - Cranfield University Soilscape portal.
- 2.24. A Site walkover conducted in 2021 allowed observation of existing topography, watercourses, and infrastructure.
- 2.25. Guidance with respect to Sustainable Drainage Systems (SuDS) is contained within DEFRA document Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems March 2015, as well as CIRIA C753 The SuDS Manual, BS8582:2013 – Code of Practice for Surface Water Management for Development Sites and Approved Document H of the Building Regulations.
- 2.26. Additional guidance on development and flood risk is contained within CIRIA C624 Development and Flood Risk – Guidance for the Construction Industry which identifies several key aims for a development to ensure it is sustainable in flood risk terms.



3.0 Baseline Environmental Conditions

Introduction

- 3.1. This chapter provides for a description of the site location, its topography, geology and hydrology.

Site Location and use

- 3.2. The site lies to the south east of Angmering centre on land to the of the A259. The site is bound along its northern side by the A259 and the railway line to the south. To the west is existing housing and to the east is additional land making up the rest of existing farm land.
- 3.3. Overall the site covers approximately 2.9 hectares (Ha) which comprises entirely arable field with no discernible landscape features
- 3.4. The site lies within the administrative area of Arun District Council.
- 3.5. The National Grid Reference of the site is TF 66341 27239.

Topography

- 3.6. The topography of the site is predominantly flat in nature with levels fluctuating between 8.60m AOD to 7.70m AOD across the site. However, these changes in level are not uniform across the site and made up of small variations within the site with all boundaries predominantly at the same level.

Existing Drainage

- 3.7. The site currently drains by predominantly infiltration and evapotranspiration with some overland flow.
- 3.8. There are no surface water sewers, ditches or watercourses within the site itself. However, beyond the sites western boundary there is a watercourse, partly culverted, which takes overland flow south under the railway line and to a wider drainage network.
- 3.9. A site walkover was conducted with ADC to ascertain the condition of the watercourse beyond the sites boundaries. The result confirmed remedial works would be required to the watercourse due to siltation and poor maintenance.
- 3.10. Currently surface water flows unrestricted from the site, with the only barriers to flow being the capacity of the existing ditches and the culverts under the railway which are large in nature.
- 3.11. The nearest Southern Water foul sewers are in Old Worthing Road, north west of the site which takes flows west to the wider sewer network.

Geology and Hydrogeology

- 3.12. British Geological Survey mapping indicates the superficial geology beneath the site to comprise granular River Terrace Deposits. These are underlain by the bedrock geology of New Pit Chalk Formation. Site testing has confirmed the mapping to be predominantly correct although there are more clays in the superficial geology than envisaged.



- 3.13. The Cranfield University Soilscales maps indicates the soil to be freely draining slightly acidic loamy soil.
- 3.14. Aquifer designations reflect the importance of aquifers in terms of groundwater as a resource and in their role in supporting surface water flows and wetland ecosystems.
- 3.15. Aquifer maps are split into two different types of aquifer designations namely; Superficial (Drift), which are permeable unconsolidated deposits e.g. sands, gravels, etc, and Bedrock, which are solid permeable formations e.g. Sandstone, chalk, etc.
- 3.16. Environment Agency (EA) mapping indicates the site lies within Principal aquifer designation for Bedrock and Secondary A for Superficial Drift.
- 3.17. Mapping confirms that the Site lies outside of any Groundwater Source Protection Zone (SPZ).

Hydrology

- 3.18. The site lies in the catchment of the Ferring Rife located to the east of the site. The Ferring Rife is a tidal river located some 1km to the east of the site.
- 3.19. The Ferring Rife was rated 'Moderate' for Ecological Classification and 'Fail' for Chemical Classification in 2019.

Site Investigations

- 3.20. Intrusive ground investigations, groundwater monitoring and soakage testing to BRE DG365 has been undertaken to provide confirmation of the hydrogeology. These were undertaken in winter in accordance with Arun's Drainage Policy. They indicate infiltration type techniques are viable on the site and this tallies with the flood risk and the lack of existing surface water drainage features.

Groundwater Monitoring

- 3.21. Groundwater monitoring was commenced in October 2020 with nine further groundwater monitoring visits through to March 2021.
- 3.22. Groundwater levels ranged between 1.10m to 2m below ground level. Full results are contained within the Appendix.

Infiltration Testing

- 3.23. Infiltration testing was carried out between the 10 February 2021 to 02 March 2021. The scope of works comprised the mechanical excavation of eight trial pits and had a maximum of three soakage tests conducted in line with BRE365.
- 3.24. Tests were completed to depth of approximately 1.00m below ground level and no Groundwater was found.
- 3.25. The results indicated infiltration type techniques are viable across the site but not as good as expected giving the underlying Bedrock. This could be due to the high groundwater encountered above and also the clays in the Superficial deposits.



- 3.26. Winter testing resulted in infiltration rates of between 2.6×10^{-6} m/s and 8.8×10^{-6} m/s across the site. Full results are contained within the Appendix.

4.0 Flood Risk

Introduction

- 4.1. This chapter assesses flood risk at the site from all sources including appropriate allowance for climate change required by relevant National and Local planning policy.

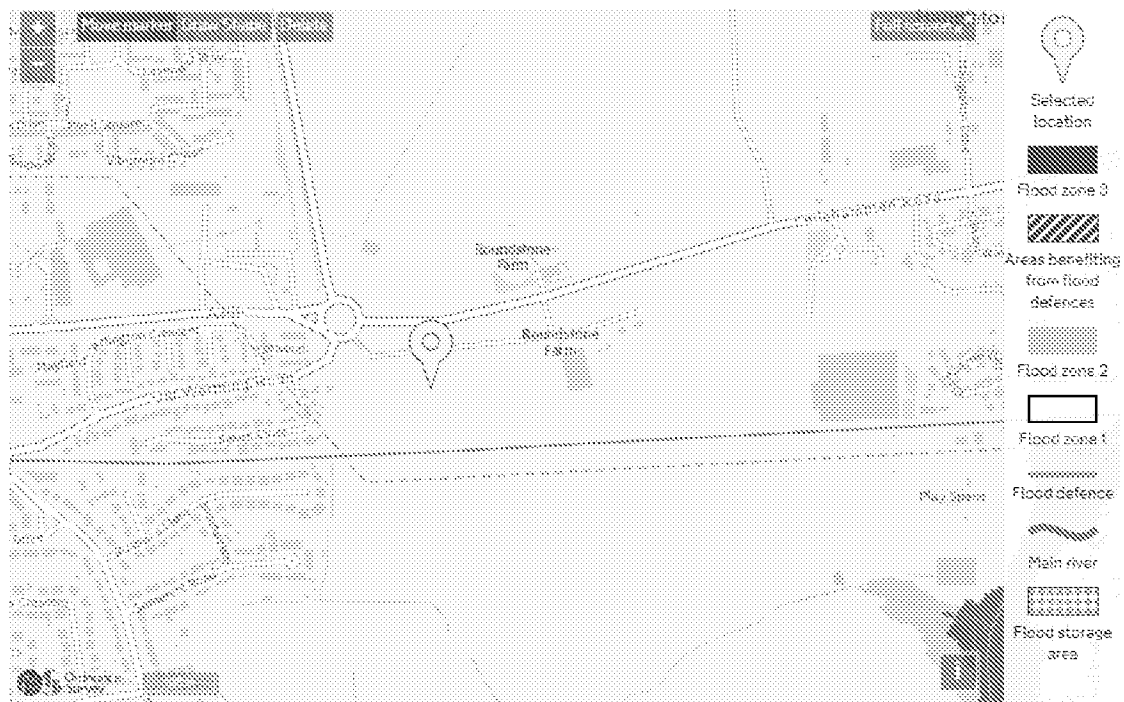
Flood Risk to the Site from Tidal Sources

- 4.2. The site is at a low risk from tidal flooding due to its inland elevated location.

Flood Risk to the Site from Fluvial Flooding Sources

- 4.3. A review of the EA's Flood Map for Planning maps show the site to be located entirely within Flood Zone 1. This zone comprises land where flooding from rivers and the sea (fluvial) is very unlikely. There is less than a 0.1% (1 in 1000) chance of flooding occurring each year. The site is at a low risk of flooding from fluvial sources.
- 4.4. Extracts from the EA Flood Maps are included below.

Environment Agency's Flood Zone Map



Flood Risk to the Site from Pluvial Flooding Sources

- 4.5. The SFRA, EA and GOV.uk websites and local available documents indicate there is no history of flooding at the site from heavy rainfall events or overland flood routes. The EA flood maps indicate a low to medium risk of surface water flooding on the site, this is confined to small locations.

- 4.6. Due to the flat nature of the site and no positive outfalls, it is assumed that any surface water flooding is generated by rainfall falling on-site and not be able to escape the site quickly enough.
- 4.7. The proposed development will provide positive improvements to overland flow with surface water being intercepted, stored in attenuation areas and discharged at controlled rates or into the ground.
- 4.8. The remaining Greenfield areas will be managed with grass and vegetation providing a surface treatment more conducive to reductions in overland flow.
- 4.9. Not only will these measures assist in management of surface water on site, but also contribute to a reduction in flood risk downstream, as the discharge rate off site is controlled, restricted and attenuated on site. However, cognisance will be taken to ensure downstream receptors are suitably recharged.
- 4.10. Therefore, overall, the site is at a very low risk of flooding from pluvial sources.

Environment Agency's Surface Water Map



Flood Risk to the Site from Groundwater

- 4.11. Groundwater flooding has the potential to occur after prolonged periods of unusually high rainfall. During such periods, more water than usual infiltrates through the ground, raising the water table above its normal depth below the surface. Where the water table is at shallow depth in any case, the water table can reach the surface. This can cause ground water to merge with rainfall and cause localised flooding.



- 4.12. On site ground water monitoring, during winter months provided a suite, of groundwater levels across the site with the groundwater predominantly 3.5m to 4.5m below ground level or non-existent. Only in one location was groundwater encountered during the onsite investigations and this was in the very low spot highlighted with the pluvial flood risk above. However, even this was some 1.8m below ground level and not in a location of development.
- 4.13. Groundwater flooding tends to occur sporadically in both location and time. Surface groundwater flooding has not been a risk on the site and there is no reason to believe it would present a problem and the test confirm this.

Flood Risk to the Site from Other Sources

- 4.14. The SFRA, EA and GOV.uk websites and local available documents indicate there is no existing flood risk from: reservoirs, sewers, canals or other artificial sources.
- 4.15. The site is deemed of low risk of flooding from these sources.

The Sequential Test

- 4.16. In the context of PPG Flood Risk and Coastal Change ID: 7 (Table 2) the proposed development has been identified as 'residential' development and therefore is classified as 'More Vulnerable'.
- 4.17. The proposed development is situated wholly within Flood Zone 1.
- 4.18. By applying the Flood Risk Vulnerability compatibility matrix under PPG Flood Risk Coastal Change ID:7 (Table 3), all development types are deemed to be accepted in Flood Zone 1 as depicted.

Flood Risk Vulnerability Classification Table 3 PPG ID 7

Flood Risk Vulnerability classification (see Table 1 PPG ID: 7)	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	Yes	Yes	Yes	Yes	Yes
Zone 2	Yes	Yes	Exception test required	Yes	Yes
Zone 3a	Exception test required	Yes	No	Exception test required	Yes
Zone 3b 'Functional Floodplain'	Exception test required	Yes	No	No	No

Key: Yes: Development is appropriate, No: Development should not be permitted.

- 4.19. It is therefore considered that, within the context of Flood Risk, the Site passes the Sequential Test with respect to NPPF and is suitable for the type of development proposed.



Flood Risk Summary

4.20. An overall summary of the risk of flooding from all sources is provided below.

Flood Risk Summary

Source of Flooding	High	Medium	Low	Comments
Tidal			✓	The Site is elevated and inland.
Fluvial			✓	The Site is located wholly within Flood Zone 1.
Pluvial			✓	There is minor pluvial flood risk associated with the low spot on the site and the inability to continue off site beyond the western boundary of the development. The proposed development and mitigation will reduce any perceived flood risk.
Groundwater			✓	EA/GOV.UK mapping and onsite groundwater monitoring does not indicate the Site to be at risk.
Sewers			✓	The Site has no exposure to existing sewer assets, except the aforementioned foul water rising main, with no evidence of flooding.
Reservoirs, canals and other artificial sources			✓	EA/GOV.UK mapping does not indicate the Site to be at risk.

4.21. Based upon the above information, the Site is deemed to be at **LOW RISK OF FLOODING**. The Proposed Site Plan is therefore in full accordance with National and Local planning policy concerning Flood Risk and as such is suitable for residential development.



5.0 Surface Water Strategy

Introduction

- 5.1. This chapter provides details on an indicative surface water drainage strategy and measures to drain the Development.

Overall Strategy

- 5.2. The proposed drainage strategy has been designed to exceed the requirements of the NPPF by providing a comprehensive drainage system which embraces the Sustainable Drainage Systems (SuDS) philosophy and key principles. The utilisation of SuDS not only provides the benefit of controlling waters at source and online treatment of collected surface water but also allows enhanced aesthetics through improved landscaping, biodiversity, and ecological opportunities.
- 5.3. These features offer a holistic treatment train and management system to the benefit of new residents, members of the wider community, downstream receptors and the environment.
- 5.4. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. Changes to land uses can have significant downstream impacts where existing drainage systems may not have sufficient capacity for any additional surface water flow.
- 5.5. A surface water management strategy is therefore required to manage and reduce the flood risk posed by the surface water runoff from the site. The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates to the pre-development scenario, unless specific off-site arrangements are made and result in the same net effect.
- 5.6. Sustainable water management measures (SuDS) should be introduced to control the surface water runoff from the proposed development site therefore, managing the flood risk to the site and surrounding areas from the surface water runoff.
- 5.7. The Construction Industry Research and Information Association, CIRIA's C690 states the following:
- **Prevention** – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing surfaces)
 - **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting)
 - **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one or several soakaways for the entire site)
 - **Regional Control** – management of runoff from several sites, typically in a detention basin or wetland.



- 5.8. The SuDS Manual 2015 (C753) provides best practice guidance on the planning, design, construction, operation and maintenance of SuDS. This document provides guidance to ensure that SuDS are planned and designed to maximise the opportunities and benefits of surface water management.
- 5.9. The four main categories of benefits that can be achieved by SuDS, referred to as the four pillars of SuDS design, are:
- **Water quantity** – control the quantity of runoff to support the management of flood risk, and maintain and protect the natural water cycle;
 - **Water quality** – manage the quality of the runoff to prevent pollution
 - **Amenity** – create and sustain better places for people
 - **Biodiversity** – create and sustain better places for nature.
- 5.10. Supplemental to CIRIA guidance, Document H of the Building Regulations 2015 sets out three possible options to discharge surface water runoff. Rainwater shall discharge to one of the following, listed in order of priority:
- An adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable,
 - A watercourse; or where that is not reasonably practicable
 - A sewer.
- 5.11. Although infiltration is considered to be a viable method of disposal, the surface water drainage proposals will be designed to attenuate runoff with discharge offsite, due to the high groundwater and restrictive infiltration rates.
- 5.12. Implementation of SuDS will ensure that flood risk downstream is not increased due to the proposed development. These features will also provide positive improvements to the quality of surface water runoff.
- 5.13. The following SuDS components are deemed applicable to the Site:
- Pervious surfacing systems – structural surfaces that allow water to penetrate into a granular layer thus providing storage and treatment, e.g. pervious paving.
 - Infiltration systems – components that facilitate the infiltration of water into the ground, e.g. soakaways.
 - Conveyance systems – components that convey flows to downstream storage systems, e.g. swales and filter drains.
 - Storage systems – components that control flow, and possibly volumes, by storing water and releasing it slowly, e.g. geocellular units, attenuation basins and wetlands.
 - Treatment systems – components that remove or facilitate the degradation of contaminants present in runoff, e.g. filter strips and proprietary treatment systems.



Pre and Post Development Rates / Areas

- 5.14. To quantify any potential increase in surface water runoff, the existing Greenfield/Pre-Development runoff rate from the Site must be determined. The rates of runoff have been determined using the current 'industry best practice' guidelines as outlined in the Interim Code of Practice for SuDS. The recommended methodology for sites up to 50 hectares in area is the ICP SuDS method.
- 5.15. An assessment of existing surface water runoff has been undertaken, to determine the potential surface water options and attenuation requirements for the site utilising the following parameters.
- Catchment Area: 1 ha (to determine a l/s/ha discharge rate)
 - Average Annual Rainfall (SAAR): 719mm/year
 - Soil: 0.300
 - Region No.: 7
- 5.16. Greenfield run off calculations for the existing site provided in the appendix show the following discharge rates:

Pre-Development Runoff Rates/Volumes

Annual Probability	Greenfield/Pre-Development Runoff Rate per Hectare (l/s/ha)
1 in 1 year event	1.60
QBar	1.88
1 in 30 year event	4.33
1 in 100 year event	6.00

- 5.17. As QBar is < 2.0 l/s/ha the limiting discharge rate is set at 2.0 l/s/ha
- 5.18. The existing site is predominantly Greenfield. Therefore, any development will increase the impermeable area and surface water run off.
- 5.19. Based on the Illustrative Masterplan, it has been measured that the impermeable surfaces is approximately 1.5ha
- 5.20. Urban Creep is the conversion of permeable surfaces to impermeable over time through individual dwellings adding items such as extra parking spaces, extensions, conservatories, etc. In accordance with Arun Policy and The SuDS Manual (CIRIA 753) this can be up to 10% dependent on density applied to impermeable area within the property curtilage only. As a general rule by applying 5% to the total site impermeable area is far greater than just applying 10% to individual properties. Therefore, the inclusion of an additional 5% to the overall impermeable area in all calculations provides for all future Urban Creep. As the design develops this will be turned into a more accurate figure by applying Urban Creep to individual properties but, as this will be far less than the overall 5% provided, a robust assessment of rates and areas is provided at this time, in line with Arun DC Policy.



- 5.21. In order to comply with best practice as stipulated in EA Report SC030219 'Rainfall Runoff Management for Developments', proposed discharge rates should be restricted to one of two methods for all storms up to and including the 1 in 100 year storm event plus a 40% upper end allowance for climate change.
- 5.22. This is either the Variable Greenfield discharge rates, with Long term Storage method or restricting all rates to the estimated mean greenfield runoff rate (QBar). This is the preferred method for Arun DC.

