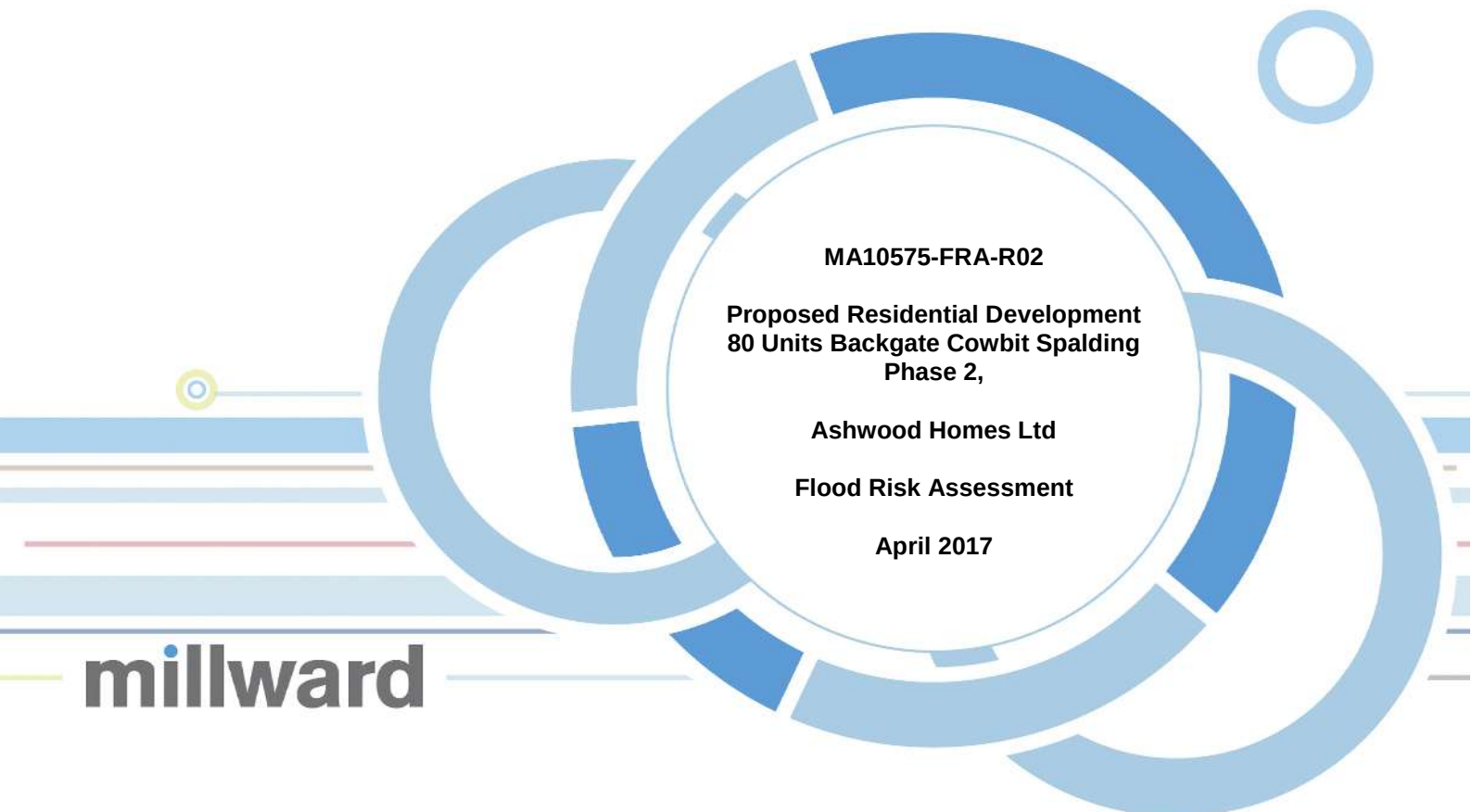




MA10575-FRA-R02

**Proposed Residential Development
80 Units Backgate Cowbit Spalding
Phase 2,**

Ashwood Homes Ltd

Flood Risk Assessment

April 2017

millward

-  Civil & Structural Engineering
-  Environmental & Geotechnical
-  Flood Risk & Drainage
-  Highways & Infrastructure
-  Structural Inspections
-  Transportation

REVISION

Reference	Revision	Author	Date
MA10575-FRA-R01	Initial Issue	JMcK	04 May 2017
MA10575-FRA-R02	Amendments to introduction	JMcK	09 May 2017

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1. INTRODUCTION

- 1.2 Millward have been appointed to undertake a Flood Risk Assessment (FRA) and Drainage Strategy (DS) for a proposed residential development for 80 units on land adjacent to Backgate Cowbit.
- 1.3 This development forms a second phase to the original development of 37 no dwellings which is accessed directly from Backgate. This second phase is accessed from the on-site carriageways on Phase 1.
- 1.4 This FRA is undertaken in accordance with the National Planning Policy Framework and associated Technical Guidance Document March 2012 (NPPF).
- 1.5 This FRA discusses and provides both a qualitative assessment and quantitative assessment for the residential development in terms of flood risk, future flood risk over the anticipated lifetime of the development and reference to the sequential and exception test using a precautionary and risk based approach.