Surface Water Proposals

- 5.23. A surface water management strategy for the proposed development has been developed to manage and reduce the flood risk posed by the surface water runoff from the site. The drainage system for the proposed development will manage and reduce the flood risk posed by the surface water runoff.
- 5.24. It is proposed to provide a network of trapped gullies, pipes and Sustainable Drainage (SuDS) features to collect the surface water runoff from impermeable areas such as roads, roofs and driveways. The traditional system will work in combination with such features as permeable paving and attenuation features to provide attenuation storage and high-quality water benefits.
- 5.25. The layout of boundary ditches are unaffected and therefore existing outfall points will remain as is, with new headwalls being constructed within the site as required. In addition, the partly culverted watercourse to the sites western boundary will be opened up within the site. The watercourse south of the railway line, which takes flow from the site to the wider drainage network, will be remediated to clear silt and vegetation to reduce existing flood risk and provide a clear channel for discharge.
- 5.26. The banks of SuDS basins will be designed in accordance with the SuDS Manual C753 in respect to having a maximum gradient of 1 in 4 and an appropriate freeboard above the maximum water level. This allows landscaping of both wetland and wildflower mixes to provide an appropriate landscape context in the vicinity of the features through the provision of an aquatic shelf.
- 5.27. The development could utilise Source Control techniques (such as swales, granular strips and permeable paving) which assist with the reduction of larger attenuation storage features. This should be embraced and investigated as the project progresses.
- 5.28. Open SuDS features will be designed so as not to compromise the safety of residents, visitors and their property. Generally open boundaries are provided, and perimeter planting could be utilised to define the extents of the features.
- 5.29. Proposed discharge rates will be restricted to QBAR, or minimum 2 l/s should rate be too low, for all storm events up to and including the 1 in 100 year storm event plus 40% allowance for climate change. This would negate the requirement for Long Term Storage and flows would be attenuated on site and discharged utilising an on-site flow control device such as a Hydrobrake.
- 5.30. All conveyance systems will be designed to cater for the 1:30 year storm event, in accordance with industry standard, with all attenuation features designed to allow for the 1 in 100 year storm event plus 40% climate change allowance.
- 5.31. The proposals draw reference to the DEFRA document Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems March 2015, as well as CIRIA C753 The SuDS Manual.



- 5.32. This proposal identifies the principal components of the surface water strategy and is subject to further detailed localised investigations as part of the subsequent Reserved Matters applications. These assumptions are subject to evolution as the design develops.

Exceedance Flood Routing

- 5.33. Flows in excess of the above design storms, which may flood from the network, will be kept within the internal road network, until such time as they can be directed into adjacent landscaping areas. This ensures that onsite or offsite residential units are afforded an increased level of protection from flood waters until such time as the rain events become significant.

Water Quality Improvements

- 5.34. CIRIA report C753 The SuDS Manual outlines the methodology for assessing water quality risks associated with new development. This is a simple index approach which provides a high level scoping analysis of the land usage and gives guidelines for appropriate treatment stages.
- 5.35. This process identifies features necessary to provide adequate substance removal in line with Environment Agency requirements. This is a three step process of Allocation, Mitigation and Review.
- 5.36. Surfaces generating runoff are 'graded' on their potential to contribute to various harmful pollutants and gives each surface a risk of pollution from each element. An extract of Table 26.2 within the SuDS Manual is set out below.

Extract from Table 26.2 SuDS Manual

Land Use	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Other Roofs	Low	0.3	0.2-0.8	0.05
Low traffic residential roads and non-residential parking with infrequent change.	Low	0.5	0.4	0.4
Commercial yard, parking with frequent change, other roads,	Medium	0.7	0.6	0.7
Sites with heavy pollution	High	0.8	0.8	0.9

- 5.37. The use of non-mechanical features decreases the requirements for maintenance and increase natural biodiversity. That said, the SuDS Manual does not remove the possibility of utilising separators, so long as they are considered in partnership with a comprehensive overall SuDS regime.
- 5.38. Without adequate treatment, the pollutants would cause damage if they were to enter the watercourse or water table in large volumes. The use of SuDS features to slow down and degrade these pollutants is critical to the provision of an acceptable discharge.
- 5.39. The respective cleansing abilities of common SuDS features are given by corresponding mitigation indices within the SuDS Manual. An extract of Table 26.3 is set out below.



Extract from Table 26.3 SuDS Manual

Type of SuDS component	Total Suspended Solids	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable Paving	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8

- 5.40. The individual pollution indices are totalled, with the first SuDS component utilising its full value and subsequent downstream SuDS features acting with 50% efficiency. This provides a realistic strategy which mimics the reduced cleansing effectiveness as the concentration of a pollutant decreases along the SuDS train.
- 5.41. In line with Environment Agency guidance, before the design phase is concluded, the proposals are reviewed and analysed in order to identify potential shortcomings and to ensure that adequate volume of SuDS features are provided to mitigate the risk of pollution from each source.
- 5.42. Surface water arising from highways or driveways should be provided with two trains of treatment prior to leaving the site in line with national guidance.
- 5.43. Rainwater falling on the permeable paving flows into the underlying granular layers. This effectively traps suspended solids and filters pollutants from the water. This will be directed to the swales and the basin. The drainage strategy provides a level of treatment in advance of discharging from the Site. This can be demonstrated using the Simple Index Approach outlined within CIRIA C753. The most significant pollutant load will arise from roadways and driveways and similar within the Site. These have an identified pollutant hazard level of 'Low' as set out in the tables above.
- 5.44. Under this designation, Table 26.3 of the SuDS Manual requires pollutant indices of 0.5 for Total Suspended Solids (TSS), 0.4 for Metals, and 0.4 for Liquid Hydrocarbons. By reference to the above tables, the provision of permeable paving, swales and basin within the drainage strategy exceeds the maximum anticipated pollutant hazard indices.

SuDS Maintenance Strategy

- 5.45. For the water treatment effects of SuDS features to remain effective, a comprehensive maintenance strategy should be implemented.
- 5.46. During construction, maintenance of SuDS features should be undertaken by the Contractor. Upon completion, the assets should be passed over to the Management Company, statutory authority, or community group commissioned to maintain the features in perpetuity.



- 5.47. As part of the strategy, a regular maintenance regime will be created, which consists of several primary measures required to ensure the longevity of the system. These should be undertaken on a regular basis to ensure consistent performance. Typical maintenance activities consist of:
- Inspecting and reporting; relatively regular review of the condition identifying issues and providing resolutions. Periodic review from the maintenance contractor;
 - Litter and debris removal;
 - Grass trimming, overall cutting and localised strimming preventing blockages;
 - Weed and evasive plant control;
 - Shrub management;
 - Aquatic and shoreline vegetation management;
 - Sweeping pervious surfaces; and
 - Oil removal from proprietary systems.
- 5.48. A remedial maintenance schedule would be recommended as part of the handover of the SuDS features, remedial maintenance is required to provide repairs to the system and monitor long term damage ensuring the system remains consistently productive. the schedule could consist of;
- Structure rehabilitation and repair;
 - Infiltration surface rehabilitation;
 - Scarifying to remove “Thatch”;
 - Spiking or Tining the soil, which assists with aeration;
 - Air pressure treatment.
- 5.49. The maintenance schedule contents and timing will depend upon multiple factors including usage, contents of water utilising the system, location and biology. To this end, it is suggested that the schedule be finalised as part of detailed design; ensuring the most comprehensive maintenance schedule is incorporated for the phase in hand.
- 5.50. Community outreach can be undertaken as part of the development, which will raise awareness on the importance of SuDS to both flood risk and water quality in the local area. Imparting the new residents with knowledge on the risks associated with pollution to the surface water drainage system is key, as is the direct effect their actions may have on water quality and biodiversity in the area.

Adoption and Ownership

- 5.51. The drainage system is designed to the appropriate standards including the new Sewerage Sector Guidance (SSG), the Building Regulations and the requirement of the National Planning Policy Framework
- 5.52. The intention of adoption and ownership of drainage and SuDS is as follows:



- Surface water sewers within development parcels to be offered for adoption to Southern Water under the Section 104 process of the Water Industry Act.
- Surface water highway drains, gullies and leads within adopted roads to be maintained by the Highway Authority.
- Above ground attenuation (i.e. swales and basins) within development parcels to be offered for adoption to either the Local Authority or ownership under a management company.
- SuDS features serving single properties, for example, permeable paved driveways to single dwellings, will be owned and maintained by the owner of that property.

5.53. Suitable adoption and maintenance regimes for SuDS should be submitted in support of the Reserved Matters application.



6.0 Foul Water Drainage

Introduction

- 6.1. This chapter provides details on the proposed foul water drainage strategy and measures to convey effluent.

Overall Strategy

- 6.2. Due to the topography of the site and location of the existing foul sewer point of connection, wastewater from the site will require pumping to the receiving public sewer.
- 6.3. The nearest current point of connection is likely to be into the Southern Water existing manhole 8102, located in Old Worthing Road.
- 6.4. A gravity network on site will drain all flows to a pumping station before pumping flows into existing manhole 8102.
- 6.5. Discussions are ongoing with Southern Water regarding the extent of additional off-site sewers or improvements to existing sewers that will be required to provide sufficient capacity to service the development.
- 6.6. Notwithstanding this, the delivery of the proposed on-site foul water sewers will be designed in collaboration with Southern Water as approving body in accordance with the new Sewerage Sector Guidance (SSG) and will be offered to Southern Water for adoption under S104 Agreement of the Water Industry Act. The connection to the existing public sewer system will be made via a S106 Agreement of the Water Industry Act with Southern Water as part of the overall adoption process.

Adoption and Ownership

- 6.7. The drainage system is designed to the appropriate standards including the new Sewerage Sector Guidance (SSG), the Building Regulations and British Standards.
- 6.8. Foul water sewers within the development are to be offered for adoption to Southern Water under the Section 104 process of the Water Industry Act 1991.



7.0 Development Suitability

Introduction

- 7.1. This chapter assesses the suitability of the development proposals in the context of on and off-site vulnerability.

Assessment

- 7.2. This site-specific Flood Risk Assessment demonstrates that the Development satisfies the requirements of NPPF and can be justified in the proposed location by:

- meeting the criteria set out in NPPF;
- assessing the risk posed to the site from flood events;
- assessing the risk posed to the site from the site storm water generation and the site storm water runoff management; and
- assessing the risk the site poses to increase in flooding elsewhere.

- 7.3. Specifically, it has demonstrated:

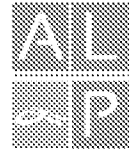
- The detailed Fluvial flood map, for fluvial sources, provided by the GOV.UK's Flood Map for Planning indicate that the site area is entirely located with Flood Zone 1; assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%).
- Whilst the detailed flood map provided by GOV.UK indicates minimal pluvial flooding within the site, any future risk of pluvial flooding will be mitigated by the development and drainage regime.
- That a detailed review of available data indicates a low risk from secondary flooding sources, such as groundwater, sewers, reservoirs or canal.
- Through the provision of a positive drainage network attributed to the Development, pluvial flooding to offsite receptors will be significantly reduced.
- Exceedance flows can be safely accommodated within the Development.

Conclusion

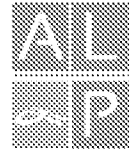
- 7.4. The proposed surface water drainage strategy will manage the flood risk posed by uncontrolled surface water runoff from the Site. Any increase in surface water run-off can be managed using SuDS source control techniques as well as attenuation features to provide storage in extreme storm events.
- 7.5. The above provides the minimum of two treatment stages which is in accordance with the recommendations of CIRIA C753.
- 7.6. All surface water drainage systems will be designed to restrict discharge rates to greenfield QBAR runoff rate and store the balance of water for all events up to and including the 1 in 100 year event including allowance for a 40% increase in rainfall intensities as a result of climate change and urban creep.



- 7.7. The proposed foul water drainage strategy presents a robust, viable method of conveyance of effluent to the public sewerage system.
- 7.8. Overall, the Site should not be precluded on flood risk grounds as the Development will not be at risk from existing sources and will not result in an increase in flooding downstream.

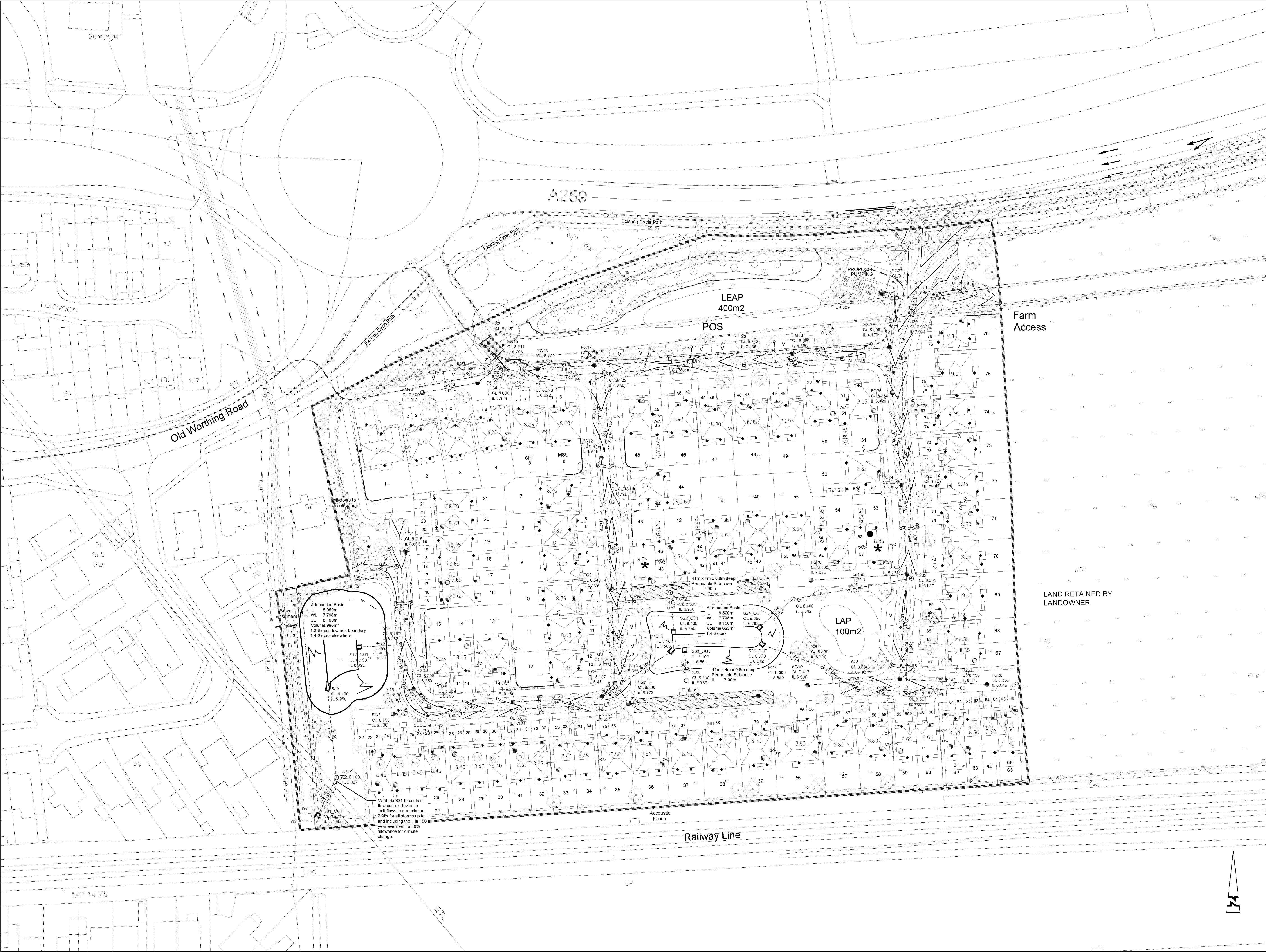


Appendices



Appendix 1 – Drawings

Preliminary Drainage Strategy



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GENERAL NOTES:

- Do not scale.
- Refer to all other Project Drawings.
- All sewers to comply with the requirements of the Design and Construction Guidance together with Southern Waters Addendum.
- All public sewers are to be the subject of a Section 104 agreement of the Water Industry Act 1991.
- Invert levels of existing manholes and sewers are to be checked on site before construction commences and results reported to engineers.
- All manhole ironworks to comply with BS EN124, and be stamped with BS Kitemark. Covers to suit loading as below:
 - Carriageways and Roads - D400
 - Driveways and Verges - C250
 - Footways and Pedestrian Areas - B125
 - Gardens/Landscaping - A15
- All sewer pipes, up to, and including 225mm are to be vitrified clay to BS EN295. All sewer pipes 300mm diameter and above to concrete pipes to BS EN1916.
- All drainage shall be installed and tested strictly in accordance with the Manufacturers' printed instructions, BS EN 752, BS EN 1601, Local Water Authority requirements and the Building Regulations.
- All bedding shall be Class 5 unless noted otherwise.
- All trenches under existing and proposed public highways are to be backfilled with thoroughly compacted Type 1 granular sub-base material.
- Drainage laid beneath roads and areas of vehicular access (car parking etc) with less than 1200mm of cover shall be encased in concrete bed and surround with associated movement joints. Drainage laid beneath paths, footways and pedestrian areas with less than 900mm of cover shall be similarly treated.
- Chambers with outgoing pipes greater than 600mm diameter shall be fitted with guard bars, safety chains or other approved safety devices.
- The use of precast concrete products made with sulphate resisting cement is mandatory, unless a laboratory report proves such precautions are not necessary.
- All gully connections to use a minimum diameter pipe of 150mm and to be surrounded by a minimum of 150mm of grade C8/C10 concrete over its full length (which should not exceed 15m) and its connection to the carrier system.
- All laterals to be 150mm laid at 1:80 (surface), 1:60 (foul) unless otherwise noted.

DRAINAGE NOTES:

- Do not scale.
- Refer to all other Project Drawings.
- All drainage to be in accordance with Document H of the Building Regulations, together with NHC Standards Chapter 5.3 & BS8301.
- All private drains to be 100mm diameter unless stated otherwise.
- Where pipes pass through footings, retaining or screen walls, lintels to be provided over drains.
- Where inverts are less than 0.6m deep, inspection chambers (min dia 190mm) or access fittings (225x100mm) to be used, elsewhere proprietary plastic, brick or pcc is to be used (sized in accordance with table 11 of Approved Document H).
- All gullies connected direct to drains to be roddable.
- Rainwater downpipes to be easily removable for rodding or to be provided with rodding access at ground level.
- Unless noted otherwise FW, ICs & REs to be 0.6m below DPC level, SW, ICs & REs to be 0.45m.
- Adequate precautions in accordance with Approved Document H and manufacturer's recommendations to be taken to protect drains (particularly plastic) at shallow depths.

KEY

FOUL

STORM

Proposed adoptable sewer & MH

Highway gully and 150mm connection

Rising Main

Headwall

Proposed road contours (major at 100mm intervals, minor at 25mm intervals)

Proposed DPC Level (G) denotes Garage

Proposed area of deepened permeable sub-base

P1	06/21	First Issue	DS	SM
Rev	Date	Description	Drawn	Created

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Client

REDROW HOMES

Project
LAND SOUTH OF A259, ANGMERING

Title
RESERVED MATTERS DRAINAGE LAYOUT

Status
PRELIMINARY

Scale	Date	Drawn	Created
1:500 @ A1	JUNE 2021	DS	SM

Drawing No. A334-RM-50

Revision P1

ARUN DISTRICT COUNCIL A15821PL



Appendix 2 – Documents

Arun District Council Surface Water Drainage Proposal Checklist

Ground Water Monitoring

Infiltration Testing



Surface Water Drainage Proposal Checklist

Ground Investigation Results				
Results Required		Results Provided?		
Winter groundwater monitoring results (Please refer to guidance note 1 below)		Yes	☐	☐
Period of winter groundwater monitoring Note 1		From	01/10/2020	
		To	30/03/2021	
Maximum recorded groundwater level		1.07 mBGL		
Winter infiltration test results Note 2		Yes	☐	☐
Date of winter infiltration testing		10/02/2021		
Details of the location and depth of the infiltration testing Note 3		Yes	☐	☐
Minimum infiltration rate Note 4		2.6 x 10-6 m/s		

Guidance Notes

1. A full winters groundwater monitoring should be undertaken, (October to March inclusive) to enable the peak annual groundwater levels to be established. The extent of winter monitoring for developments of less than 5 properties should be discussed with the council's Engineers.
2. Infiltration testing should be undertaken during the wet winter months (typically January) and in line with BRE365, or a similar approved method. Tests should be repeated 3x, to replicate saturated ground conditions. Please note that infiltration testing is to be carried out at a time and depth agreed with the Councils engineers.
3. Infiltration testing should be undertaken at the location and depth of any proposed infiltration structures. This must be above the maximum recorded groundwater level in that vicinity.
4. The minimum infiltration rate obtained at the location and depth of the proposed infiltration structures should be used to inform the design of the structures.