2 THE SITE

- 2.1 This proposed residential development is located to the western side of Backgate Cowbit, Spalding with a site area of 2.135 hectares. The site location is shown on drawing MA10575/SK01 contained within Appendix A.
- 2.2 Vehicular access to the development will be through the phase 1 development area which connects direct onto Backgate itself.
- 2.3 The site is not currently developed nor has been previously developed therefore the site is classified as Greenfield. However, the site is allocated for residential development in the South east Lincolnshire Local Plan (Site Cow004 and Cow009).
- 2.4 The development boundary for this Phase 2 development does not cover the whole Cow004 and Cow009 areas allocated for residential. The easternmost 0.5ha of the two areas of land up to the Backgate highway boundary is outside the perimeter of the Phase 2 development.
- 2.5 There is no evidence that the site is or has been formally drained previously and is currently used for agricultural.
- 2.6 Site levels within the development area vary from circa 3.00m AOD to the Eastern boundary down to 1.60m AOD to the Western boundary (adjacent to the drainage ditch), giving an average gradient across the site of circa 1 in 190 east to west.
- 2.7 The site is currently 100% Greenfield and therefore the site surface water run-off has been calculated by the HR Wallingford Greenfield Runoff tool, which confirms a Q-Bar (Mean annual flood flow) Greenfield run-off rate of 2.98 l/s with the 1 in 1 year run off rate calculated at 2.59 l/s, 1 in 30 years 7.3 l/s and 1 in 100 years 10.61 l/s. The Greenfield run off tool results are contained within Appendix C.



- 2.8 There is an existing drainage ditch located adjacent to the site on the western boundary which extends around the north eastern corner of the site running between the site and the playing field to the North. The phase 1 development's surface water run off outfalls into a culverted section to the north of the phase 1 boundary via a restricted outfall flow rate.
- 2.9 The location of the ditch is shown on the proposed drainage strategy drawing MA10575/200 contained within Appendix A.
- 2.10 The southernmost point of the ditch is located part way down the western boundary with an invert level of 1.088m AOD and a ditch depth of circa 500mm. The ditch depth increases as it flows north, then east and north again before the ditch becomes culverted (via a headwall) with a 600mm culvert at IL 0.5m AOD. This culvert then heads east across the northern boundary of the phase 1 scheme before outfalling into a further piped system in Backgate itself.



3 CONSULTATIONS

3.1 Environment Agency (EA)

- 3.1.1 The EA national flood risk maps available on their web site have been interrogated firstly to define in terms of planning what flood zone the site is contained within.
- 3.1.2 The development site is located within Flood Zones 2 and 3 which in accordance with Table 1 of the NPPF Technical Guidance document, is defined as Medium Probability (having between a 1 in 100 and 1 in 1,000 annual probability of river flooding) and High Probability (having a 1 in 100 or greater annual probability of river flooding) in any year (National Planning Policy Framework Technical Guidance, March 2012). The EA flood map for planning does not take into account flood defences.
- 3.1.3 The site and surrounding area benefit from significant flood defences.
- 3.1.4 Therefore further information has been requested from the EA relating to this site, which is awaited at the time of writing of this assessment. Therefore, the South Holland Strategic Flood Risk Assessment is being used to assess the residual risk to this development site.

3.2 Anglian Water (AW)

- 3.2.1 As part of this assessment AW Pre-Planning Assessment Report has been requested to determine the location of sewers in the vicinity of the site. We know that the phase 1 development has a gravity foul connection into Backgate approved for 37 dwellings. At the time of writing of this assessment, the formal response from AW is awaited and once this information becomes available an addendum / revision will be provided to this FRA incorporating the Pre development enquiry response from AW when received.
- 3.2.2 There are no public sewers or other assets owned by Anglian Water within the boundary or overlapping the site.