Proposed Method of Surface Water Disposal				
Infiltration On-site, via soak-away structures			No	☐
If on-site infiltration is not to be used, has justification for this been provided? Note 5	Yes	☐		☐
Attenuation (on-site) with a restricted discharge to a watercourse on, or adjacent to, the site	Yes	☐		☐
Attenuation (on-site) with a restricted discharge to a surface water sewer on, or adjacent to, the site			No	☐
Attenuation (on-site) with a restricted discharge to a foul water sewer on, or adjacent to, the site			No	☐

Guidance Notes

5. If on-site infiltration is not being used to drain the site you will need to provide evidence that demonstrates on-site infiltration is unviable.

Drainage Design: Supporting Calculations				
Calculations Required		Calculations Provided?		
Infiltration Structures	Half-drain time for 10 year event (plus climate change allowance)		No	
		Hours		
	Half-drain time for 100 year event (plus climate change allowance)		No	
		Hours		
	Calculations demonstrating that the 1 in 100 year event, plus climate change allowance can be accommodated on-site. Note 7		No	
Attenuation and Subsequent Restricted Discharge	Lowest base level of infiltration structure	mAOD mBGL		
	Has the design sought to provide treatment of potential contaminants? E.g. hydrocarbons.		No	
	Pre-development run-off rate calculations	Yes		
		2.9 l/s		
	Proposed discharge rate Note 6	2.9 l/s		
Attenuation and Subsequent Restricted Discharge	Calculations demonstrating that the 1 in 100 year event, plus climate change allowance can be accommodated on-site. Note 7	Yes		
	Has the design sought to provide treatment of potential contaminants? E.g. hydrocarbons.	Yes		
	If your proposed scheme incorporates any impermeable lined attenuation features we require calculations to demonstrate that appropriate resistance to floatation (due to groundwater levels) is catered for in the design	To Follow		
	If you propose discharging into or altering an ordinary watercourse; have you sought Ordinary Watercourse/Land Drainage Consent? Note 8	To Follow		
	If discharging to a watercourse, piped system or the sea, has the proposed drainage network been modelled against predicted top water levels for the 1 in 100 year storm event plus climate change allowance, within the existing system? Note 9	Yes		

Guidance Notes

- Any proposed discharge rate must be less than, or equal to, the pre-development rate. Greenfield sites must use the mean flow rate (Qbar) and be based upon the area occupied by the development, ignoring significant open spaces. Please note that the minimum acceptable discharge rate is 2l/s when using formal flow control devices, unless otherwise agreed. Additionally, if you are developing a brownfield site, we expect you to provide fully detailed plans of the existing surface water drainage arrangements on site, including impermeable areas, gullies, outfalls, pipes & diameters, manholes, etc. We generally seek 50% betterment in terms of run off from brownfield sites.
- The appropriate factor of safety from the table below must be applied to your calculations to ensure your design is fully in accordance with CIRIA R156/ CIRIA C753.



Factor of Safety Table						
Size of Area to be Drained	Consequences of failure					
	No damage or inconvenience		Minor inconvenience, e.g. surface water on car park		Damage to buildings or structures or roads.	
	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75
<100 m ²	1.5	2	2	3	10	13
100m ² to 1000m ²	1.5	2	3	4	10	13
>1000m ²	1.5	2	5	6.5	10	13

8. Ordinary Watercourse/Land Drainage Consent will need to be sought, ideally in parallel with planning permission, if you propose discharging into, culverting or altering a watercourse.
9. Modelling is required to ensure that problems, such as surcharged outfalls, are addressed.

Plans/Drawings/Diagrams				
Required	Provided?			
Plan detailing the location of groundwater monitoring and infiltration testing	Yes			
Detailed drainage layout plan ^{Note 10}	Yes			
Construction detail plans ^{Note 11}	Yes			
Exceedance flow route plans ^{Note 12}	Yes			
Impermeable area plan	To Follow a			sign
If ground levels are being raised $\geq 300\text{mm}$ above existing levels and is unavoidable, have fully detailed plans been provided, together with drainage proposals, to address any potential drainage related issues.	Yes			

Guidance Notes

10. Drainage layout plans should include:
 - All surface water drainage pipes labelled with; diameters, pipe materials, falls and invert levels.
 - All infiltrating and attenuating structures (including permeable paving) labelled with; dimensions, invert and cover levels.
 - All manholes labelled with; cover levels, invert levels, cover types detailed.
 - All silt traps clearly labelled with sump depths.
 - Control structures with outflow rates and invert levels.
 - Proposed/existing levels of any areas subject to ground raising, together with suitable measures/detailed drawings for the associated management of surface water runoff. Please note that ground raising should be avoided unless there are exceptional circumstances.
11. Site specific construction detail plans should be supplied if your proposed drainage scheme includes any of the following elements: pipe bed and surround; infiltrating structures; attenuating structures; manholes; catch-pits/silt traps; control devices; permeable paving; headwalls.

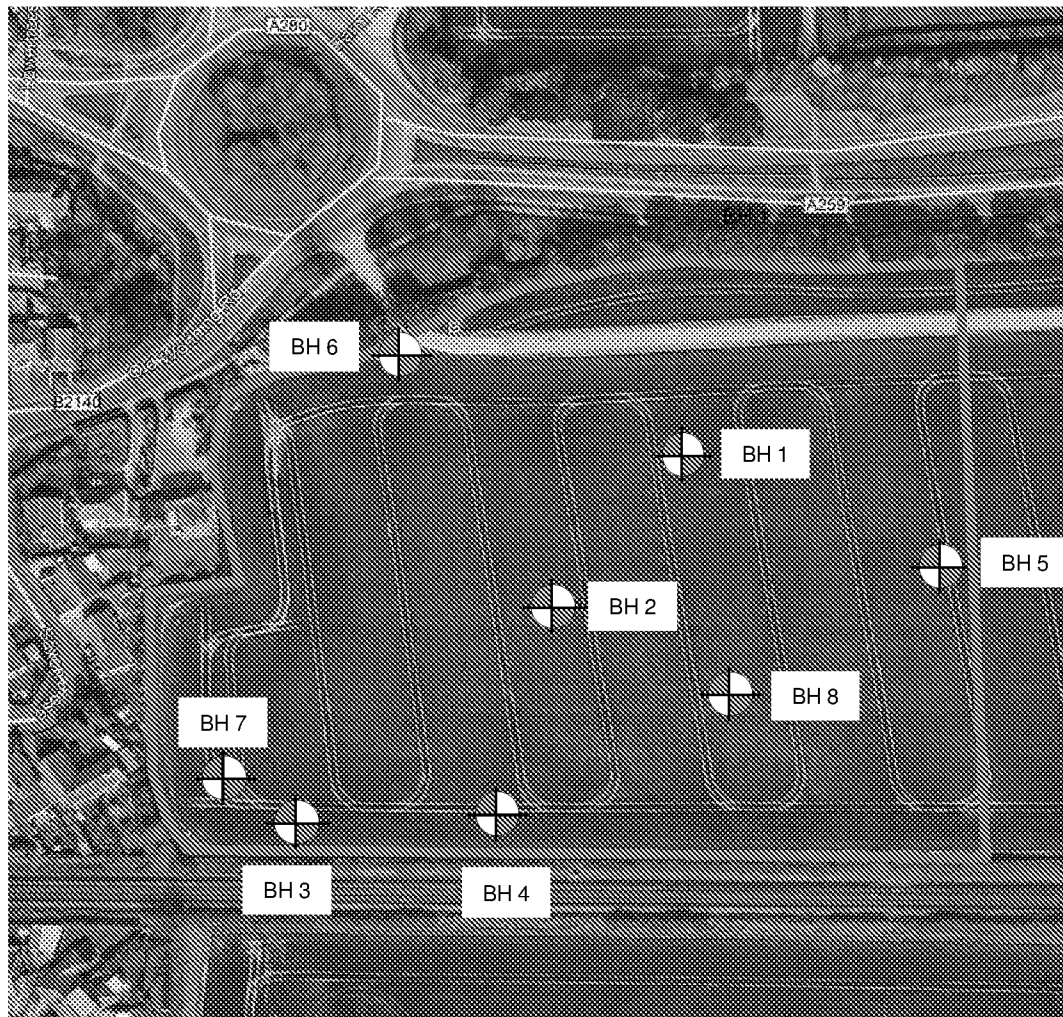


12. Unless specifically requested by the council's drainage engineers 'Exceedance Flow Route Plans' are only required for developments of more than 5 residential properties or more than 0.5ha of commercial development .

Site Angmering Land Parcel South of A259

Client Redrow Homes Limited

**Winter Water Level
Monitoring
2020-2021**



Results of monitoring visits presented as depth below ground level (mBGL)

	01/10/20	18/11/20	07/12/20	18/12/20	04/01/21	18/01/21	16/02/21	11/03/21	30/03/21
BH 1	1.62	1.41	1.41	1.11	1.52	1.51	1.59	1.63	1.66
BH 2	1.14	1.23	1.25	1.20	1.39	1.37	1.45	1.49	1.53
BH 3	1.27	1.21	1.20	1.19	1.32	1.30	1.34	1.40	1.43
BH 4	1.17	1.07	1.07	1.08	1.19	1.16	1.21	1.26	1.31
BH 5	1.12	1.21	1.21	1.21	1.37	1.32	1.39	1.41	1.45
BH 6	1.95	1.81	1.80	1.78	1.88	1.85	1.90	1.94	1.97
BH 7	--	--	--	--	--	1.76	1.80	1.83	1.88
BH 8	--	--	--	--	--	1.69	1.73	1.76	1.80



Approximate Scale in metres

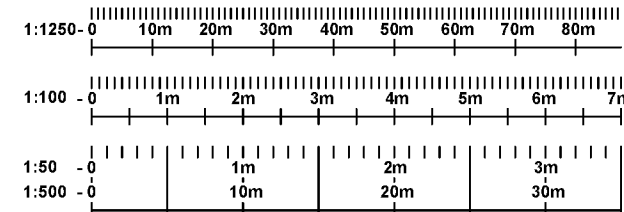


The Contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts. The Contractor is to comply in all respects with current Building Legislation, British Standard Specifications, Building Regulations, Construction (Design & Management) Regulations, Party Wall Act, etc. whether or not specifically stated on this drawing. This drawing must be read with and checked against any structural, geotechnical or other specialist documentation provided. This drawing is not intended to show details of foundations, ground conditions or ground contaminants. Each area of ground relied upon to support any structure depicted (including drainage) must be investigated by the Contractor. A suitable method of foundation should be provided allowing for existing ground conditions. Any suspect or fluid ground, contaminants on or within the ground, should be further investigated by a suitable expert. Any earthwork constructions shown indicate typical slopes for guidance only & should be further investigated by a suitable expert. Where existing trees are to be retained they should be subject to a full Arboricultural Inspection for safety. All trees are to be planted so as to ensure they are a minimum of 5 metres from buildings and 3 metres from drainage and services. A suitable method of foundation is to be provided to accommodate the proposed tree planting. Geoff Perry Associates Limited do not accept any responsibility for any losses (financial or otherwise) to any Client or third party arising out of the Client's (be it Developer or Contractor but not limited thereto) non-compliance with above mentioned provisions.

Revisions:

- A. Plot substitution. Pump station added in south west corner, visitor parking added. 19.10.20 BPC
- B. Central POS creates additional POS / suds in south west corner. 22.11.20 BPC
- C. Plots 16-29, 57-67 & 72-76 amended. 23.11.20 GVP
- D. All 76 plots reviewed and amended to version 23 of the crib sheet. New Access, relocation of affordable, increase size of Suds and introduction of the Windsor. (Full instruction on email from Craige Burden 01.12.20 @ 06.07). 03.12.20 GVP
- E. All units respaced to provide 1.35m minimum between units. Plots 16-21, 28-41, 56-60, 67-71 and 76 amended. 10.12.20 GVP
- F. H.A Symbols added to plots 28-32 and 61-66. Acoustic fence line thickened. 11.12.20 HS
- G. Plots 39 and 56 handed (meaning plots 28-39 & 56 needed re-spacing). Plots 36-39 and 56-58 pulled forward 3 metres. Basin centrally amended and basin the the West amended to sit under the overhead cables. Sewer Easement standoff located on drawing to the West and rear gardens of plots 22-27 amended. GVP 15.12.20

Scale Check:



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Client: REDROW HOMES SOUTHERN CONTIES

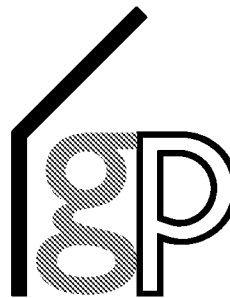
Project: LAND SOUTH OF THE A259 ANGMERING

Title: PLANNING LAYOUT

Date: 15 / 10 / 2020 Scale: 1:500 @ A1

Drawn by: BPC Checked by: ~

Job No. A 924 Drg No. 003 Rev. G



Geoff Perry Associates Limited

The Shrubbery, 28 Erdington Road, Aldridge, Walsall, WS9 6UH

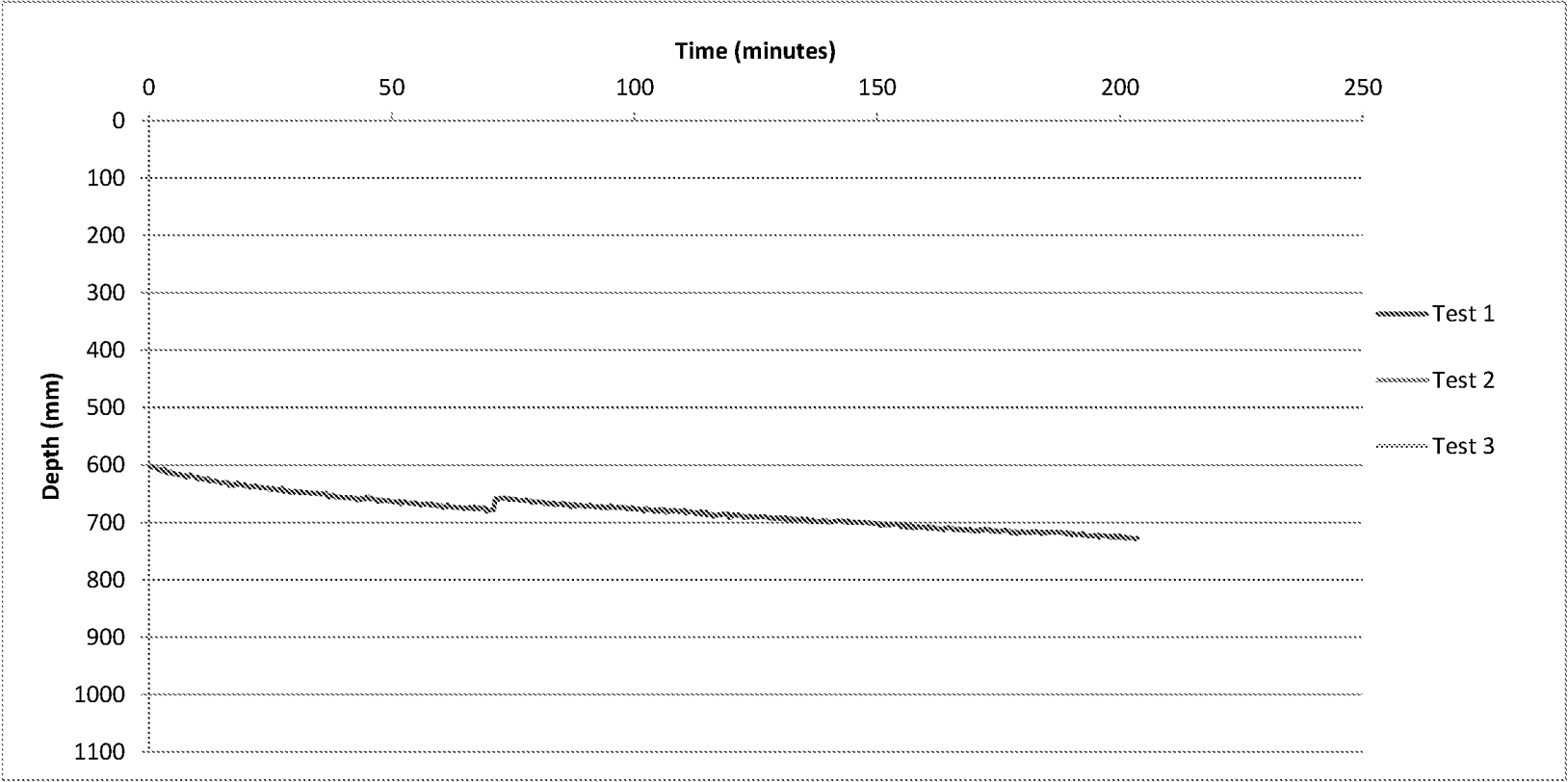
e : enquiries@geoffperryassoc.co.uk

t: 01922 744 900

Infiltration Test Results and Calculation of Infiltration Rates

Site: Land South of A529 - Angmering
Client: Redrow Homes
Test Reference: SA01

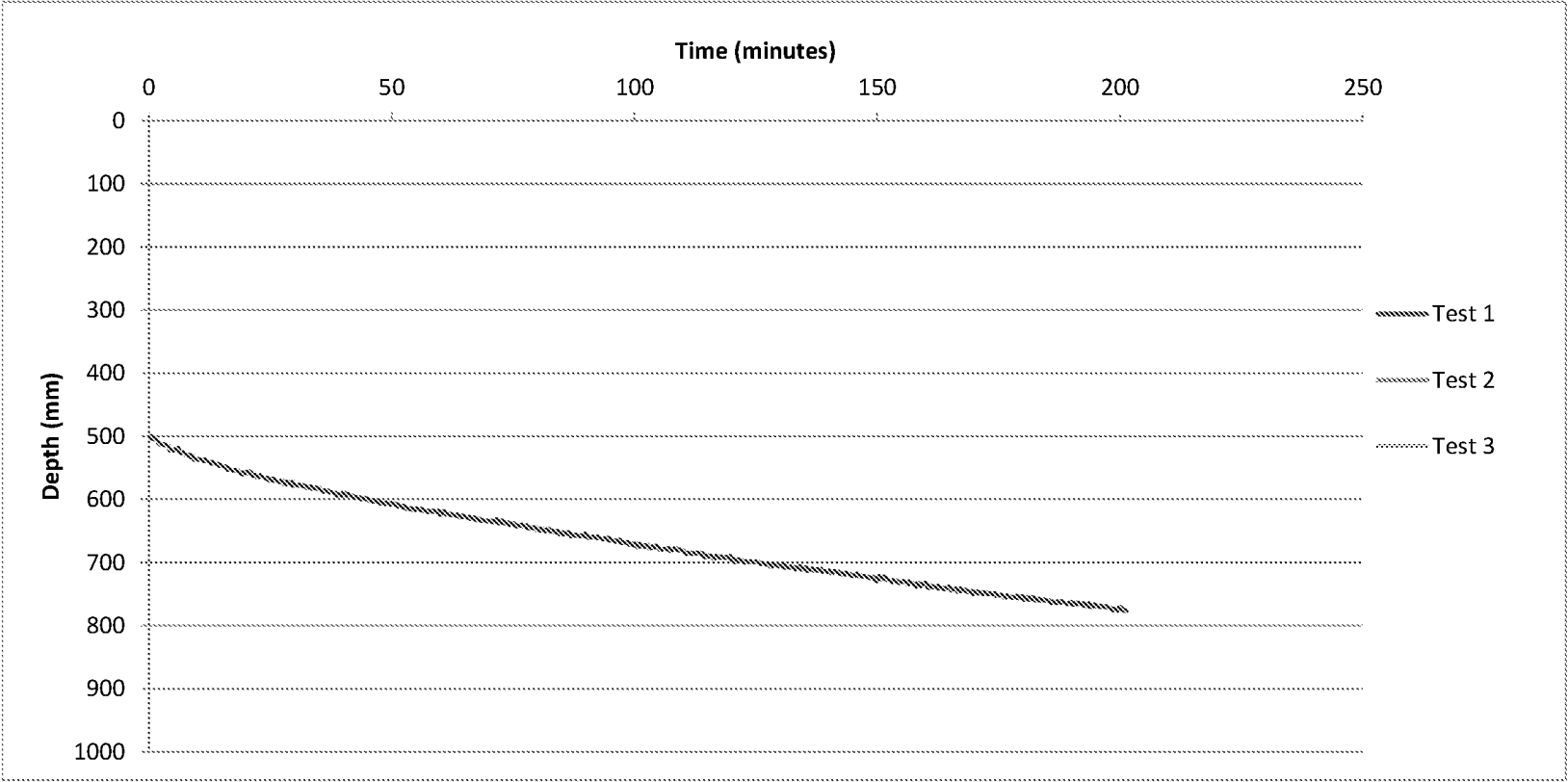
Test 1		Test 2		Test 3	
Pit Dimensions		Pit Dimensions		Pit Dimensions	
Trial pit length (mm)	1800	Trial pit length (mm)		Trial pit length (mm)	
Trial pit width (mm)	600	Trial pit width (mm)		Trial pit width (mm)	
Trial pit depth (mm)	1100	Trial pit depth (mm)		Trial pit depth (mm)	
Plan area (m ²)	1.08	Plan area (m ²)	0	Plan area (m ²)	0
Depth to water at start of test (mm)	600	Depth to water at start of test (mm)		Depth to water at start of test (mm)	
End time (sec)	12220	End time (sec)		End time (sec)	
Final depth (mm)	727	Final depth (mm)		Final depth (mm)	
75% Effective depth (mm)	725	75% Effective depth (mm)	0	75% Effective depth (mm)	0
25% Effective depth (mm)	975	25% Effective depth (mm)	0	25% Effective depth (mm)	0
Time at 75% effective depth - t _{p75} (sec)	11860	Time at 75% effective depth - t _{p75} (sec)		Time at 75% effective depth - t _{p75} (sec)	
Time at 25% effective depth - t _{p25} (sec)	NA	Time at 25% effective depth - t _{p25} (sec)		Time at 25% effective depth - t _{p25} (sec)	
Effective Storage volume of water (m ³)	0.54	Effective Storage volume of water (m ³)	0	Effective Storage volume of water (m ³)	0
V _{p75-25} (m ³)	0.27	V _{p75-25} (m ³)	0	V _{p75-25} (m ³)	0
Internal surface area - a _{p50} (m ²)	2.28	Internal surface area - a _{p50} (m ²)	0	Internal surface area - a _{p50} (m ²)	0
t _{p75-25} (sec)	#VALUE!	t _{p75-25} (sec)	0	t _{p75-25} (sec)	0
BR365 Soil Infiltration Rate	#VALUE!	BR365 Soil Infiltration Rate	#DIV/0!	BR365 Soil Infiltration Rate	#DIV/0!
Average Soil Infiltration Rate	3.5E-06	Average Soil Infiltration Rate	#DIV/0!	Average Soil Infiltration Rate	#DIV/0!
Testing completed by	GC	Calculation completed by	GC	Calculation checked by	
Date	10/02/2021	Date	02/03/2021	Date	



Infiltration Test Results and Calculation of Infiltration Rates

Site: Land South of A529 - Angmering
Client: Redrow Homes
Test Reference: SA02

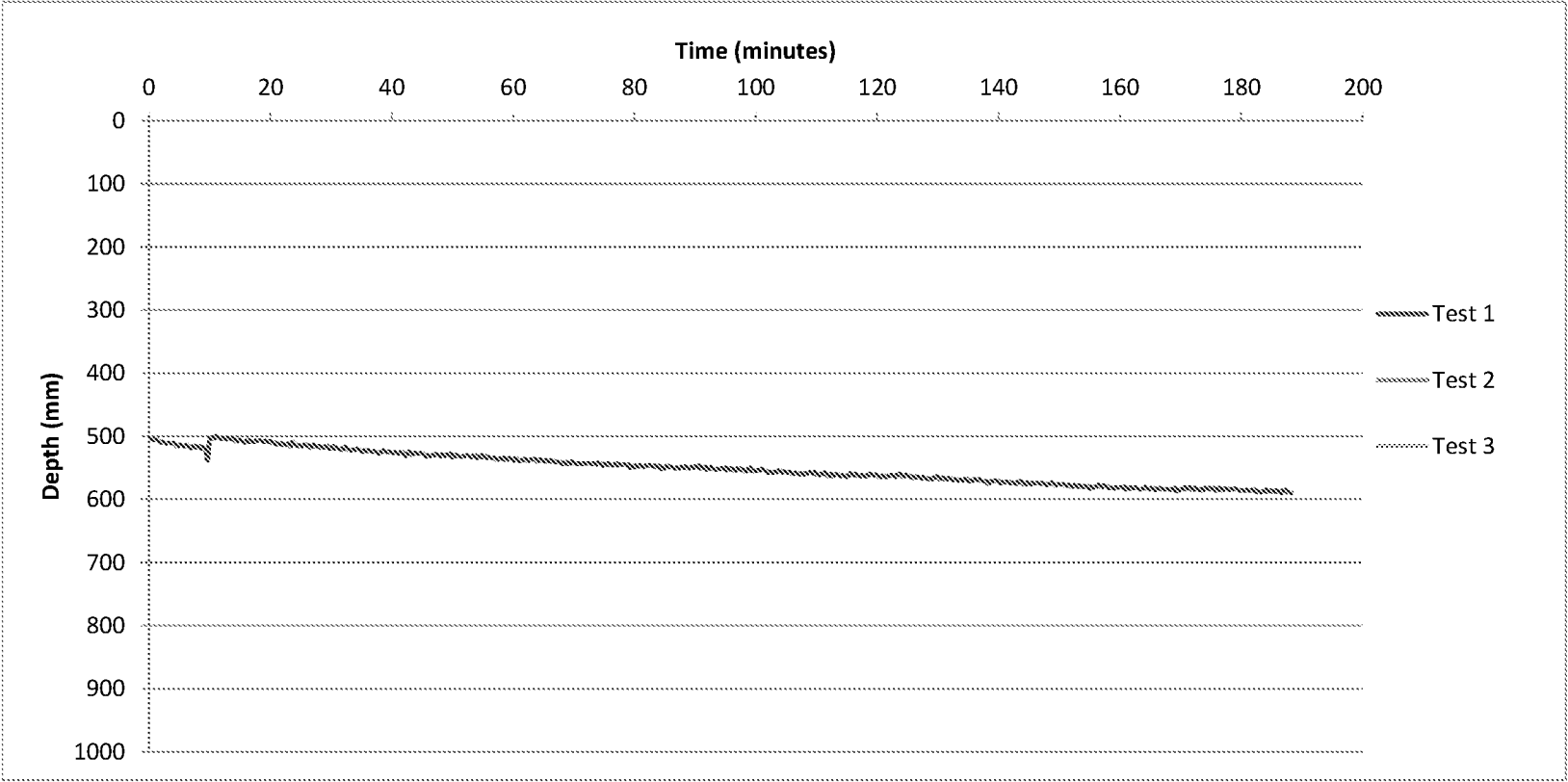
Test 1		Test 2		Test 3	
Pit Dimensions		Pit Dimensions		Pit Dimensions	
Trial pit length (mm)	1800	Trial pit length (mm)		Trial pit length (mm)	
Trial pit width (mm)	600	Trial pit width (mm)		Trial pit width (mm)	
Trial pit depth (mm)	1000	Trial pit depth (mm)		Trial pit depth (mm)	
Plan area (m ²)	1.08	Plan area (m ²)	0	Plan area (m ²)	0
Depth to water at start of test (mm)	500	Depth to water at start of test (mm)		Depth to water at start of test (mm)	
End time (sec)	12080	End time (sec)		End time (sec)	
Final depth (mm)	777	Final depth (mm)		Final depth (mm)	
75% Effective depth (mm)	625	75% Effective depth (mm)	0	75% Effective depth (mm)	0
25% Effective depth (mm)	875	25% Effective depth (mm)	0	25% Effective depth (mm)	0
Time at 75% effective depth - t _{p75} (sec)	3600	Time at 75% effective depth - t _{p75} (sec)		Time at 75% effective depth - t _{p75} (sec)	
Time at 25% effective depth - t _{p25} (sec)	NA	Time at 25% effective depth - t _{p25} (sec)		Time at 25% effective depth - t _{p25} (sec)	
Effective Storage volume of water (m ³)	0.54	Effective Storage volume of water (m ³)	0	Effective Storage volume of water (m ³)	0
V _{p75-25} (m ³)	0.27	V _{p75-25} (m ³)	0	V _{p75-25} (m ³)	0
Internal surface area - a _{p50} (m ²)	2.28	Internal surface area - a _{p50} (m ²)	0	Internal surface area - a _{p50} (m ²)	0
t _{p75-25} (sec)	#VALUE!	t _{p75-25} (sec)	0	t _{p75-25} (sec)	0
BR365 Soil Infiltration Rate	#VALUE!	BR365 Soil Infiltration Rate	#DIV/0!	BR365 Soil Infiltration Rate	#DIV/0!
Average Soil Infiltration Rate	8.8E-06	Average Soil Infiltration Rate	#DIV/0!	Average Soil Infiltration Rate	#DIV/0!
Testing completed by	GC	Calculation completed by	GC	Calculation checked by	
Date	10/02/2021	Date	02/03/2021	Date	



Infiltration Test Results and Calculation of Infiltration Rates

Site: Land South of A529 - Angmering
Client: Redrow Homes
Test Reference: SA03

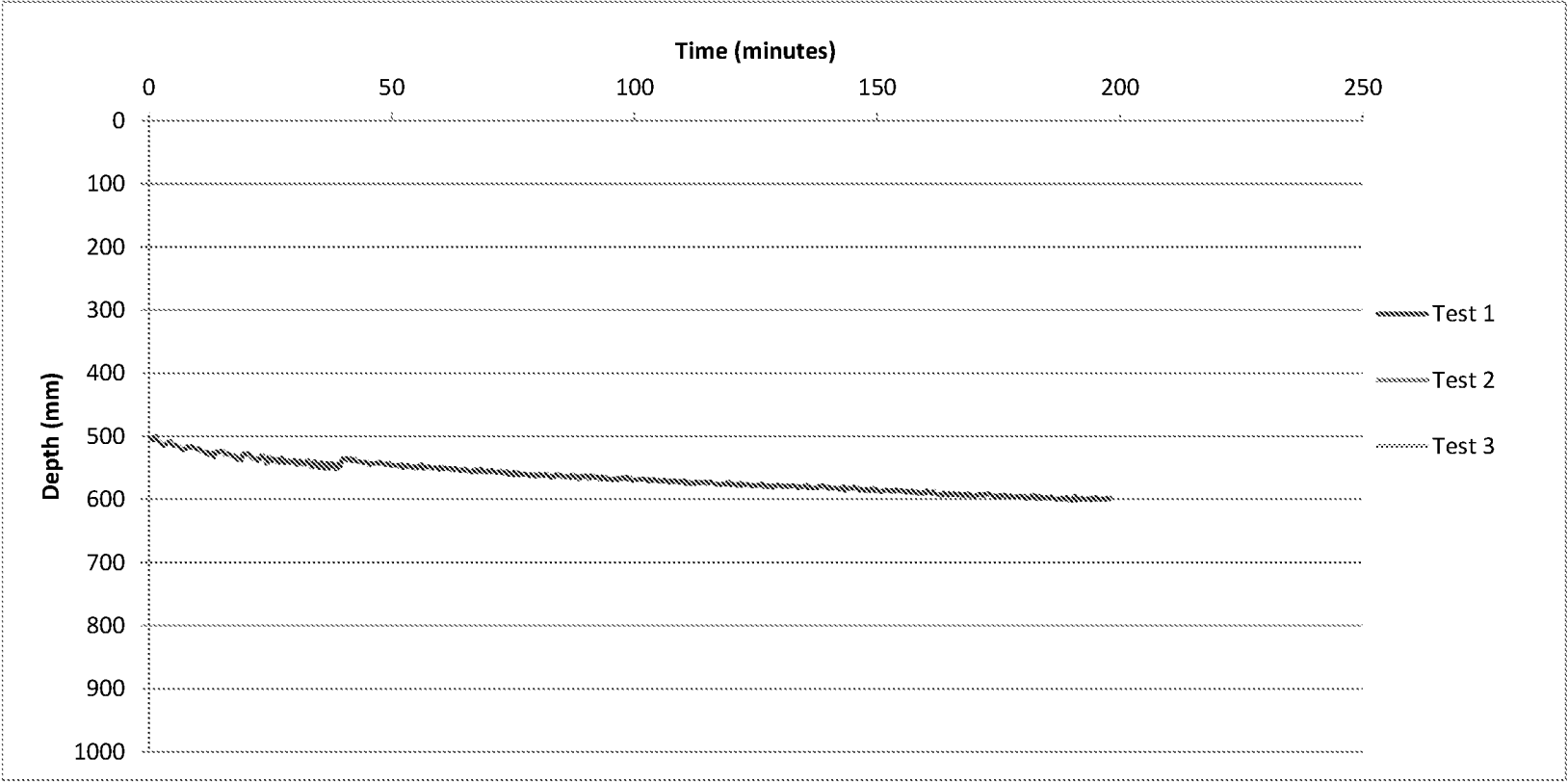
Test 1		Test 2		Test 3	
Pit Dimensions		Pit Dimensions		Pit Dimensions	
Trial pit length (mm)	1800	Trial pit length (mm)		Trial pit length (mm)	
Trial pit width (mm)	600	Trial pit width (mm)		Trial pit width (mm)	
Trial pit depth (mm)	1000	Trial pit depth (mm)		Trial pit depth (mm)	
Plan area (m ²)	1.08	Plan area (m ²)	0	Plan area (m ²)	0
Depth to water at start of test (mm)	500	Depth to water at start of test (mm)		Depth to water at start of test (mm)	
End time (sec)	11300	End time (sec)		End time (sec)	
Final depth (mm)	590	Final depth (mm)		Final depth (mm)	
75% Effective depth (mm)	625	75% Effective depth (mm)	0	75% Effective depth (mm)	0
25% Effective depth (mm)	875	25% Effective depth (mm)	0	25% Effective depth (mm)	0
Time at 75% effective depth - t _{p75} (sec)	NA	Time at 75% effective depth - t _{p75} (sec)		Time at 75% effective depth - t _{p75} (sec)	
Time at 25% effective depth - t _{p25} (sec)	NA	Time at 25% effective depth - t _{p25} (sec)		Time at 25% effective depth - t _{p25} (sec)	
Effective Storage volume of water (m ³)	0.54	Effective Storage volume of water (m ³)	0	Effective Storage volume of water (m ³)	0
V _{p75-25} (m ³)	0.27	V _{p75-25} (m ³)	0	V _{p75-25} (m ³)	0
Internal surface area - a _{p50} (m ²)	2.28	Internal surface area - a _{p50} (m ²)	0	Internal surface area - a _{p50} (m ²)	0
t _{p75-25} (sec)	#VALUE!	t _{p75-25} (sec)	0	t _{p75-25} (sec)	0
BR365 Soil Infiltration Rate	#VALUE!	BR365 Soil Infiltration Rate	#DIV/0!	BR365 Soil Infiltration Rate	#DIV/0!
Average Soil Infiltration Rate	2.6E-06	Average Soil Infiltration Rate	#DIV/0!	Average Soil Infiltration Rate	#DIV/0!
Testing completed by	GC	Calculation completed by	GC	Calculation checked by	
Date	10/02/2021	Date	02/03/2021	Date	