- 3.2.3 There are no public surface water sewers within the vicinity of the site however there is a ditch (riparian ownership) on the Western boundary. Therefore infiltration and discharge into the ditch will be considered as an initial way of treating and disposing of the surface water drainage rather than connection into any existing AW adopted surface water sewers.
- 3.2.4 AW are likely to respond with confirmation of whether the local water treatment works has or has not got available capacity currently. Dependent upon the response from AW, there may be a requirement for off-site reinforcement works to ensure there is no detrimental impact on their systems due to the development. If there is capacity to take these flows into the water treatment works then no works would be expected to be required (of course capacity cannot be reserved and can change at any time)
- 3.2.5 Used Water Network: - AW will assess either a gravity or pumped connection into their network to see if there is any detrimental impact upon the receiving adopted foul sewer system. From assessment of the likely connection points for this development, it is likely to require a pumped discharge from Phase 2 connecting into the existing system in Phase 1 but AW will confirm in their response to our pre development enquiry.
- 3.2.6 Any foul connections to any existing adoptable sewers are subject to a S106 sewer connection agreement which would be undertaken as part of the detailed design of the drainage for the development.



4 SEQUENTIAL AND EXCEPTION TESTS

4.1 Sequential Test

- 4.1.1 The site has been assessed in line with the NPPF technical guidance. The site is confirmed to be wholly within Flood Zone 3 (High probability) and Flood Zone 2 (Medium Probability) as defined in Table 1 (Flood zones) of the technical guidance document for the NPPF.
- 4.1.2 Table 2, (Flood risk vulnerability classification) of the same document confirms that residential development (buildings used for dwelling houses) is classified as 'More Vulnerable' development.
- 4.1.3 Table 3, (Flood risk vulnerability and flood zone 'compatibility') confirms that development classified as 'More vulnerable' development in Flood Zone 2 is appropriate but areas within Flood Zone 3a requires the exception test' to be carried out.
- 4.1.4 In terms of Sequential Test the site sits partially within flood zone 2 and partially within flood zone 3 which is the case for the vast majority of the Cowbit urban area.
- 4.1.5 The South Holland Local Plan has this area of land allocated for housing development under references Cow004 and Cow009 to which Policies 11, 12 and 13 apply.
- 4.1.6 Cowbit is referenced as a minor Service Centre and the South Lincolnshire Local Plan Housing Paper (June 2016) confirms that Policy 12 of the draft Local Plan identified housing allocations should be made in Cowbit to provide for 80 dwellings between April 2011 and March 2036.
- 4.1.7 The conclusions for Cow004 are that the land is considered a suitable potential housing site as it is well located within the built up area of the village, close to recent development and against a site with planning permission for further development and is in mostly flood zone 2 or better.



- 4.1.8 The conclusions for Cow009 are that the land is considered a suitable potential housing site as it is well located within the built up area of the village, close to recent development and against a site with planning permission for further development and is in mostly flood zone 2 or better.
- 4.1.9 The South East Lincolnshire Local Plan: Housing Paper – Cowbit (June 2016) concludes that the preferred options housing allocations and trajectory, Cow004 and Cow009 are taken forward as preferred housing sites.
- 4.1.10 As the Council have identified the sites Cow004 and Cow009 as their preferred sites, and this development proposal utilises land within these areas of land the Sequential Test is considered to have been passed.

4.2 Exception Test

- 4.2.1 The SFRA relevant for this site is the South Holland 2016 update (28 February 2017). This SFRA update is supplementary to the June 2009 modelling report of the previous SFRA study and applies new climate change increases (EA guidance 2016).
- 4.2.2 The new modelling includes for breach events of the eastern embankment to Cowbit Washes.
- 4.2.3 The SFRA Map showing residual peak depth present day shows the western half of the site potentially affected by flood waters present day with the eastern half unaffected. Depths expected in the affected areas are between 0m – 0.25m band and 0.25m - 0.5m bands.
- 4.2.4 In the 2116 scenario, the maximum peak depths on site are 0.5m – 1m to the western half of the site, reducing to 0.25-0.5m band for the eastern half of the site.



- 4.2.5 The residual risk extent, present day map for the 1% Fluvial and 0.5% tidal shows the site partially in high probability and partially in low / medium probability bands. The eastern half of the site is in the low / medium probability band.
- 4.2.6 The South Holland SFRA 2016 update maps have been interrogated with regard to the hazard rating for the site. The present day Hazard rating for the site varies between none, low, danger for some and a very small amount of danger for most which looks to be adjacent to the drainage ditch.
- 4.2.7 The hazard rating for the 2116 scenario varies between low, danger for some, and danger for most. Therefore, the maximum hazard rating for the lifetime of the development is 'danger for most'.
- 4.2.8 The Standing advice for South East Lincolnshire Council (for major development, more vulnerable uses greater than 10 dwellings or 0.5Ha in size) confirms that consultation with the EA should take place and appropriate mitigation measures should incorporate raising of finished floor levels 1m above existing ground levels and flood resilient construction 300mm above the predicted flood depth applies to areas where depths of flooding are 0.5m-1m.
- 4.2.9 Where residual peak depths are 0.25m – 0.5m, the finished floor level must be set 500mm above existing ground level with flood resilient construction to a height 300mm above the predicted flood depth.
- 4.2.10 Where residual peak depths are 0m – 0.25m the finished floor level must be set 300mm above existing ground level.
- 4.2.11 These mitigation measures will be incorporated in to the design of the site layout as shown on drawing MA10575/200 contained within Appendix A and the integration of these mitigation measures means the Exception Test is considered to be passed.