Infiltration Test Results and Calculation of Infiltration Rates

Site: Land South of A529 - Angmering
Client: Redrow Homes
Test Reference: SA04

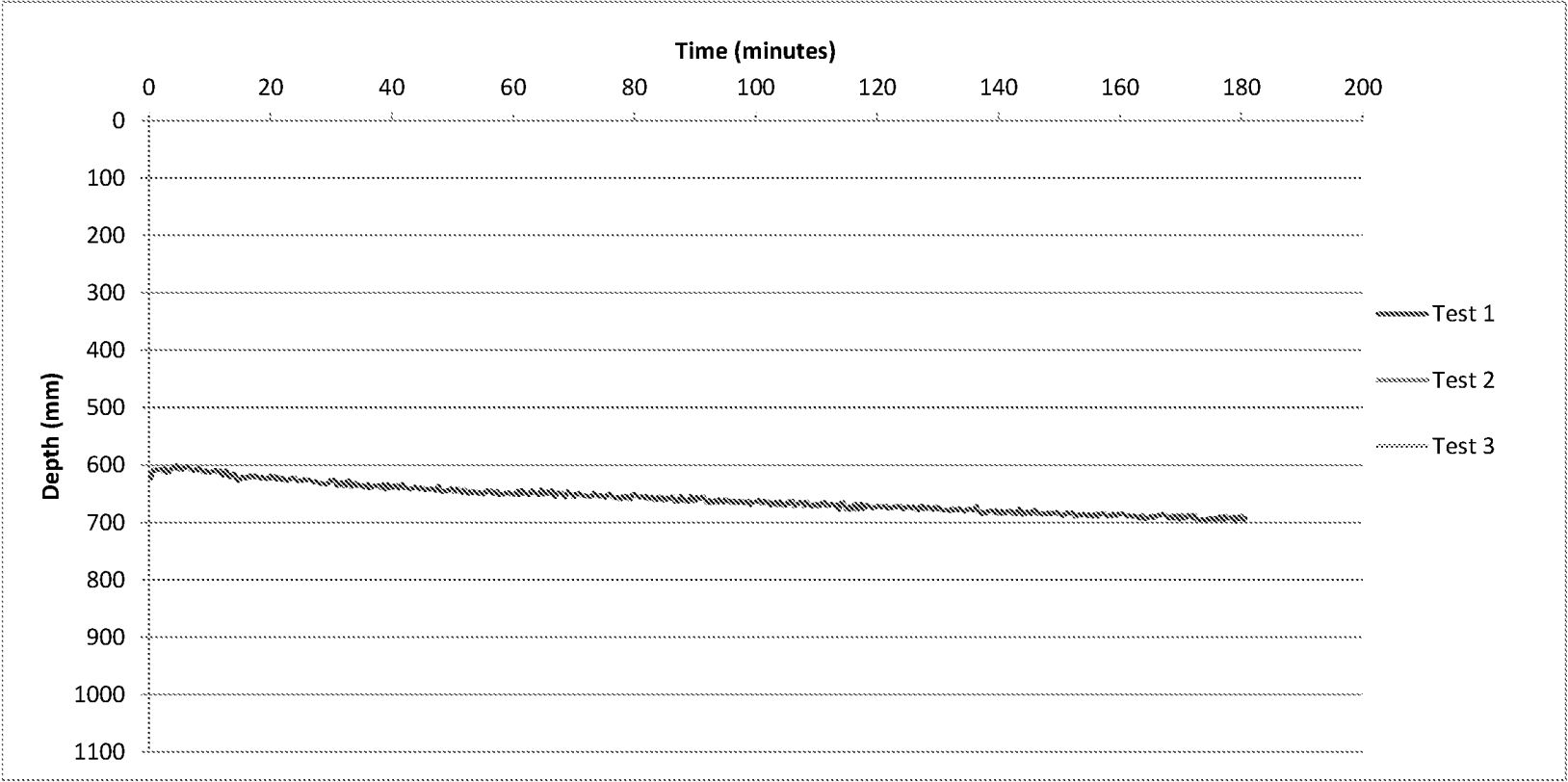
Test 1		Test 2		Test 3	
Pit Dimensions		Pit Dimensions		Pit Dimensions	
Trial pit length (mm)	1800	Trial pit length (mm)		Trial pit length (mm)	
Trial pit width (mm)	600	Trial pit width (mm)		Trial pit width (mm)	
Trial pit depth (mm)	1000	Trial pit depth (mm)		Trial pit depth (mm)	
Plan area (m ²)	1.08	Plan area (m ²)	0	Plan area (m ²)	0
Depth to water at start of test (mm)	500	Depth to water at start of test (mm)		Depth to water at start of test (mm)	
End time (sec)	11880	End time (sec)		End time (sec)	
Final depth (mm)	598	Final depth (mm)		Final depth (mm)	
75% Effective depth (mm)	625	75% Effective depth (mm)	0	75% Effective depth (mm)	0
25% Effective depth (mm)	875	25% Effective depth (mm)	0	25% Effective depth (mm)	0
Time at 75% effective depth - t _{p75} (sec)	NA	Time at 75% effective depth - t _{p75} (sec)		Time at 75% effective depth - t _{p75} (sec)	
Time at 25% effective depth - t _{p25} (sec)	NA	Time at 25% effective depth - t _{p25} (sec)		Time at 25% effective depth - t _{p25} (sec)	
Effective Storage volume of water (m ³)	0.54	Effective Storage volume of water (m ³)	0	Effective Storage volume of water (m ³)	0
V _{p75-25} (m ³)	0.27	V _{p75-25} (m ³)	0	V _{p75-25} (m ³)	0
Internal surface area - a _{p50} (m ²)	2.28	Internal surface area - a _{p50} (m ²)	0	Internal surface area - a _{p50} (m ²)	0
t _{p75-25} (sec)	#VALUE!	t _{p75-25} (sec)	0	t _{p75-25} (sec)	0
BR365 Soil Infiltration Rate	#VALUE!	BR365 Soil Infiltration Rate	#DIV/0!	BR365 Soil Infiltration Rate	#DIV/0!
Average Soil Infiltration Rate	2.7E-06	Average Soil Infiltration Rate	#DIV/0!	Average Soil Infiltration Rate	#DIV/0!
Testing completed by	GC	Calculation completed by	GC	Calculation checked by	
Date	10/02/2021	Date	02/03/2021	Date	



Infiltration Test Results and Calculation of Infiltration Rates

Site: Land South of A529 - Angmering
Client: Redrow Homes
Test Reference: SA05

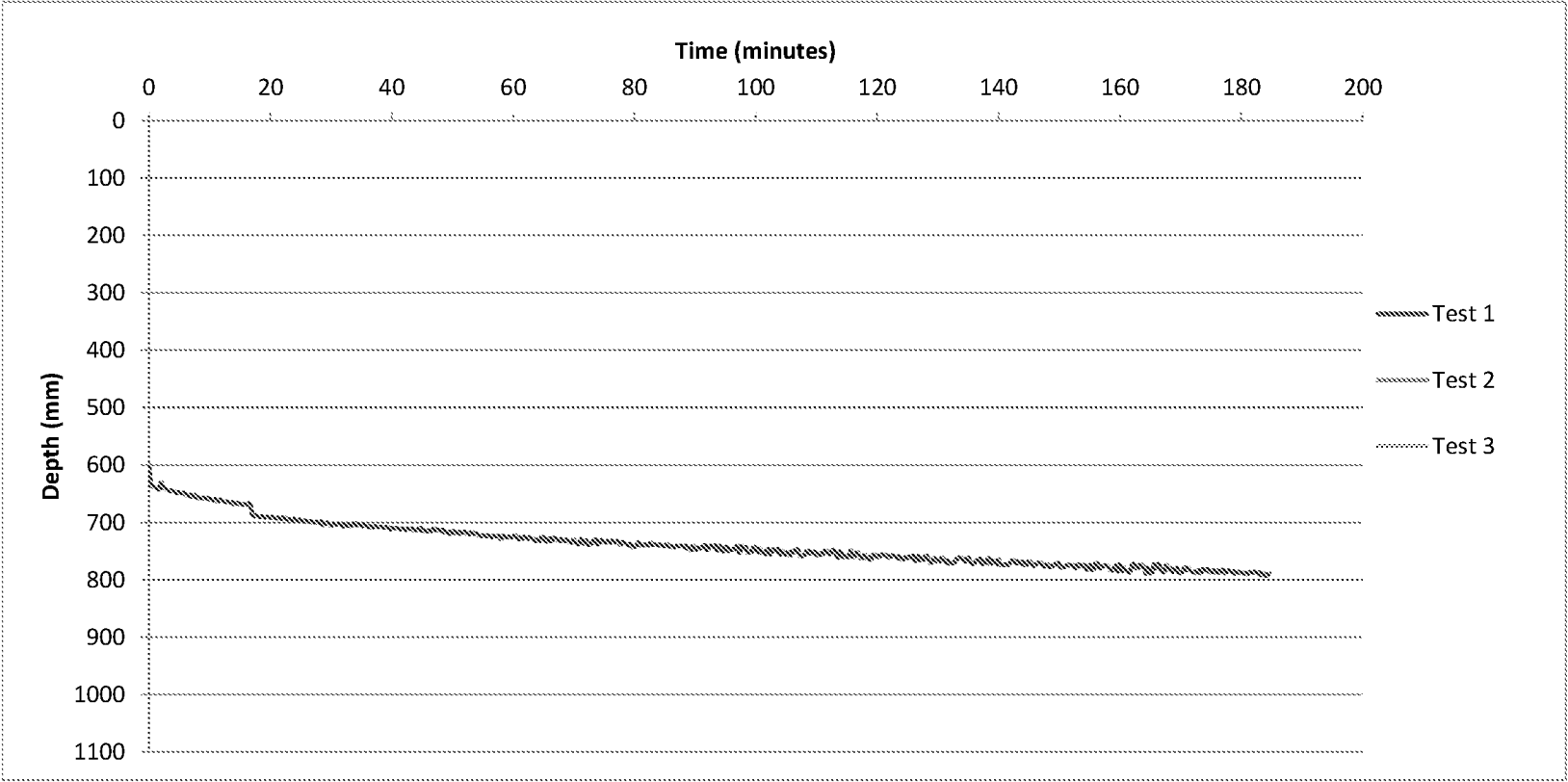
Test 1		Test 2		Test 3	
Pit Dimensions		Pit Dimensions		Pit Dimensions	
Trial pit length (mm)	1800	Trial pit length (mm)		Trial pit length (mm)	
Trial pit width (mm)	600	Trial pit width (mm)		Trial pit width (mm)	
Trial pit depth (mm)	1100	Trial pit depth (mm)		Trial pit depth (mm)	
Plan area (m ²)	1.08	Plan area (m ²)	0	Plan area (m ²)	0
Depth to water at start of test (mm)	600	Depth to water at start of test (mm)		Depth to water at start of test (mm)	
End time (sec)	10840	End time (sec)		End time (sec)	
Final depth (mm)	693	Final depth (mm)		Final depth (mm)	
75% Effective depth (mm)	725	75% Effective depth (mm)	0	75% Effective depth (mm)	0
25% Effective depth (mm)	975	25% Effective depth (mm)	0	25% Effective depth (mm)	0
Time at 75% effective depth - t _{p75} (sec)	NA	Time at 75% effective depth - t _{p75} (sec)		Time at 75% effective depth - t _{p75} (sec)	
Time at 25% effective depth - t _{p25} (sec)	NA	Time at 25% effective depth - t _{p25} (sec)		Time at 25% effective depth - t _{p25} (sec)	
Effective Storage volume of water (m ³)	0.54	Effective Storage volume of water (m ³)	0	Effective Storage volume of water (m ³)	0
V _{p75-25} (m ³)	0.27	V _{p75-25} (m ³)	0	V _{p75-25} (m ³)	0
Internal surface area - a _{p50} (m ²)	2.28	Internal surface area - a _{p50} (m ²)	0	Internal surface area - a _{p50} (m ²)	0
t _{p75-25} (sec)	#VALUE!	t _{p75-25} (sec)	0	t _{p75-25} (sec)	0
BR365 Soil Infiltration Rate	#VALUE!	BR365 Soil Infiltration Rate	#DIV/0!	BR365 Soil Infiltration Rate	#DIV/0!
Average Soil Infiltration Rate	2.8E-06	Average Soil Infiltration Rate	#DIV/0!	Average Soil Infiltration Rate	#DIV/0!
Testing completed by	GC	Calculation completed by	GC	Calculation checked by	
Date	10/02/2021	Date	02/03/2021	Date	



Infiltration Test Results and Calculation of Infiltration Rates

Site: Land South of A529 - Angmering
Client: Redrow Homes
Test Reference: SA06

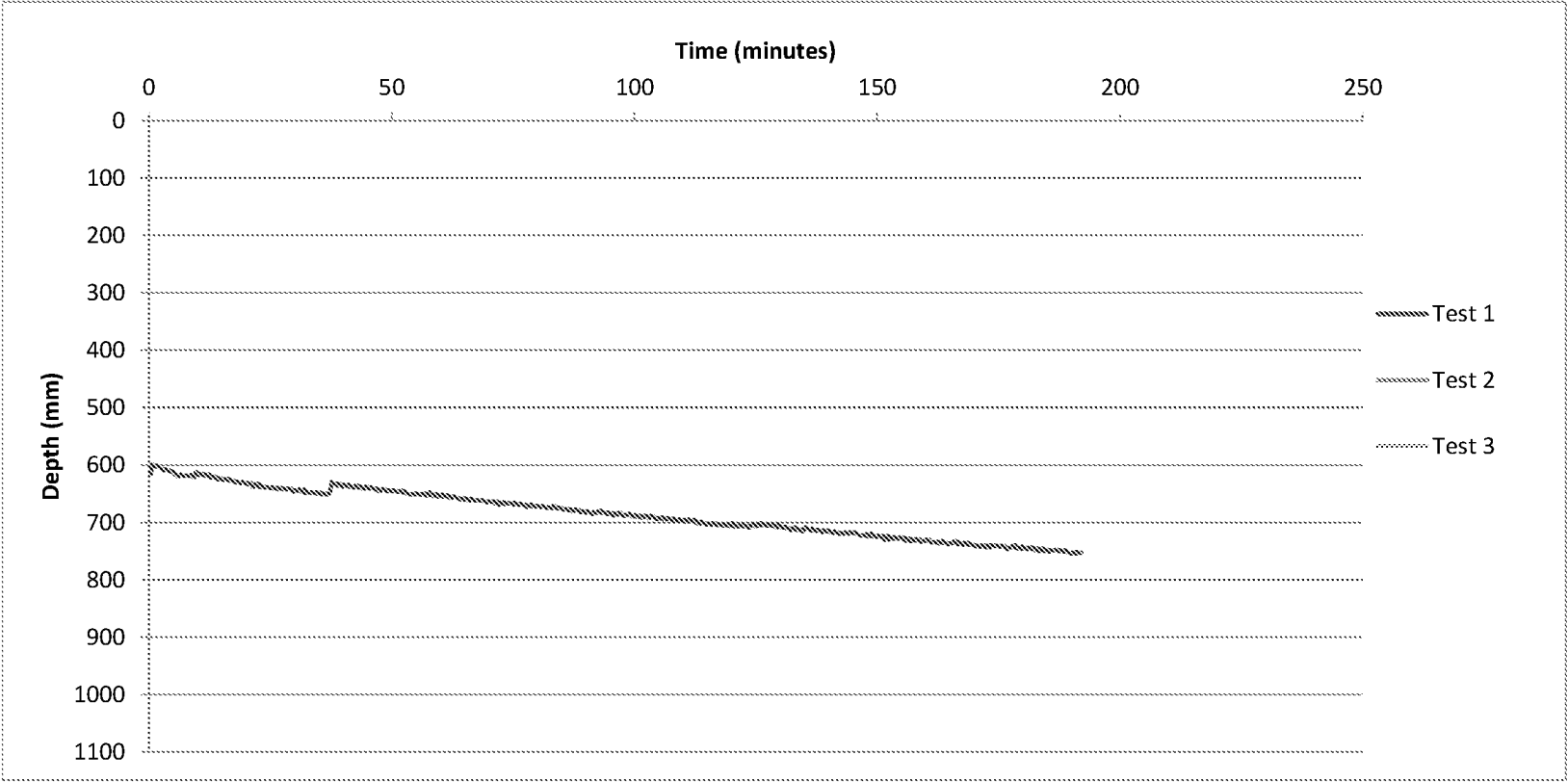
Test 1		Test 2		Test 3	
Pit Dimensions		Pit Dimensions		Pit Dimensions	
Trial pit length (mm)	1800	Trial pit length (mm)		Trial pit length (mm)	
Trial pit width (mm)	600	Trial pit width (mm)		Trial pit width (mm)	
Trial pit depth (mm)	1100	Trial pit depth (mm)		Trial pit depth (mm)	
Plan area (m ²)	1.08	Plan area (m ²)	0	Plan area (m ²)	0
Depth to water at start of test (mm)	600	Depth to water at start of test (mm)		Depth to water at start of test (mm)	
End time (sec)	11080	End time (sec)		End time (sec)	
Final depth (mm)	789	Final depth (mm)		Final depth (mm)	
75% Effective depth (mm)	725	75% Effective depth (mm)	0	75% Effective depth (mm)	0
25% Effective depth (mm)	975	25% Effective depth (mm)	0	25% Effective depth (mm)	0
Time at 75% effective depth - t _{p75} (sec)	3280	Time at 75% effective depth - t _{p75} (sec)		Time at 75% effective depth - t _{p75} (sec)	
Time at 25% effective depth - t _{p25} (sec)	NA	Time at 25% effective depth - t _{p25} (sec)		Time at 25% effective depth - t _{p25} (sec)	
Effective Storage volume of water (m ³)	0.54	Effective Storage volume of water (m ³)	0	Effective Storage volume of water (m ³)	0
V _{p75-25} (m ³)	0.27	V _{p75-25} (m ³)	0	V _{p75-25} (m ³)	0
Internal surface area - a _{p50} (m ²)	2.28	Internal surface area - a _{p50} (m ²)	0	Internal surface area - a _{p50} (m ²)	0
t _{p75-25} (sec)	#VALUE!	t _{p75-25} (sec)	0	t _{p75-25} (sec)	0
BR365 Soil Infiltration Rate	#VALUE!	BR365 Soil Infiltration Rate	#DIV/0!	BR365 Soil Infiltration Rate	#DIV/0!
Average Soil Infiltration Rate	6.1E-06	Average Soil Infiltration Rate	#DIV/0!	Average Soil Infiltration Rate	#DIV/0!
Testing completed by	GC	Calculation completed by	GC	Calculation checked by	
Date	10/02/2021	Date	02/03/2021	Date	



Infiltration Test Results and Calculation of Infiltration Rates

Site: Land South of A529 - Angmering
Client: Redrow Homes
Test Reference: SA07

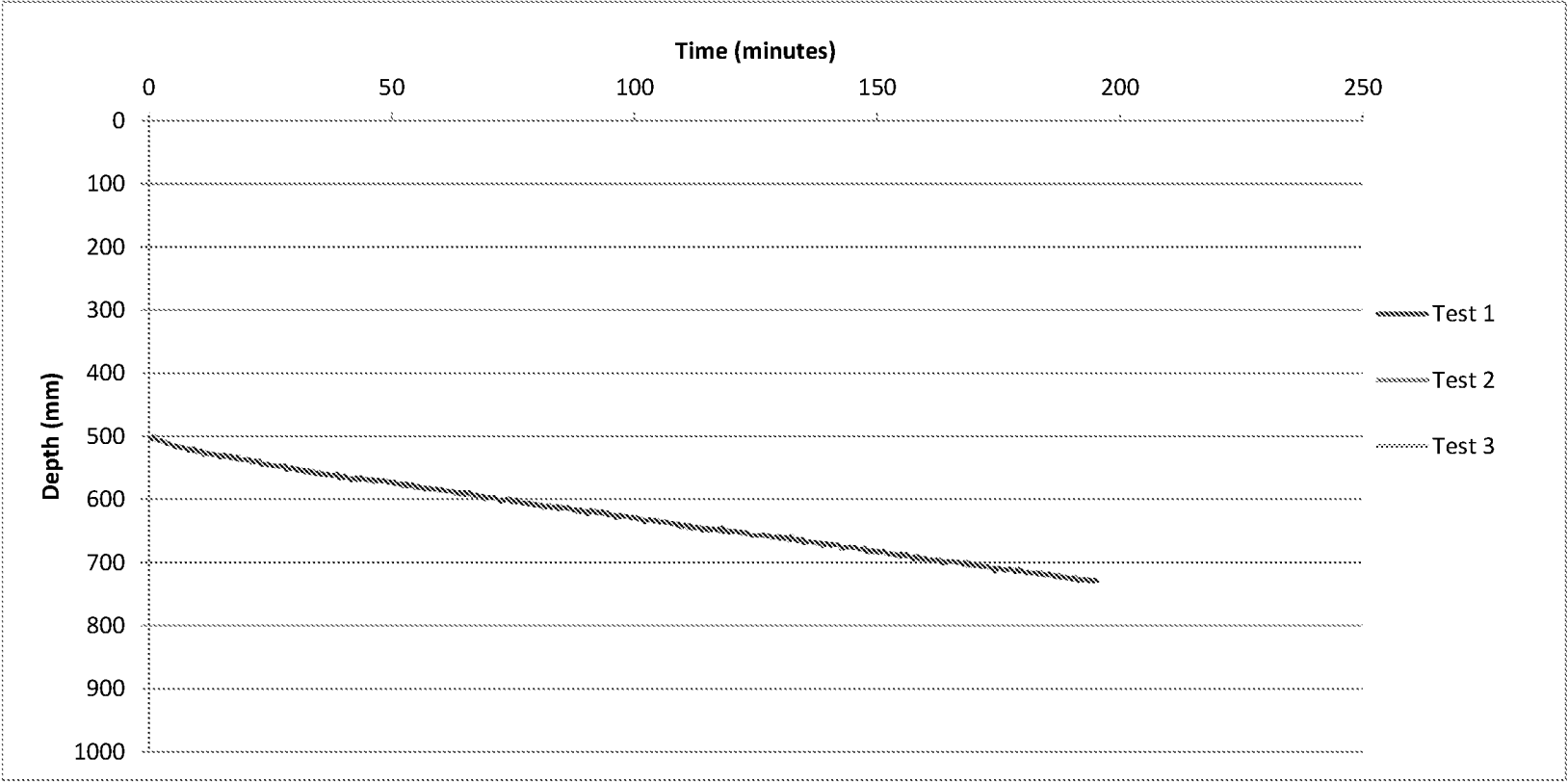
Test 1		Test 2		Test 3	
Pit Dimensions		Pit Dimensions		Pit Dimensions	
Trial pit length (mm)	1800	Trial pit length (mm)		Trial pit length (mm)	
Trial pit width (mm)	600	Trial pit width (mm)		Trial pit width (mm)	
Trial pit depth (mm)	1100	Trial pit depth (mm)		Trial pit depth (mm)	
Plan area (m ²)	1.08	Plan area (m ²)	0	Plan area (m ²)	0
Depth to water at start of test (mm)	600	Depth to water at start of test (mm)		Depth to water at start of test (mm)	
End time (sec)	11520	End time (sec)		End time (sec)	
Final depth (mm)	753	Final depth (mm)		Final depth (mm)	
75% Effective depth (mm)	725	75% Effective depth (mm)	0	75% Effective depth (mm)	0
25% Effective depth (mm)	975	25% Effective depth (mm)	0	25% Effective depth (mm)	0
Time at 75% effective depth - t _{p75} (sec)	8900	Time at 75% effective depth - t _{p75} (sec)		Time at 75% effective depth - t _{p75} (sec)	
Time at 25% effective depth - t _{p25} (sec)	NA	Time at 25% effective depth - t _{p25} (sec)		Time at 25% effective depth - t _{p25} (sec)	
Effective Storage volume of water (m ³)	0.54	Effective Storage volume of water (m ³)	0	Effective Storage volume of water (m ³)	0
V _{p75-25} (m ³)	0.27	V _{p75-25} (m ³)	0	V _{p75-25} (m ³)	0
Internal surface area - a _{p50} (m ²)	2.28	Internal surface area - a _{p50} (m ²)	0	Internal surface area - a _{p50} (m ²)	0
t _{p75-25} (sec)	#VALUE!	t _{p75-25} (sec)	0	t _{p75-25} (sec)	0
BR365 Soil Infiltration Rate	#VALUE!	BR365 Soil Infiltration Rate	#DIV/0!	BR365 Soil Infiltration Rate	#DIV/0!
Average Soil Infiltration Rate	4.6E-06	Average Soil Infiltration Rate	#DIV/0!	Average Soil Infiltration Rate	#DIV/0!
Testing completed by	GC	Calculation completed by	GC	Calculation checked by	
Date	10/02/2021	Date	02/03/2021	Date	