5 PROPOSED DEVELOPMENT

- 5.1 The proposed development proposals consist of 80 no dwellings in total with associated driveways and garages (off road) and garden areas to the rear of the proposed dwellings. The site is to be accessed from the phase 1 development in line with the current master plan for the site contained within Appendix A.
- 5.2 The impermeable areas of the proposed site are estimated at 1.131Ha (which takes into account a 6% increase in the calculated impermeable areas for urban creep in accordance with the LCC SUDS Specification. This is an increase in impermeable area on the site, which therefore will require mitigation measures in terms of surface water drainage to reduce the surface water run-off to acceptable levels in line with IDB requirements and policies.
- 5.3 Surface water drainage is proposed to outfall into the existing riparian ditch to the west of the site. The local IDB (South Holland Internal Drainage Board) has current development control bylaws which requires a development control charge for Surface Water Development Contributions. The proposed surface water drainage for the site will be designed to comply with the IDB requirements and is further discussed in section 6.
- 5.4 Foul drainage would proposed to be connected into the Phase 1 development area (this is subject to the AW response on the Pre-development enquiry currently lodged with AW). The form of drainage will be by a pumping station for phase 2 and a rising main connecting onto the phase 1 foul system (via a 5m minimum length gravity connection). The foul drainage is discussed further in section 6.
- 5.5 The existing riparian maintained drains will be cleared out as required and a 9m easement to each bank is to be applied for maintenance purposes as shown on drawing MA10575/200 contained within Appendix A.



6 PROPOSED DRAINAGE STRATEGY

- 6.1 Site levels within the development area vary from circa 3.00m AOD to the Eastern boundary down to 1.60m AOD to the Western boundary (adjacent to the drainage ditch), giving an average gradient across the site of circa 1 in 190 east to west.
- 6.2 The preliminary drainage strategy shown on drawing MA10575/200 is based upon the current master plan for the site and assumes that private driveways and shared drives will utilise permeable paving as part of the strategy.
- 6.3 Trapped highway gullies will intercept surface water run-off from the proposed carriageways before outfall into the conveyance pipes and cellular storage (for attenuation storage) before ultimate outfall into the IDB maintained ditches at restricted discharge rates.
- 6.4 The IDB have a schedule of Development Control Charges and fees relating to Surface Water discharge in their current development control bylaws (Effective from March 2013).
- 6.5 Prior written consent is required from the board where a development will result in an increase in the rate or volume of flows in any watercourse and one of the conditions imposed as part of any such approval is the payment of a development contribution to the Board.
- 6.6 Where there is an attenuated discharge from a site to a watercourse, a development contribution will still be due to the board, but in these circumstances, the contribution due will be calculated based on one of five bands. The equivalent run-off rate (litres/second/impermeable hectare) between the rates of 1.4 l/s to 25 l/s per impermeable hectare triggers a rate of 20% of the full contribution rate (Full rate £75,500 per impermeable hectare).



- 6.7 The proposed surface water system for the phase 2 development is proposed to discharge at 22 l/s which is equivalent to 20 l/s/impermeable hectare (which is in line with the phase 1 development proposals).
- 6.8 The surface water drainage system to be designed for the site will ensure that there is no flooding from the site in the 1 in 100 year event including a 40% allowance for climate change whilst maintaining the 22 l/s maximum cumulative discharge rate.
- 6.9 A WinDES model has been produced based upon the current master-plan for the site which confirms that in order to provide sufficient attenuation within the site the surface water sewers are required to 600mm diameter and a cellular storage structure is required under the proposed public open space area. The whole surface water system is controlled by a vortex flow control designed to restrict discharge to 22 l/s.
- 6.10 Shared private driveways where cars are proposed to be parked are proposed to be permeable pavement structures which are linked into the main surface water drainage under the proposed carriageway areas.
- 6.11 The proposed drainage strategy is shown on drawing MA10575/200 contained within Appendix A.
- 6.12 As the site is to be raised above adjacent ground levels, consideration of inclusion of perimeter land drains (especially at the boundaries of the existing dwellings which back onto the site along the southern and western boundaries of the site) which would intercept any water from the gardens of the proposed dwellings and prevent it entering the existing gardens. (Currently, there is no such facility to protect the existing gardens).
- 6.13 The proposed surface water drainage is proposed to be put forward for adoption to Anglian Water through a S104 process. The cellular storage areas will be constructed 'offline' and will be privately maintained by a management company with a regular maintenance regime.



- 6.14 The proposed maintenance regime for the cellular storage structure will consist of visual inspection of manholes and access points to the structure which should be undertaken on a 6 monthly basis. The cellular storage structure is to be cleaned / jetted out via access chambers.
- 6.15 The cellular storage structure and any other private drainage structure serving the development will be adopted and maintained by a private management company which will be funded through the residents of the development which this funding requirement secured through their deeds. This will ensure that the private management company is suitable funded throughout the lifetime of the development.
- 6.16 The existing riparian maintained drain will be cleared out as required and a 9m easement to the eastern bank is to be applied for maintenance purposes as shown on drawing MA10575/200 contained within Appendix A.
- 6.17 A preliminary Geo-Environmental Assessment has been undertaken by GeoDyne which confirms that intrusive investigations conclude that the natural strata of typically firm SILT with varying amounts of Clay and Sand was encountered at depth of between 0.6 and 1.00 below ground level. Sand and gravel was encountered to depth of between 1.2 and 2.3 below ground level.
- 6.18 There are also areas of clay and peat inter-beds to depths of between 6.10m and 9.80m below ground levels.
- 6.19 Within the majority of trial pits slight water seepages were observed between 1.2 to 2.9m below ground levels. Groundwater was encountered at depths of between 8.00m and 10.00m below ground level. Groundwater monitoring will be undertaken by GeoDyne.



- 6.20 Infiltration tests conducted as part of the Geo-Environmental assessment confirms soakaway tests have been undertaken in three locations which has revealed variable but typically poor soil infiltration rates ranging between 1.43×10^{-5} m/s and 2.48×10^{-6} m/s. One of the test locations was unable to provide any results as the water level only dropped 20mm in nearly 6 hours of testing.
- 6.21 Therefore surface water is proposed to drain to the existing drainage ditches at a maximum rate of 22 l/s up to and including the 1 in 100 year event including climate change allowance of 40%.
- 6.22 In terms of foul drainage it is proposed to have a gravity foul system within the site to convey flows to the western area adjacent to the public open space where a wet well and pumping station compound will be constructed (to AW adoptable standards) before a pumped discharge from the site at circa 1.36 l/s (Calculated pump rate in accordance with AW calculation method) to an agreed discharge point into the phase 1 foul drainage subject to AW approval in principle (Pre development response awaited from AW).



7 FLOOD RISK

7.1 Flooding From Fluvial and Tidal Sources

- 7.1.1 The SFRA relevant for this site is the South Holland 2016 update (28 February 2017). This SFRA update is supplementary to the June 2009 modelling report of the previous SFRA study and applies new climate change increases (EA guidance 2016).
- 7.1.2 The new modelling includes for breach events of the eastern embankment to Cowbit Washes.
- 7.1.3 The SFRA Map showing residual peak depth present day shows the western half of the site potentially affected by flood waters present day with the eastern half unaffected. Depths expected in the affected areas are between 0m – 0.25m band and 0.25m - 0.5m bands.
- 7.1.4 The source of tidal flooding is from the River Welland to the west.
- 7.1.5 In the 2116 scenario, the maximum peak depths on site are 0.5m – 1m to the western half of the site, reducing to 0.25-0.5m band for the eastern half of the site.
- 7.1.6 The residual risk extent, present day map for the 1% Fluvial and 0.5% tidal shows the site partially in high probability and partially in low / medium probability bands. The eastern half of the site is in the low / medium probability band.
- 7.1.7 The South Holland SFRA 2016 update maps have been interrogated with regard to the hazard rating for the site. The present day Hazard rating for the site varies between none, low, danger for some and a very small amount of danger for most which looks to be adjacent to the drainage ditch.
- 7.1.8 The hazard rating for the 2116 scenario varies between low, danger for some, and danger for most. Therefore, the maximum hazard rating for the lifetime of the development is 'danger for most'.



7.1.9 As the risk of flooding is high (Flood Zone 3a) and the probability of flooding (due to the flood defences) low the residual risk of flooding from this source is **MODERATE**.

7.1.10 Therefore mitigation measures are required to counteract this which involves raised floor levels in line with the Environment Agencies standing advice. The mitigation measures are outlined in Section 8.

7.2 Flooding From Land / Adjacent Development

7.2.1 The main risk of flooding to this site is from the east which is slightly higher in terms of topography. Due to the flat nature of the surrounding land and flooding from overland flow is likely to be slow and shallow site.