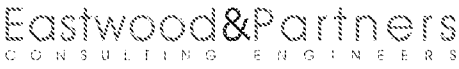


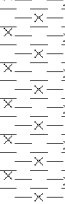
Infiltration Test Results and Calculation of Infiltration Rates

Site: Land South of A529 - Angmering
Client: Redrow Homes
Test Reference: SA08

Test 1		Test 2		Test 3	
Pit Dimensions		Pit Dimensions		Pit Dimensions	
Trial pit length (mm)	1800	Trial pit length (mm)		Trial pit length (mm)	
Trial pit width (mm)	600	Trial pit width (mm)		Trial pit width (mm)	
Trial pit depth (mm)	1000	Trial pit depth (mm)		Trial pit depth (mm)	
Plan area (m ²)	1.08	Plan area (m ²)	0	Plan area (m ²)	0
Depth to water at start of test (mm)	500	Depth to water at start of test (mm)		Depth to water at start of test (mm)	
End time (sec)	11720	End time (sec)		End time (sec)	
Final depth (mm)	729	Final depth (mm)		Final depth (mm)	
75% Effective depth (mm)	625	75% Effective depth (mm)	0	75% Effective depth (mm)	0
25% Effective depth (mm)	875	25% Effective depth (mm)	0	25% Effective depth (mm)	0
Time at 75% effective depth - t _{p75} (sec)	5680	Time at 75% effective depth - t _{p75} (sec)		Time at 75% effective depth - t _{p75} (sec)	
Time at 25% effective depth - t _{p25} (sec)	NA	Time at 25% effective depth - t _{p25} (sec)		Time at 25% effective depth - t _{p25} (sec)	
Effective Storage volume of water (m ³)	0.54	Effective Storage volume of water (m ³)	0	Effective Storage volume of water (m ³)	0
V _{p75-25} (m ³)	0.27	V _{p75-25} (m ³)	0	V _{p75-25} (m ³)	0
Internal surface area - a _{p50} (m ²)	2.28	Internal surface area - a _{p50} (m ²)	0	Internal surface area - a _{p50} (m ²)	0
t _{p75-25} (sec)	#VALUE!	t _{p75-25} (sec)	0	t _{p75-25} (sec)	0
BR365 Soil Infiltration Rate	#VALUE!	BR365 Soil Infiltration Rate	#DIV/0!	BR365 Soil Infiltration Rate	#DIV/0!
Average Soil Infiltration Rate	7.2E-06	Average Soil Infiltration Rate	#DIV/0!	Average Soil Infiltration Rate	#DIV/0!
Testing completed by	GC	Calculation completed by	GC	Calculation checked by	
Date	10/02/2021	Date	02/03/2021	Date	

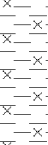


				TrialPit No SA01 Sheet 1 of 1			
Project Name Land South of A259			Project No. 45405		Co-ords: - Level:		Date 10/02/2021
Location: Angmering, West Sussex					Dimensions: 1.80m		Scale 1:25
Client: Redrow Homes					Depth: 1.10m		Logged GC

Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.40			TOPSOIL: Firm, brown, silty CLAY. Roots noted.	
			1.10			RIVER TERRACE DEPOSITS: Firm to stiff, orangish brown, silty CLAY.	1
						Trialpit Complete at 1.100m	
							2
							3
							4

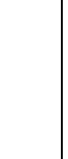
Remarks:							
Stability: 1. Trial pit remained dry and stable							

Project Name	Project No.	Co-ords: -	Date
Land South of A259	45405	Level:	10/02/2021
Location: Angmering, West Sussex	Dimensions:		Scale
Client: Redrow Homes	Depth: 1.00m	0.60m 	1:25
			Logged GC

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.50			TOPSOIL: Firm, brown, silty CLAY. Roots noted.	
						RIVER TERRACE DEPOSITS: Firm to stiff, orangish brown, silty CLAY.	
			1.00				Trialpit Complete at 1.000m

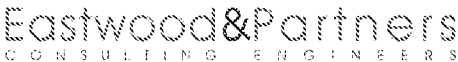
Remarks:	
Stability:	1. Trial pit remained dry and stable

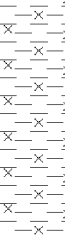
Project Name	Project No.	Co-ords: -	Date
Land South of A259	45405	Level:	10/02/2021
Location: Angmering, West Sussex	Dimensions:		Scale
Client: Redrow Homes	Depth: 1.00m	0.60m 	1:25
			Logged GC

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.30			TOPSOIL: Firm, brown, silty CLAY. Roots noted.
			1.00			RIVER TERRACE DEPOSITS: Firm to stiff, orangish brown, silty CLAY.
						Trialpit Complete at 1.000m

Remarks:	
Stability: 1. Trial pit remained dry and stable	

Eastwood&Partners CONSULTING ENGINEERS						TrialPit No SA05 Sheet 1 of 1	
Project Name Land South of A259			Project No. 45405		Co-ords: - Level:		Date 10/02/2021
Location: Angmering, West Sussex					Dimensions: 1.80m		Scale 1:25
Client: Redrow Homes					Depth: 1.10m		Logged GC
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.20			TOPSOIL: Firm, brown, silty CLAY. Roots noted.	
			1.10			RIVER TERRACE DEPOSITS: Firm to stiff, orangish brown, silty CLAY.	
						Trialpit Complete at 1.100m	
Remarks:							
Stability: 1. Trial pit remained dry and stable							

				TrialPit No SA06 Sheet 1 of 1			
Project Name Land South of A259			Project No. 45405		Co-ords: - Level:		Date 10/02/2021
Location: Angmering, West Sussex					Dimensions: 1.80m		Scale 1:25
Client: Redrow Homes					Depth: 1.10m		Logged GC

Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.30			TOPSOIL: Firm, brown, silty CLAY. Roots noted.	
			1.10			RIVER TERRACE DEPOSITS: Firm to stiff, orangish brown, silty CLAY.	1
						Trialpit Complete at 1.100m	2
							3
							4

Remarks:	
Stability: 1. Trial pit remained dry and stable	



Appendix 3 – Calculations

Qbar Calculation

Drainage Calculation

Greenfield runoff rate estimation for sites

Greenfield runoff tool

Calculated by:	Jonathan Shuttleworth
Site name:	Land South of A259
Site location:	Angmering

Site Details

Latitude:	50.81716° N
Longitude:	0.46647° W
Reference:	3108805516
Date:	Jun 02 2021 15:32

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

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	1.0
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Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	719	719
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	1.88	1.88
1 in 1 year (l/s):	1.6	1.6
1 in 30 years (l/s):	4.33	4.33
1 in 100 year (l/s):	6	6
1 in 200 years (l/s):	7.03	7.03

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

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	5	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	9.999
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.061	5.00	8.988	1200	508090.139	103142.596	1.657
2	0.064	5.00	8.742	1200	508061.314	103140.895	1.656
3	0.048	5.00	8.587	1200	507985.789	103146.553	1.425
4	0.076	5.00	8.650	1200	507986.468	103135.400	1.476
5			8.588	1200	507991.432	103139.592	1.554
6	0.023	5.00	8.693	1200	508001.296	103137.196	1.701
7	0.039	5.00	8.722	1350	508020.300	103138.409	1.883
8	0.036	5.00	8.518	1350	508022.455	103100.599	1.796
9	0.068	5.00	8.499	1350	508024.012	103073.290	1.862
10	0.067	5.00	8.100		508039.367	103056.227	1.600
11	0.012	5.00	8.233	1350	508025.659	103047.575	1.877
12	0.029	5.00	8.167	1350	508020.952	103041.244	1.836
13	0.109	5.00	8.072	1350	507996.525	103039.801	1.892
14	0.063	5.00	8.309	1350	507968.255	103038.166	2.199
15			8.301	1350	507961.489	103046.358	2.218
16	0.039	5.00	8.178	1200	507959.419	103081.609	1.425
17			8.187	1350	507960.765	103058.681	2.135
17_OUT	0.077		8.100		507949.209	103058.022	2.096
18	0.027	5.00	8.971	1200	508124.614	103161.991	1.425
19			9.144	1200	508111.431	103159.705	1.677
20	0.027	5.00	9.032	1200	508107.873	103147.838	1.638
21	0.103	5.00	8.823	1200	508107.833	103125.500	1.636
22	0.037	5.00	8.613	1200	508110.019	103104.954	1.516
23	0.043	5.00	8.661	1200	508110.375	103078.104	1.674
24	0.054	5.00	8.400	1200	508075.597	103072.018	1.558
24_OUT			8.350		508066.312	103064.356	1.729
25	0.017	5.00	8.682	1200	508109.383	103063.997	1.395
26	0.086	5.00	8.400	1200	508125.385	103045.949	1.425
27	0.032	5.00	8.525	1200	508108.792	103044.969	1.648
28			8.680	1200	508094.513	103045.503	1.888
29			8.300	1200	508084.383	103052.183	1.580
29_OUT			8.300		508067.175	103058.402	1.688
30		5.00	8.100		507939.130	103045.118	2.150
31			8.100	1350	507941.638	103019.670	2.213
31_OUT			8.100		507936.465	103009.041	2.331
32	0.069	5.00	8.500	1200	508039.719	103073.986	1.600
32_OUT			8.100		508040.602	103063.170	1.479
33	0.082	5.00	8.100	1200	508044.309	103048.191	1.350
33_OUT			8.100		508043.882	103056.352	1.479

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.010	17	17_OUT	11.575	0.600	6.952	6.923	0.029	399.1	450	9.94	50.0
1.009	15	17	12.344	0.600	6.983	6.952	0.031	398.2	450	8.85	50.0
5.000	16	17	22.367	0.600	6.753	6.277	0.476	48.3	225	5.20	50.0
1.008	14	15	10.625	0.600	6.110	6.063	0.047	393.5	450	9.65	50.0
1.007	13	14	28.817	0.600	6.180	6.110	0.070	494.5	450	8.47	50.0
1.006	12	13	24.470	0.600	6.331	6.255	0.076	322.0	375	8.00	50.0
1.005	11	12	7.869	0.600	6.356	6.331	0.025	315.6	375	7.60	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	E Area (ha)	E Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.010	1.011	160.8	113.0	1.685	1.627	0.834	0.0	279	1.092
1.009	1.012	161.0	99.5	1.768	1.685	0.734	0.0	256	1.063
5.000	1.887	75.0	13.5	1.200	1.685	0.099	0.0	65	1.441
1.008	1.018	162.0	99.5	1.749	1.768	0.734	0.0	255	1.068
1.007	1.004	159.7	91.0	1.442	1.749	0.671	0.0	244	1.036
1.006	1.004	110.9	76.3	1.461	1.442	0.563	0.0	229	1.079
1.005	1.014	112.0	72.3	1.502	1.461	0.534	0.0	219	1.075

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.004	9	11	25.768	0.600	6.637	6.356	0.281	91.7	375	7.47	50.0
4.000	10	11	16.210	0.600	6.500	6.431	0.069	234.9	300	5.26	50.0
1.003	8	9	27.353	0.600	6.722	6.637	0.085	321.8	375	7.24	50.0
1.002	7	8	37.971	0.600	6.839	6.722	0.117	323.7	375	6.79	50.0
1.001	2	7	41.089	0.600	7.086	6.914	0.172	238.9	300	6.16	50.0
2.002	6	7	19.043	0.600	6.992	6.914	0.078	244.1	300	5.69	50.0
2.001	5	6	16.151	0.600	7.034	6.992	0.042	241.7	300	5.32	50.0
2.000	3	5	8.961	0.600	7.162	7.109	0.053	169.1	225	5.15	50.0
3.000	4	5	6.497	0.600	7.174	7.109	0.065	100.6	225	5.08	50.0
1.000	1	2	28.875	0.600	7.331	7.161	0.170	169.9	225	5.48	50.0
6.006	24	24_OUT	12.038	0.600	6.942	6.792	0.050	240.8	300	7.37	50.0
6.005	23	24	35.306	0.600	6.987	6.842	0.145	243.5	300	7.17	50.0
6.004	22	23	26.852	0.600	7.097	6.987	0.110	244.1	300	6.58	50.0
6.003	21	22	26.662	0.600	7.187	7.097	0.090	230.5	300	6.15	50.0
6.002	20	21	22.338	0.600	7.394	7.262	0.132	169.2	225	5.80	50.0
6.001	19	20	12.389	0.600	7.467	7.394	0.073	169.7	225	5.43	50.0
6.000	18	19	13.389	0.600	7.546	7.467	0.079	169.4	225	5.22	50.0
7.003	29	29_OUT	18.297	0.600	6.720	6.612	0.108	169.4	225	6.02	50.0
7.002	28	29	12.134	0.600	6.792	6.720	0.072	168.5	225	5.72	50.0
7.001	27	28	14.289	0.600	6.877	6.792	0.085	168.1	225	5.51	50.0
7.000	25	27	19.637	0.600	7.287	6.877	0.410	46.4	225	5.16	50.0
8.000	26	27	16.622	0.600	6.975	6.877	0.098	168.6	225	5.26	50.0
9.001	31	31_OUT	11.821	0.600	5.887	5.769	0.118	100.2	150	5.62	50.0
9.000	30	31	25.371	0.600	5.950	5.887	0.063	405.9	450	5.43	50.0
10.000	32	32_OUT	10.892	0.600	6.900	6.750	0.150	72.3	150	5.15	50.0
11.000	33	33_OUT	8.172	0.600	6.750	6.669	0.081	100.9	150	5.14	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	E Area (ha)	E Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.004	1.892	209.0	61.7	1.487	1.502	0.455	0.0	139	1.653
4.000	1.021	72.2	9.0	1.300	1.502	0.067	0.0	71	0.702
1.003	1.004	110.9	52.5	1.421	1.487	0.387	0.0	181	0.990
1.002	1.001	110.6	47.5	1.508	1.421	0.351	0.0	172	0.965
1.001	1.013	71.6	19.6	1.356	1.508	0.145	0.0	107	0.867
2.002	1.002	70.8	19.8	1.401	1.508	0.146	0.0	108	0.862
2.001	1.007	71.2	16.7	1.254	1.401	0.124	0.0	99	0.827
2.000	1.002	39.9	6.5	1.200	1.254	0.048	0.0	61	0.741
3.000	1.307	52.0	10.3	1.251	1.254	0.076	0.0	67	1.019
1.000	1.000	39.8	8.3	1.432	1.356	0.061	0.0	70	0.795
6.006	1.009	71.3	39.7	1.258	1.258	0.293	0.0	160	1.035
6.005	1.003	70.9	32.4	1.374	1.258	0.239	0.0	142	0.980
6.004	1.002	70.8	26.3	1.216	1.374	0.194	0.0	126	0.929
6.003	1.031	72.9	21.3	1.336	1.216	0.157	0.0	110	0.897
6.002	1.002	39.8	7.3	1.413	1.336	0.054	0.0	65	0.764
6.001	1.001	39.8	3.6	1.452	1.413	0.027	0.0	45	0.622
6.000	1.002	39.8	3.6	1.200	1.452	0.027	0.0	45	0.623
7.003	1.001	39.8	18.3	1.355	1.463	0.135	0.0	107	0.980
7.002	1.004	39.9	18.3	1.663	1.355	0.135	0.0	107	0.982
7.001	1.005	40.0	18.3	1.423	1.663	0.135	0.0	107	0.984
7.000	1.924	76.5	2.2	1.170	1.423	0.017	0.0	26	0.853
8.000	1.001	39.8	11.6	1.200	1.423	0.086	0.0	83	0.871
9.001	1.004	17.7	0.0	2.063	2.181	0.000	0.0	0	0.000
9.000	1.003	159.5	0.0	1.700	1.763	0.000	0.0	0	0.000
10.000	1.183	20.9	9.4	1.450	1.200	0.069	0.0	70	1.149
11.000	1.000	17.7	11.2	1.200	1.281	0.082	0.0	86	1.056

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.010	11.575	399.1	450	PH1	8.187	6.052	1.685	8.100	6.052	1.627
1.009	12.344	398.2	450	PH1	8.301	6.083	1.768	8.187	6.052	1.685
5.000	22.967	498.2	225	PH1	8.178	6.753	1.200	8.187	6.277	1.685
1.008	10.625	399.5	450	PH1	8.309	6.110	1.749	8.301	6.083	1.768