7.2.2 Any overland flow from adjacent development site is likely to be shallow and there are no localised low points within the site which would create a localised depression in the ground which would be at risk of ponding / pooling water from this source. Any surface water flow would flow through the site towards the existing drainage ditches.

7.2.3 Overall the risk of flooding from this source is considered to be **LOW**.

7.2.4 However the mitigation measures proposed as part of the development layout and raising of levels to mitigate fluvial and tidal flooding risk will reduce any small residual risk to this site from this source.

7.3 Flooding From Infrastructure Failure

7.3.1 The site is within an area deemed to be at risk of flooding from reservoirs (according to the data on the EA website – long term flooding).

7.3.2 Reservoirs are maintained to a high standard and are controlled by Anglian Water. Maintenance and monitoring is required under the Reservoirs and HSW Act. Breaching of a reservoir would be a very unlikely event and therefore the residual risk of flooding to the site is considered **LOW**.



7.3.3 There is also a risk of flooding to the site from the IDB and riparian drainage ditches in the local vicinity of the site.

7.3.4 The South Holland IDB have a very robust maintenance regime and high standards of maintenance, whilst there is a residual risk, it is considered to be **LOW** due to the standards of maintenance.

7.3.5 If the Wisemans Pumping Station was to fail due to mechanical breakdown or power supply failure there are emergency measures which would be put in place by the IDB utilising temporary pumping equipment. Therefore the probability of flooding from this source affecting the site is considered **LOW**.

7.3.6 The overtopping and breaching of the flood defences is covered in section 7.1.

7.4 Flooding From Groundwater

7.4.1 There are no confirmed records of groundwater flooding in the vicinity of the site in the SFRA.

7.4.2 The Geo Environmental Assessment undertaken for this development site confirms the presence of perched groundwater within 1.2 to 2.9m below ground levels with the main groundwater table circa 8-10m below ground levels.

7.4.3 Overall the risk of flooding from this source is considered to be **LOW**.

7.4.4 However, mitigation measures are proposed as part of measures to counteract other sources of flooding (raising of land levels) which will essentially further reduce any likelihood of flooding from this source.

7.5 Flooding From Sewers

7.5.1 There are existing sewers in the vicinity of the site in Backgate to the east and sewers located within the Phase 1 development to the north which may pose a risk of flooding to the phase 2 site.



- 7.5.2 Any flood flow velocities and depths are expected to be relatively slow and shallow respectively towards the site and likely to be constrained within the carriageways initially then directed into the IDB maintained drains realistically.
- 7.5.3 Overall taking into account the proximity of the sewers and topography of the area, the risk of flooding from this source is considered to be **LOW**.
- 7.5.4 However, mitigation measures are proposed as part of measures to counteract other sources of flooding which will essentially reduce any likelihood of flooding of properties on the site from this source.

7.6 Off-Site Flood Risks

- 7.6.1 The site proposals along with the proposed drainage strategy outlined in Section 6.1 will intercept surface water run off from the development, and the proposed surface water drainage will be designed to accommodate the 1 in 100 year event scenario (including 40% allowance for climate change) without flooding of the drainage system..
- 7.6.2 Consideration at the detailed design stage will be given to either a land drain / land drains to intercept any surface water flow from the site which may approach the southern site boundary where there are adjacent gardens to the site boundary. This would be reviewed at detailed design stage once final proposed floor levels, layout and finished level contours are produced to confirm any flood flow routes.
- 7.6.3 With regard to risk to areas off site, the residual risk is considered to be **LOW** as the onsite drainage system will be designed to accommodate the extreme events without flooding and there will be an overflow system in place to ensure any exceedence water does not flow into other land.



7.7 Flooding from Climate Change

- 7.7.1 The NPPF Technical Guidance Document confirms in Table 5 that peak rainfall intensity is estimated to increase potentially up to 40% over the lifetime of this development (100 years) and peak river flows by 20%. Tidal aspects extreme wave heights could increase between 5% and 10%. Sea level rises in this area over the lifetime of the development would be anticipated to be circa 1.2m (to year 2115).
- 7.7.2 From the overtopping scenarios provided, the 1 in 200 year event at scenario year 2115 does not affect the site. The 1 in 200 year event breach scenarios from 2006 to 2115 do change due to the effects of climate change being applied. Hazard ratings increase in magnitude from 'Low Hazard' and 'Danger for Some' to predominantly 'Danger for Most' rating at the 2115 event.
- 7.7.3 The proposed site drainage will be designed not to flood at the 1 in 100 year event with an allowance of 40% for climate change in line with the NPPF technical guidance document. The surface water drainage will be designed to be restricted to a 20 l/s/ imp ha rate for the site which equates to 22 l/s.
- 7.7.4 Overall the risk of flooding from the effects of climate change is considered to be **MODERATE**.
- 7.7.5 The mitigation measures in Section 8 are designed to counteract this increase in risk.