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.010	17	1350	Manhole	Adoptable	17_OUT		Junction	
1.009	15	1350	Manhole	Adoptable	17	1350	Manhole	Adoptable
5.000	16	1200	Manhole	Adoptable	17	1350	Manhole	Adoptable
1.008	14	1350	Manhole	Adoptable	15	1350	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	28.317	404.5	450	PH1	8.072	6.188	1.442	8.309	6.188	1.749
1.006	24.470	322.0	375	PH1	8.167	6.231	1.461	8.072	6.235	1.442
1.005	7.889	315.6	375	PH1	8.233	6.356	1.502	8.167	6.381	1.461
1.004	25.768	31.7	375	PH1	8.499	6.637	1.487	8.233	6.356	1.502
4.000	16.210	234.9	300	PH1	8.100	6.500	1.300	8.233	6.431	1.502
1.003	27.353	321.8	375	PH1	8.518	6.722	1.421	8.499	6.637	1.487
1.002	37.871	323.7	375	PH1	8.722	6.839	1.508	8.518	6.722	1.421
1.001	41.089	239.9	300	PH1	8.742	7.086	1.356	8.722	6.814	1.508
2.002	19.043	244.1	300	PH1	8.693	6.992	1.401	8.722	6.919	1.508
2.001	10.151	241.7	300	PH1	8.588	7.034	1.254	8.693	6.992	1.401
2.000	6.961	169.1	225	PH1	8.587	7.162	1.200	8.588	7.109	1.254
3.000	6.437	160.0	225	PH1	8.650	7.174	1.251	8.588	7.109	1.254
1.000	28.375	169.9	225	PH1	8.988	7.331	1.432	8.742	7.161	1.356
6.006	12.939	249.9	300	PH1	8.400	6.842	1.258	8.350	6.792	1.258
6.005	35.306	243.5	300	PH1	8.661	6.987	1.374	8.400	6.842	1.258
6.004	26.952	244.1	300	PH1	8.613	7.097	1.216	8.661	6.987	1.374
6.003	20.662	239.5	300	PH1	8.823	7.187	1.336	8.613	7.097	1.216
6.002	22.338	169.2	225	PH1	9.032	7.294	1.413	8.823	7.262	1.336
6.001	15.389	169.7	225	PH1	9.144	7.467	1.452	9.032	7.334	1.413
6.000	13.380	169.4	225	PH1	8.971	7.546	1.200	9.144	7.467	1.452
7.003	10.297	169.4	225	PH1	8.300	6.726	1.355	8.300	6.812	1.463
7.002	12.134	169.5	225	PH1	8.680	6.792	1.663	8.300	6.726	1.355
7.001	14.289	169.1	225	PH1	8.525	6.877	1.423	8.680	6.792	1.663
7.000	13.037	46.9	225	PH1	8.682	7.287	1.170	8.525	6.877	1.423
8.000	16.622	169.6	225	PH1	8.400	6.975	1.200	8.525	6.877	1.423
9.001	11.821	100.2	150	PH1	8.100	5.887	2.063	8.100	5.769	2.181
9.000	25.571	405.9	450	PH1	8.100	5.950	1.700	8.100	5.887	1.763
10.000	10.852	72.3	150	PH1	8.500	6.900	1.450	8.100	6.750	1.200
11.000	8.172	100.9	150	PH1	8.100	6.750	1.200	8.100	6.689	1.281

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.007	13	1350	Manhole	Adoptable	14	1350	Manhole	Adoptable
1.006	12	1350	Manhole	Adoptable	13	1350	Manhole	Adoptable
1.005	11	1350	Manhole	Adoptable	12	1350	Manhole	Adoptable
1.004	9	1350	Manhole	Adoptable	11	1350	Manhole	Adoptable
4.000	10		Junction		11	1350	Manhole	Adoptable
1.003	8	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable
1.002	7	1350	Manhole	Adoptable	8	1350	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	7	1350	Manhole	Adoptable
2.002	6	1200	Manhole	Adoptable	7	1350	Manhole	Adoptable
2.001	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
2.000	3	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
3.000	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
6.006	24	1200	Manhole	Adoptable	24_OUT		Junction	
6.005	23	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
6.004	22	1200	Manhole	Adoptable	23	1200	Manhole	Adoptable
6.003	21	1200	Manhole	Adoptable	22	1200	Manhole	Adoptable
6.002	20	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable
6.001	19	1200	Manhole	Adoptable	20	1200	Manhole	Adoptable
6.000	18	1200	Manhole	Adoptable	19	1200	Manhole	Adoptable
7.003	29	1200	Manhole	Adoptable	29_OUT		Junction	
7.002	28	1200	Manhole	Adoptable	29	1200	Manhole	Adoptable
7.001	27	1200	Manhole	Adoptable	28	1200	Manhole	Adoptable
7.000	25	1200	Manhole	Adoptable	27	1200	Manhole	Adoptable
8.000	26	1200	Manhole	Adoptable	27	1200	Manhole	Adoptable
9.001	31	1350	Manhole	Adoptable	31_OUT		Junction	
9.000	30		Junction		31	1350	Manhole	Adoptable
10.000	32	1200	Manhole	Adoptable	32_OUT		Junction	
11.000	33	1200	Manhole	Adoptable	33_OUT		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	508090.139	103142.596	8.988	1.657	1200				
							0	1.000	7.931



Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
2	508061.314	103140.895	8.742	1.656	1200		1	1.000	7.161 225
							0	1.001	7.086 300
3	507985.789	103146.553	8.587	1.425	1200		0	2.000	7.162 225
4	507986.468	103135.400	8.650	1.476	1200		0	3.000	7.174 225
5	507991.432	103139.592	8.588	1.554	1200		1	3.000	7.169 225
							2	2.000	7.169 225
6	508001.296	103137.196	8.693	1.701	1200		0	2.001	7.084 300
							1	2.001	6.992 300
7	508020.300	103138.409	8.722	1.883	1350		0	2.002	6.992 300
							1	2.002	6.914 300
							2	1.001	6.914 300
8	508022.455	103100.599	8.518	1.796	1350		0	1.002	6.839 375
							1	1.002	6.722 375
9	508024.012	103073.290	8.499	1.862	1350		0	1.003	6.722 375
							1	1.003	6.637 375
							0	1.004	6.637 375
10	508039.367	103056.227	8.100	1.600			0	4.000	6.500 300
11	508025.659	103047.575	8.233	1.877	1350		1	4.000	6.431 300
							2	1.004	6.356 375
							0	1.005	6.356 375
12	508020.952	103041.244	8.167	1.836	1350		1	1.005	6.331 375
							0	1.006	6.331 375
13	507996.525	103039.801	8.072	1.892	1350		1	1.006	6.253 375
							0	1.007	6.180 450
14	507968.255	103038.166	8.309	2.199	1350		1	1.007	6.110 450
							0	1.008	6.110 450
15	507961.489	103046.358	8.301	2.218	1350		1	1.008	6.083 450
							0	1.009	6.083 450
16	507959.419	103081.609	8.178	1.425	1200		0	5.000	6.753 225
17	507960.765	103058.681	8.187	2.135	1350		1	5.000	6.277 225
							2	1.009	6.052 450
							0	1.010	6.052 450
17_OFT	507949.209	103058.022	8.100	2.096			1	1.010	6.023 450
18	508124.614	103161.991	8.971	1.425	1200		0	6.000	7.546 225



Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
19	508111.431	103159.705	9.144	1.677	1200		1 6.000	7.487	225
20	508107.873	103147.838	9.032	1.638	1200		0 6.001 7.487 225 1 6.001 7.394 225		
21	508107.833	103125.500	8.823	1.636	1200		0 6.002 7.394 225 1 6.002 7.262 225		
22	508110.019	103104.954	8.613	1.516	1200		0 6.003 7.187 300 1 6.003 7.097 300		
23	508110.375	103078.104	8.661	1.674	1200		0 6.004 7.097 300 1 6.004 6.987 300		
24	508075.597	103072.018	8.400	1.558	1200		0 6.005 6.987 300 1 6.005 6.842 300		
24_OUT	508066.312	103064.356	8.350	1.729			0 6.006 6.842 300 1 6.006 6.782 300		
25	508109.383	103063.997	8.682	1.395	1200		0 7.000 7.287 225		
26	508125.385	103045.949	8.400	1.425	1200		0 8.000 6.875 225 1 8.000 6.877 225 2 7.000 6.877 225		
27	508108.792	103044.969	8.525	1.648	1200		0 7.001 6.877 225 1 7.001 6.782 225		
28	508094.513	103045.503	8.680	1.888	1200		0 7.002 6.782 225 1 7.002 6.720 225		
29	508084.383	103052.183	8.300	1.580	1200		0 7.003 6.720 225 1 7.003 6.612 225		
29_OUT	508067.175	103058.402	8.300	1.688					
30	507939.130	103045.118	8.100	2.150			0 9.000 6.980 450 1 9.000 6.887 450		
31	507941.638	103019.670	8.100	2.213	1350		0 9.001 6.887 150 1 9.001 6.789 150		
31_OUT	507936.465	103009.041	8.100	2.331					
32	508039.719	103073.986	8.500	1.600	1200		0 10.000 6.980 150 1 10.000 6.750 150		
32_OUT	508040.602	103063.170	8.100	1.479					

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
33	508044.309	103048.191	8.100	1.350	1200				
							0	11.000	8.750 150
33_OUT	508043.882	103056.352	8.100	1.479			1	11.000	8.869 150

Simulation Settings

Rainfall Methodology	FEH-13	Drain Down Time (mins)	240
Summer CV	0.750	Additional Storage (m³/ha)	20.0
Winter CV	0.840	Check Discharge Rate(s)	x
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	✓		

Storm Durations

30	120	240	480	720	1440	2880	5760	8640
60	180	360	600	960	2160	4320	7200	10080

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	40	5	0

Node 31 Online StormBrake™ Control

Flap Valve	x	Design Flow (l/s)	2.9
Replaces Downstream Link	✓	Product Code	FPM-SB1-01550-00290-1100
Invert Level (m)	5.887	Min Outlet Diameter (m)	0.150
Design Depth (m)	1.552	Min Node Diameter (mm)	1200

Node 32 OUT Online Orifice Control

Flap Valve	x	Invert Level (m)	6.621	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 18A Online StormBrake™ Control

Flap Valve	x	Design Flow (l/s)	2.0
Replaces Downstream Link	✓	Product Code	FPM-SB1-01600-00200-1100
Invert Level (m)	0.000	Min Outlet Diameter (m)	0.100
Design Depth (m)	1.600	Min Node Diameter (mm)	1200

Node 32 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	7.000
Safety Factor	5.0	Time to half empty (mins)	

Depth	Area	Inf Area	Depth	Area	Inf Area	Depth	Area	Inf Area
(m)	(m ²)	(m ²)	(m)	(m ²)	(m ²)	(m)	(m ²)	(m ²)
0.000	164.0	0.0	0.800	164.0	0.0	0.801	0.0	0.0

Node 33 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	7.000
Safety Factor	5.0	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	164.0	0.0	0.800	164.0	0.0	0.801	0.0	0.0



Node 30 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	
Side Inf Coefficient (m/hr)	0.00000	Main Channel Length (m)	17.637
Safety Factor	2.0	Main Channel Slope (1:X)	325.7
Porosity	1.00	Main Channel n	0.035
Invert Level (m)	5.950		

Inlets

17_OUT

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	151.1	0.0	2.150	770.9	0.0

Node 10 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	
Side Inf Coefficient (m/hr)	0.00000	Main Channel Length (m)	30.200
Safety Factor	2.0	Main Channel Slope (1:X)	250.0
Porosity	1.00	Main Channel n	0.035
Invert Level (m)	6.500		

Inlets

24_OUT : 29_OUT : 32_OUT : 33_OUT

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	120.9	0.0	1.600	666.8	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	18	7.400	0.069	7.9	0.1290	0.0000	OK
30 minute summer	2	18	7.191	0.105	18.6	0.2256	0.0000	OK
30 minute summer	3	18	7.224	0.062	6.1	0.1124	0.0000	OK
30 minute summer	4	18	7.246	0.072	9.8	0.1551	0.0000	OK
30 minute summer	5	18	7.140	0.106	15.9	0.1199	0.0000	OK
30 minute summer	6	18	7.102	0.110	18.8	0.1536	0.0000	OK
30 minute summer	7	18	7.010	0.171	44.5	0.3531	0.0000	OK
30 minute summer	8	19	6.895	0.173	48.6	0.3181	0.0000	OK
960 minute winter	9	930	6.829	0.192	6.0	0.4164	0.0000	OK
960 minute winter	10	930	6.829	0.329	8.3	0.2746	0.0000	SURCHARGED
960 minute winter	11	930	6.829	0.473	14.6	0.7374	0.0000	SURCHARGED
960 minute winter	12	930	6.829	0.498	14.5	0.8715	0.0000	SURCHARGED
960 minute winter	13	930	6.829	0.649	15.5	1.6745	0.0000	SURCHARGED
960 minute winter	14	930	6.829	0.719	15.7	1.4393	0.0000	SURCHARGED
960 minute winter	15	930	6.829	0.746	15.5	1.0680	0.0000	SURCHARGED
960 minute winter	16	930	6.829	0.076	1.3	0.1925	0.0000	OK
960 minute winter	17	930	6.829	0.777	16.7	1.1123	0.0000	SURCHARGED
960 minute winter	17_OUT	930	6.829	0.825	17.6	0.6083	0.0000	OK
30 minute summer	18	18	7.592	0.046	3.4	0.0685	0.0000	OK
30 minute summer	19	18	7.511	0.044	3.4	0.0498	0.0000	OK
30 minute summer	20	18	7.458	0.064	6.9	0.0937	0.0000	OK
30 minute summer	21	18	7.299	0.112	20.0	0.2681	0.0000	OK
30 minute summer	22	18	7.224	0.126	24.7	0.2049	0.0000	OK
30 minute summer	23	19	7.127	0.139	30.2	0.2321	0.0000	OK
30 minute summer	24	19	6.998	0.156	36.3	0.2844	0.0000	OK
960 minute winter	24_OUT	930	6.829	0.208	3.7	0.0000	0.0000	OK
30 minute summer	25	18	7.313	0.026	2.1	0.0351	0.0000	OK
30 minute summer	26	18	7.057	0.082	11.1	0.1919	0.0000	OK
30 minute summer	27	18	6.988	0.111	17.4	0.1690	0.0000	OK
30 minute summer	28	18	6.902	0.110	17.3	0.1249	0.0000	OK
960 minute winter	29	930	6.830	0.110	1.7	0.1248	0.0000	OK
960 minute winter	29_OUT	930	6.829	0.217	1.7	0.0000	0.0000	OK
960 minute winter	30	930	6.829	0.879	10.0	0.0000	0.0000	SURCHARGED
960 minute winter	31	930	6.829	0.942	2.9	1.3484	0.0000	SURCHARGED
30 minute summer	31_OUT	1	5.769	0.000	2.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	1	1.000	2	7.8	0.775	0.197	0.2922	
30 minute summer	2	1.001	7	18.1	0.848	0.254	0.8848	
30 minute summer	3	2.000	5	6.1	0.707	0.153	0.0773	
30 minute summer	4	3.000	5	9.8	0.955	0.189	0.0667	
30 minute summer	5	2.001	6	15.9	0.697	0.223	0.2315	
30 minute summer	6	2.002	7	18.7	0.831	0.264	0.4280	
30 minute summer	7	1.002	8	44.3	0.900	0.400	1.8643	
30 minute summer	8	1.003	9	49.0	1.164	0.441	1.1524	
960 minute winter	9	1.004	11	6.0	0.406	0.029	2.1543	
960 minute winter	10	4.000	11	8.4	0.671	0.117	1.1415	
960 minute winter	11	1.005	12	14.1	0.639	0.126	0.8701	
960 minute winter	12	1.006	13	14.1	0.669	0.127	2.6990	
960 minute winter	13	1.007	14	14.9	0.486	0.094	4.4866	
960 minute winter	14	1.008	15	15.5	0.470	0.096	1.6835	
960 minute winter	15	1.009	17	15.4	0.443	0.096	1.9558	
960 minute winter	16	5.000	17	1.3	0.639	0.017	0.5924	
960 minute winter	17	1.010	17_OUT	16.6	0.476	0.103	1.8340	
960 minute winter	17_OUT	Flow through pond	30	10.0	0.018	0.000	233.6171	
30 minute summer	18	6.000	19	3.4	0.608	0.085	0.0749	
30 minute summer	19	6.001	20	3.4	0.462	0.085	0.0914	
30 minute summer	20	6.002	21	6.7	0.742	0.169	0.2032	
30 minute summer	21	6.003	22	19.9	0.765	0.273	0.5387	
30 minute summer	22	6.004	23	24.4	0.814	0.345	0.8049	
30 minute summer	23	6.005	24	30.0	0.870	0.424	1.2189	
30 minute summer	24	6.006	24_OUT	36.5	1.023	0.512	0.4295	
960 minute winter	24_OUT	Flow through pond	10	7.4	0.042	0.000	45.5580	
30 minute summer	25	7.000	27	2.1	0.211	0.027	0.2090	
30 minute summer	26	8.000	27	11.1	0.687	0.280	0.2707	
30 minute summer	27	7.001	28	17.3	0.891	0.433	0.2775	
30 minute summer	28	7.002	29	17.2	0.921	0.430	0.2261	
960 minute winter	29	7.003	29_OUT	1.7	0.473	0.043	0.5368	
960 minute winter	29_OUT	Flow through pond	10	7.4	0.042	0.000	45.5580	
960 minute winter	30	9.000	31	2.9	0.253	0.018	4.0516	
960 minute winter	31	StormBrake™	31_OUT	2.7				157.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	32	18	6.970	0.070	8.9	0.1404	0.0000	OK
960 minute winter	32_OUT	930	6.829	0.208	0.9	0.0000	0.0000	OK
30 minute summer	33	18	6.837	0.087	10.6	0.2053	0.0000	OK
960 minute winter	33_OUT	930	6.830	0.209	1.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	32	10.000	32_OUT	8.9	1.119	0.426	0.0863	
960 minute winter	32_OUT	Flow through pond	10	7.4	0.042	0.000	45.5580	
30 minute summer	33	11.000	33_OUT	10.6	1.025	0.600	0.0845	
960 minute winter	33_OUT	Flow through pond	10	7.4	0.042	0.000	45.5580	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	18	7.450	0.119	20.7	0.2227	0.0000	OK
30 minute summer	2	18	7.270	0.184	49.0	0.3945	0.0000	OK
30 minute summer	3	20	7.278	0.116	16.1	0.2092	0.0000	OK
30 minute summer	4	18	7.306	0.132	25.6	0.2849	0.0000	OK
30 minute summer	5	20	7.260	0.226	41.4	0.2560	0.0000	OK
30 minute summer	6	20	7.249	0.257	48.5	0.3591	0.0000	OK
960 minute winter	7	945	7.243	0.404	8.3	0.8335	0.0000	SURCHARGED
960 minute winter	8	945	7.243	0.521	9.2	0.9572	0.0000	SURCHARGED
960 minute winter	9	945	7.243	0.606	10.2	1.3116	0.0000	SURCHARGED
960 minute winter	10	945	7.243	0.743	11.8	0.6198	0.0000	SURCHARGED
960 minute winter	11	945	7.243	0.887	18.7	1.3821	0.0000	SURCHARGED
960 minute winter	12	945	7.243	0.912	18.6	1.5952	0.0000	SURCHARGED
960 minute winter	13	945	7.243	1.063	20.0	2.7416	0.0000	SURCHARGED
960 minute winter	14	945	7.243	1.133	20.4	2.2672	0.0000	SURCHARGED
960 minute winter	15	945	7.243	1.160	20.2	1.6600	0.0000	SURCHARGED
960 minute winter	16	945	7.243	0.490	2.4	1.2381	0.0000	SURCHARGED
960 minute winter	17	945	7.243	1.191	21.8	1.7043	0.0000	SURCHARGED
960 minute winter	17_OUT	945	7.243	1.239	22.9	0.9132	0.0000	OK
30 minute summer	18	18	7.622	0.076	9.0	0.1143	0.0000	OK
30 minute summer	19	18	7.540	0.073	9.0	0.0831	0.0000	OK
30 minute summer	20	18	7.502	0.108	18.2	0.1572	0.0000	OK
30 minute summer	21	19	7.436	0.249	53.2	0.5958	0.0000	OK
30 minute summer	22	19	7.398	0.300	64.0	0.4870	0.0000	SURCHARGED
30 minute summer	23	19	7.311	0.324	75.0	0.5390	0.0000	SURCHARGED
960 minute winter	24	945	7.243	0.401	7.1	0.7309	0.0000	SURCHARGED
960 minute winter	24_OUT	960	7.243	0.623	7.1	0.0000	0.0000	OK
30 minute summer	25	18	7.328	0.041	5.6	0.0562	0.0000	OK
30 minute summer	26	19	7.300	0.325	29.0	0.7601	0.0000	SURCHARGED
30 minute summer	27	20	7.257	0.380	42.9	0.5792	0.0000	SURCHARGED
960 minute winter	28	945	7.243	0.451	3.3	0.5101	0.0000	SURCHARGED
960 minute winter	29	945	7.243	0.523	3.2	0.5916	0.0000	SURCHARGED
960 minute winter	29_OUT	945	7.243	0.631	3.0	0.0000	0.0000	OK
960 minute winter	30	945	7.243	1.293	12.4	0.0000	0.0000	SURCHARGED
960 minute winter	31	945	7.243	1.356	2.9	1.9404	0.0000	SURCHARGED
30 minute summer	31_OUT	1	5.769	0.000	2.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	1	1.000	2	20.7	0.996	0.520	0.5989	
30 minute summer	2	1.001	7	48.8	0.918	0.682	2.3525	
30 minute summer	3	2.000	5	16.0	0.815	0.402	0.2200	
30 minute summer	4	3.000	5	25.4	1.168	0.489	0.1603	
30 minute summer	5	2.001	6	40.8	0.808	0.574	0.6155	
30 minute summer	6	2.002	7	46.9	0.894	0.662	1.2820	
960 minute winter	7	1.002	8	8.3	0.570	0.075	4.1771	
960 minute winter	8	1.003	9	8.6	0.674	0.078	3.0170	
960 minute winter	9	1.004	11	9.6	0.414	0.046	2.8421	
960 minute winter	10	4.000	11	10.7	0.693	0.149	1.1415	
960 minute winter	11	1.005	12	18.1	0.638	0.161	0.8701	
960 minute winter	12	1.006	13	18.1	0.645	0.163	2.6990	
960 minute winter	13	1.007	14	19.3	0.458	0.121	4.4866	
960 minute winter	14	1.008	15	20.2	0.462	0.125	1.6835	
960 minute winter	15	1.009	17	20.1	0.463	0.125	1.9558	
960 minute winter	16	5.000	17	2.2	0.616	0.029	0.9134	
960 minute winter	17	1.010	17_OUT	21.6	0.546	0.135	1.8340	
960 minute winter	17_OUT	Flow through pond	30	12.4	0.027	0.000	422.3581	
30 minute summer	18	6.000	19	9.0	0.788	0.226	0.1539	
30 minute summer	19	6.001	20	9.0	0.606	0.225	0.1856	
30 minute summer	20	6.002	21	18.3	0.814	0.460	0.5655	
30 minute summer	21	6.003	22	51.4	0.885	0.705	1.3728	
30 minute summer	22	6.004	23	59.9	0.932	0.846	1.8902	
30 minute summer	23	6.005	24	72.4	1.030	1.021	2.4862	
960 minute winter	24	6.006	24_OUT	7.1	0.648	0.099	0.8477	
960 minute winter	24_OUT	Flow through pond	10	10.6	0.048	0.000	162.6881	
30 minute summer	25	7.000	27	5.6	0.247	0.073	0.4256	
30 minute summer	26	8.000	27	26.5	0.785	0.666	0.6611	
30 minute summer	27	7.001	28	39.5	1.020	0.988	0.5683	
960 minute winter	28	7.002	29	3.2	0.578	0.080	0.4826	
960 minute winter	29	7.003	29_OUT	3.0	0.518	0.075	0.7277	
960 minute winter	29_OUT	Flow through pond	10	10.6	0.048	0.000	162.6881	
960 minute winter	30	9.000	31	2.9	0.245	0.018	4.0516	
960 minute winter	31	StormBrake™	31_OUT	2.7				176.9