8 MITIGATION MEASURES

8.1 Essential Mitigation Measures

- 8.1.1 The assessment of flood risk in Section 7 of this assessment confirms a **MODERATE** risk of flooding from Fluvial / Tidal and climate change. There is considered to be a **LOW** residual risk of flooding from all other sources.
- 8.1.2 Therefore there are several essential mitigation measures to be applied as part of the development.
- 8.1.3 Flood depths due a breach scenario are anticipated to be between 0.25m up to 1.0m based upon the Hazard maps from the South Holland SFRA 2016 update which affects the western half of the site. Therefore, in line with the EA standing advice comments, finished floor levels are to be raised 1m above existing ground levels where flood depth of 0.5m to 1m are expected, raise 500mm above existing ground levels where 0.25 to 0.5m depth of flooding is expected and raise 300mm above existing ground levels where 0 to 0.25m depth of flooding is expected. Dwelling construction should also have a minimum of 300mm flood resilient construction and removable flood gates to all ground floor entrance points. This mitigation measure applies to the whole site in line with EA requirements.
- 8.1.4 Surface water drainage for the site must be designed to accommodate the 1 in 100 year event storm scenarios including a 40% allowance for climate change without any flood waters leaving the development.



8.2 Recommended Mitigation Measures

- 8.2.1 All dwellings should have concrete ground floors with damp proof membranes as they are regarded as the most flood resilient floor types with effective connections between the dpc and dpm and shall be constructed to a height of 150mm above the predicted flood level. The dpm should be between the surface screed and the concrete slab as this enables the concrete floor to dry out quickly and would also protect against any rising groundwater should flood risk from this source increase over the lifetime of the development.
- 8.2.2 Permeable paving to private driveways and parking areas should be utilised even if infiltration SUDS are not viable as permeable paving can be designed into a sealed system before outfall into the drainage ditch to the east of the site. This would form part of a SUDS treatment train in line with CIRIA C753, subject to SAB approvals.
- 8.2.3 It is recommended that FFL to properties should be above any adjacent roads levels where possible.
- 8.2.4 Where external gradients are flat or towards the dwelling entrances, provision of linear drainage should be provided to all access points.
- 8.2.5 Electrical circuits are to be set at high level, essentially the wiring located in the cavity between ground and first floor, with the spurs fed down from the ceiling cavity to light switches and sockets which should be a minimum of 450mm above finished floor level at ground floor.
- 8.2.6 Plaster work at ground floor to be a lime based plaster which is more water resilient than traditional Gypsum based plasters.
- 8.2.7 All service meters and boilers to be a minimum 600mm above finished floor levels.



- 8.2.8 One way valves are to be fitted to both foul and surface water pipes which connect from the dwellings to prevent backing up into the houses should the systems surcharge due to a breach event.



9 CONCLUSIONS

- 9.1 This Flood Risk Assessment serves to review, assess and quantify (where applicable) the sources, or any potential flooding, the pathways of this flooding and potential receptors within the vicinity of the site.
- 9.2 The assessment of flood risk in Section 7 of this assessment confirms a **MODERATE** risk of flooding from Fluvial / Tidal and climate change. There is a **LOW** risk of flooding from all other sources
- 9.3 The mitigation measures will provide further protection to the development and reduce any residual risk (however low) as far as practicable. It is recommended that compliance with the recommendations of this FRA are conditioned as part of any planning permission.
- 9.4 This assessment concludes that the site is suitable for development for residential use without unacceptable risk of flooding from all sources to the site itself and elsewhere for the lifetime of the development.