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	32	945	7.243	0.343	2.0	12.6718	0.0000	SURCHARGED
960 minute winter	32_OUT	945	7.243	0.622	1.7	0.0000	0.0000	OK
960 minute winter	33	945	7.243	0.493	2.0	13.1457	0.0000	SURCHARGED
960 minute winter	33_OUT	945	7.243	0.622	1.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	32	10.000	32_OUT	1.7	0.697	0.081	0.1910	
960 minute winter	32_OUT	Flow through pond	10	10.6	0.048	0.000	162.6881	
960 minute winter	33	11.000	33_OUT	1.9	0.629	0.107	0.1439	
960 minute winter	33_OUT	Flow through pond	10	10.6	0.048	0.000	162.6881	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	20	7.690	0.359	26.3	0.6711	0.0000	SURCHARGED
30 minute summer	2	20	7.634	0.548	61.7	1.1734	0.0000	SURCHARGED
30 minute summer	3	20	7.631	0.469	20.5	0.8443	0.0000	SURCHARGED
30 minute summer	4	20	7.644	0.470	32.7	1.0157	0.0000	SURCHARGED
30 minute summer	5	20	7.618	0.584	50.6	0.6606	0.0000	SURCHARGED
30 minute summer	6	20	7.593	0.601	53.6	0.8409	0.0000	SURCHARGED
30 minute summer	7	20	7.539	0.700	122.3	1.4447	0.0000	SURCHARGED
1440 minute winter	8	1410	7.422	0.700	7.8	1.2859	0.0000	SURCHARGED
1440 minute winter	9	1410	7.422	0.785	8.7	1.6988	0.0000	SURCHARGED
1440 minute winter	10	1410	7.422	0.922	9.2	0.7690	0.0000	SURCHARGED
1440 minute winter	11	1410	7.422	1.066	13.7	1.6608	0.0000	SURCHARGED
1440 minute winter	12	1410	7.422	1.091	13.7	1.9081	0.0000	SURCHARGED
1440 minute winter	13	1410	7.422	1.242	14.7	3.2030	0.0000	SURCHARGED
1440 minute winter	14	1410	7.422	1.312	15.5	2.6252	0.0000	SURCHARGED
1440 minute winter	15	1410	7.422	1.339	15.4	1.9160	0.0000	SURCHARGED
1440 minute winter	16	1410	7.422	0.669	2.1	1.6903	0.0000	SURCHARGED
1440 minute winter	17	1410	7.422	1.370	17.4	1.9603	0.0000	SURCHARGED
1440 minute winter	17_OUT	1410	7.422	1.418	18.9	1.0450	0.0000	OK
30 minute summer	18	20	7.789	0.243	11.5	0.3651	0.0000	SURCHARGED
30 minute summer	19	20	7.789	0.322	11.3	0.3642	0.0000	SURCHARGED
30 minute summer	20	20	7.776	0.382	22.7	0.5582	0.0000	SURCHARGED
30 minute summer	21	20	7.738	0.551	61.0	1.3192	0.0000	SURCHARGED
30 minute summer	22	20	7.677	0.580	68.1	0.9409	0.0000	SURCHARGED
30 minute summer	23	20	7.562	0.574	81.6	0.9562	0.0000	SURCHARGED
1440 minute winter	24	1410	7.422	0.580	6.3	1.0571	0.0000	SURCHARGED
1440 minute winter	24_OUT	1410	7.422	0.801	6.0	0.0000	0.0000	OK
30 minute summer	25	20	7.507	0.220	8.2	0.3008	0.0000	OK
30 minute summer	26	20	7.566	0.591	36.9	1.3806	0.0000	SURCHARGED
30 minute summer	27	20	7.504	0.627	50.9	0.9557	0.0000	SURCHARGED
1440 minute winter	28	1410	7.422	0.630	2.8	0.7125	0.0000	SURCHARGED
1440 minute winter	29	1410	7.422	0.702	2.6	0.7939	0.0000	SURCHARGED
1440 minute winter	29_OUT	1410	7.422	0.810	2.5	0.0000	0.0000	OK
1440 minute winter	30	1410	7.422	1.472	10.8	0.0000	0.0000	SURCHARGED
1440 minute winter	31	1410	7.422	1.535	2.9	2.1964	0.0000	SURCHARGED
30 minute summer	31_OUT	1	5.769	0.000	2.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	1	1.000	2	25.7	0.990	0.646	1.1484	
30 minute summer	2	1.001	7	52.8	0.923	0.737	2.8935	
30 minute summer	3	2.000	5	19.1	0.811	0.480	0.3564	
30 minute summer	4	3.000	5	31.5	1.167	0.606	0.2584	
30 minute summer	5	2.001	6	43.8	0.820	0.615	0.7148	
30 minute summer	6	2.002	7	50.2	0.890	0.708	1.3410	
30 minute summer	7	1.002	8	119.9	1.089	1.084	4.1771	
1440 minute winter	8	1.003	9	7.3	0.611	0.065	3.0170	
1440 minute winter	9	1.004	11	8.6	0.371	0.041	2.8421	
1440 minute winter	10	4.000	11	7.8	0.645	0.108	1.1415	
1440 minute winter	11	1.005	12	13.3	0.578	0.118	0.8701	
1440 minute winter	12	1.006	13	13.3	0.605	0.120	2.6990	
1440 minute winter	13	1.007	14	14.2	0.438	0.089	4.4866	
1440 minute winter	14	1.008	15	15.4	0.441	0.095	1.6835	
1440 minute winter	15	1.009	17	15.4	0.435	0.095	1.9558	
1440 minute winter	16	5.000	17	2.0	0.565	0.027	0.9134	
1440 minute winter	17	1.010	17_OUT	17.3	0.520	0.108	1.8340	
1440 minute winter	17_OUT	Flow through pond	30	10.8	0.023	0.000	519.2669	
30 minute summer	18	6.000	19	11.3	0.819	0.283	0.5321	
30 minute summer	19	6.001	20	15.1	0.621	0.379	0.4927	
30 minute summer	20	6.002	21	24.4	0.806	0.612	0.8884	
30 minute summer	21	6.003	22	53.6	0.902	0.735	1.4550	
30 minute summer	22	6.004	23	65.2	0.942	0.921	1.8909	
30 minute summer	23	6.005	24	79.9	1.135	1.128	2.4862	
1440 minute winter	24	6.006	24_OUT	6.0	0.607	0.085	0.8477	
1440 minute winter	24_OUT	Flow through pond	10	8.2	0.042	0.000	231.5363	
30 minute summer	25	7.000	27	7.2	0.255	0.094	0.7545	
30 minute summer	26	8.000	27	34.9	0.879	0.878	0.6611	
30 minute summer	27	7.001	28	45.8	1.152	1.146	0.5683	
1440 minute winter	28	7.002	29	2.6	0.534	0.066	0.4826	
1440 minute winter	29	7.003	29_OUT	2.5	0.485	0.063	0.7277	
1440 minute winter	29_OUT	Flow through pond	10	8.2	0.042	0.000	231.5363	
1440 minute winter	30	9.000	31	2.9	0.176	0.018	4.0516	
1440 minute winter	31	StormBrake™	31_OUT	2.9				255.6

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	32	1410	7.422	0.522	1.6	21.8312	0.0000	RECHARGED
1440 minute winter	32_OUT	1410	7.422	0.801	1.4	0.0000	0.0000	OK
1440 minute winter	33	1410	7.422	0.672	1.8	22.3692	0.0000	RECHARGED
1440 minute winter	33_OUT	1410	7.422	0.801	1.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	32	10.000	32_OUT	1.4	0.641	0.067	0.1910	
1440 minute winter	32_OUT	Flow through pond	10	8.2	0.042	0.000	231.5363	
1440 minute winter	33	11.000	33_OUT	1.7	0.568	0.097	0.1439	
1440 minute winter	33_OUT	Flow through pond	10	8.2	0.042	0.000	231.5363	

Results for 100 year +40% CC +5% A Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	20	8.722	1.391	38.7	2.6511	0.0000	FLOOD RISK
30 minute summer	2	20	8.603	1.517	81.2	3.3273	0.0000	FLOOD RISK
30 minute summer	3	20	8.586	1.424	30.1	2.6095	0.0000	FLOOD RISK
30 minute summer	4	20	8.614	1.440	48.0	3.1835	0.0000	FLOOD RISK
30 minute summer	5	20	8.560	1.526	59.6	1.7254	0.0000	FLOOD RISK
30 minute summer	6	20	8.510	1.518	70.0	2.1422	0.0000	FLOOD RISK
30 minute summer	7	20	8.402	1.563	172.8	3.2753	0.0000	SURCHARGED
30 minute summer	8	20	8.058	1.336	188.8	2.4803	0.0000	SURCHARGED
2880 minute winter	9	2820	7.841	1.204	7.8	2.6486	0.0000	SURCHARGED
2880 minute winter	10	2820	7.841	1.341	5.2	1.1734	0.0000	FLOOD RISK
2880 minute winter	11	2820	7.841	1.485	8.3	2.3225	0.0000	SURCHARGED
2880 minute winter	12	2820	7.841	1.510	8.8	2.6650	0.0000	SURCHARGED
2880 minute winter	13	2820	7.841	1.661	10.7	4.3781	0.0000	FLOOD RISK
2880 minute winter	14	2820	7.841	1.731	11.8	3.5119	0.0000	SURCHARGED
2880 minute winter	15	2820	7.841	1.758	11.7	2.5155	0.0000	SURCHARGED
2880 minute winter	16	2820	7.841	1.088	1.8	2.8252	0.0000	SURCHARGED
2880 minute winter	17	2820	7.841	1.789	13.5	2.5598	0.0000	SURCHARGED
2880 minute winter	17_OUT	2820	7.841	1.837	14.8	1.4217	0.0000	OK
30 minute summer	18	20	8.710	1.164	16.9	1.7746	0.0000	FLOOD RISK
30 minute summer	19	20	8.703	1.236	38.4	1.3975	0.0000	SURCHARGED
30 minute summer	20	20	8.688	1.294	24.9	1.9139	0.0000	SURCHARGED
30 minute summer	21	20	8.622	1.435	79.9	3.5232	0.0000	FLOOD RISK
30 minute summer	22	20	8.501	1.403	93.2	2.3096	0.0000	FLOOD RISK
30 minute summer	23	20	8.271	1.283	114.7	2.1702	0.0000	SURCHARGED
30 minute winter	24	21	7.858	1.015	136.2	1.8858	0.0000	SURCHARGED
2880 minute winter	24_OUT	2820	7.842	1.221	5.0	0.0000	0.0000	OK
30 minute summer	25	20	8.212	0.925	15.0	1.2781	0.0000	SURCHARGED
30 minute summer	26	20	8.340	1.365	54.3	3.2696	0.0000	FLOOD RISK
30 minute summer	27	20	8.206	1.329	69.8	2.0510	0.0000	SURCHARGED
30 minute winter	28	21	7.934	1.142	63.1	1.2917	0.0000	SURCHARGED
2880 minute winter	29	2820	7.841	1.121	2.4	1.2680	0.0000	SURCHARGED
2880 minute winter	29_OUT	2820	7.841	1.229	2.4	0.0000	0.0000	OK
2880 minute winter	30	2820	7.841	1.891	8.9	0.0000	0.0000	FLOOD RISK
2880 minute winter	31	2820	7.841	1.954	3.2	2.7959	0.0000	FLOOD RISK
30 minute summer	31_OUT	1	5.769	0.000	2.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	1	1.000	2	30.6	1.000	0.768	1.1484	
30 minute summer	2	1.001	7	72.9	1.036	1.019	2.8935	
30 minute summer	3	2.000	5	22.4	0.818	0.563	0.3564	
30 minute summer	4	3.000	5	37.4	1.183	0.720	0.2584	
30 minute summer	5	2.001	6	59.8	0.849	0.840	0.7148	
30 minute summer	6	2.002	7	72.1	1.024	1.019	1.3410	
30 minute summer	7	1.002	8	171.4	1.554	1.550	4.1771	
30 minute summer	8	1.003	9	189.1	1.715	1.705	3.0170	
2880 minute winter	9	1.004	11	7.8	0.321	0.037	2.8421	
2880 minute winter	10	4.000	11	4.5	0.550	0.062	1.1415	
2880 minute winter	11	1.005	12	8.3	0.506	0.074	0.8701	
2880 minute winter	12	1.006	13	8.7	0.515	0.079	2.6990	
2880 minute winter	13	1.007	14	10.7	0.421	0.067	4.4866	
2880 minute winter	14	1.008	15	11.7	0.426	0.072	1.6835	
2880 minute winter	15	1.009	17	11.7	0.418	0.073	1.9558	
2880 minute winter	16	5.000	17	1.7	0.500	0.023	0.9134	
2880 minute winter	17	1.010	17_OUT	13.4	0.481	0.083	1.8340	
2880 minute winter	17_OUT	Flow through pond	30	8.9	0.015	0.000	782.2298	
30 minute summer	18	6.000	19	16.2	0.839	0.406	0.5321	
30 minute summer	19	6.001	20	22.0	0.610	0.558	0.4927	
30 minute summer	20	6.002	21	30.1	0.816	0.756	0.8884	
30 minute summer	21	6.003	22	73.2	1.040	1.004	1.4550	
30 minute summer	22	6.004	23	90.9	1.291	1.284	1.8909	
30 minute summer	23	6.005	24	112.0	1.591	1.580	2.4862	
30 minute winter	24	6.006	24_OUT	133.5	1.896	1.873	0.8477	
2880 minute winter	24_OUT	Flow through pond	10	4.7	0.032	0.000	435.4253	
30 minute summer	25	7.000	27	8.6	0.263	0.112	0.7571	
30 minute summer	26	8.000	27	44.4	1.117	1.116	0.6611	
30 minute summer	27	7.001	28	66.0	1.661	1.652	0.5683	
30 minute winter	28	7.002	29	61.5	1.548	1.542	0.4826	
2880 minute winter	29	7.003	29_OUT	2.3	0.422	0.059	0.7277	
2880 minute winter	29_OUT	Flow through pond	10	4.7	0.032	0.000	435.4253	
2880 minute winter	30	9.000	31	3.2	0.256	0.020	4.0516	
2880 minute winter	31	StormBrake™	31_OUT	3.2				506.0

Results for 100 year +40% CC +5% A Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute winter	32	2820	7.841	0.941	1.3	41.3260	0.0000	RECHARGED
2880 minute winter	32_OUT	2820	7.841	1.220	0.9	0.0000	0.0000	OK
2880 minute winter	33	2820	7.841	1.091	1.5	42.0431	0.0000	FLOOD RISK
2880 minute winter	33_OUT	2820	7.841	1.220	1.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2880 minute winter	32	10.000	32_OUT	0.9	0.547	0.043	0.1910	
2880 minute winter	32_OUT	Flow through pond	10	4.7	0.032	0.000	435.4253	
2880 minute winter	33	11.000	33_OUT	1.0	0.505	0.059	0.1439	
2880 minute winter	33_OUT	Flow through pond	10	4.7	0.032	0.000	435.4253	

development planning
infrastructure design
transport HIGHWAYS
drainage
CIVIL ENGINEERING
site appraisal
flood risk assessment
travel plans
masterplanning