Appendix A – Drawings

Site Location Plan: MA10575/SK01

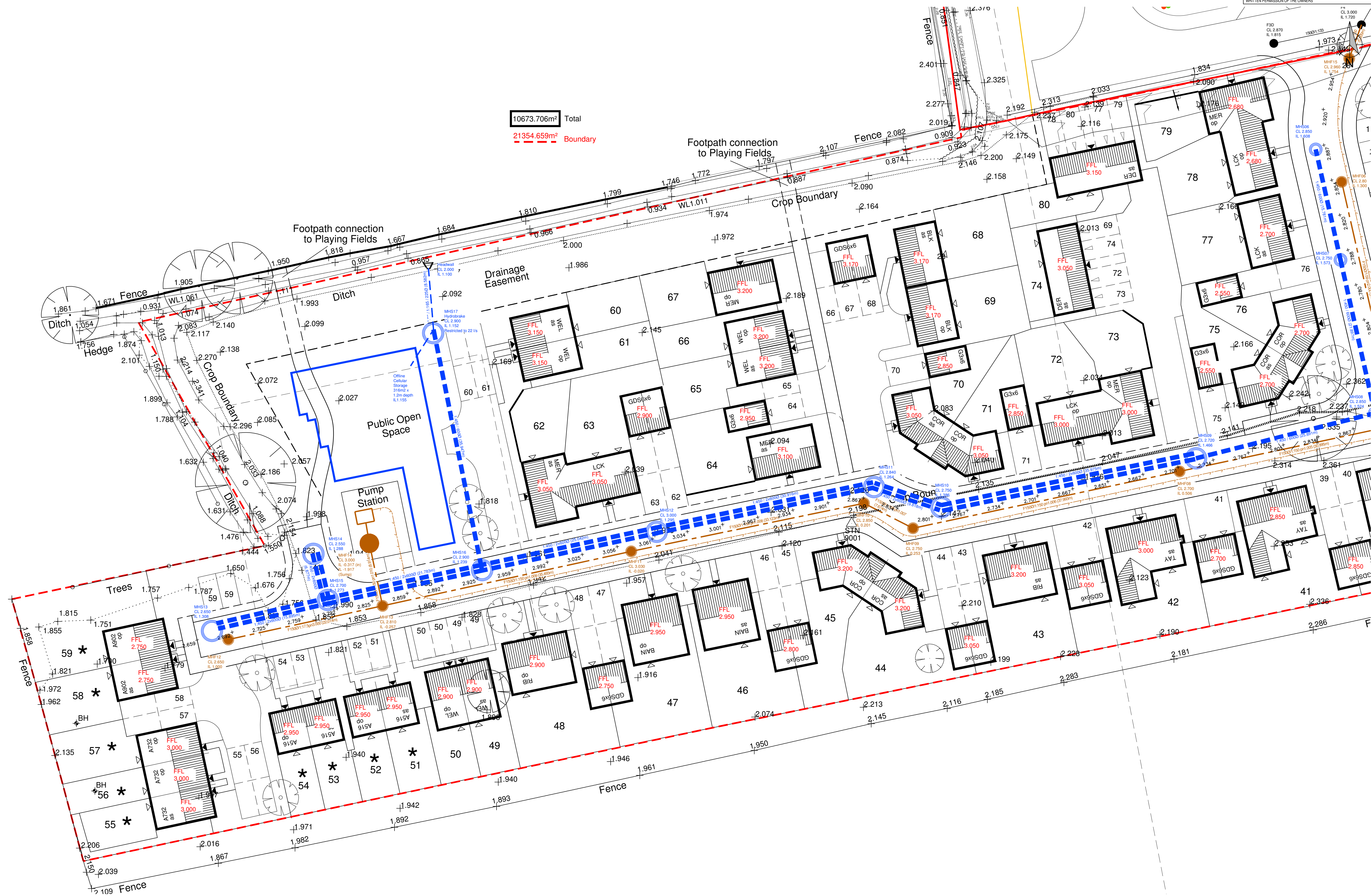
Proposed Site Layout: 1205-003

Proposed Drainage Strategy: MA10575/200





ASSOCIATED DRAWINGS				
No.	TITLE			
NOTES				
REV	DATE	BY	DETAILS	CHK'D
AMENDMENTS				
CLIENT				
Ashwood Homes				
PROJECT				
Proposed Residential Development at Backgate, Cowbit PE12 6FN				
TITLE				
Site Location Plan				
DRAWING No:			DRAWING STATUS	
MA10575-SK01			PRELIMINARY	
SCALE		DRAWN	ENGINEER	
1:2500 @A3		CB	JMCK	
DATE		CHECKED	APPROVED BY	
April 2017				
				
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REV	DATE	BY	DETAILS	CHKD
A1			AMENDMENTS	

NOTES

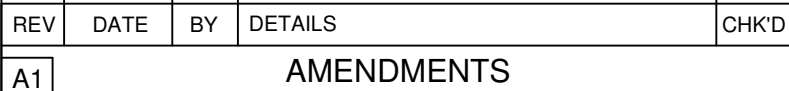
TITLE	Provisional Drainage Strategy Sheet 1 of 2
DATE	April 2017
CHECKED	JMcK
APPROVED BY	JMcK

PROJECT	Backgate Cowbit Phase 2
SCALE	1:250
DRAWN	JMcK
ENGINEER	JMcK

CLIENT	Ashwood Homes Ltd
DRAWING No.	MA10575-200-1
DRAWING STATUS	PRELIMINARY



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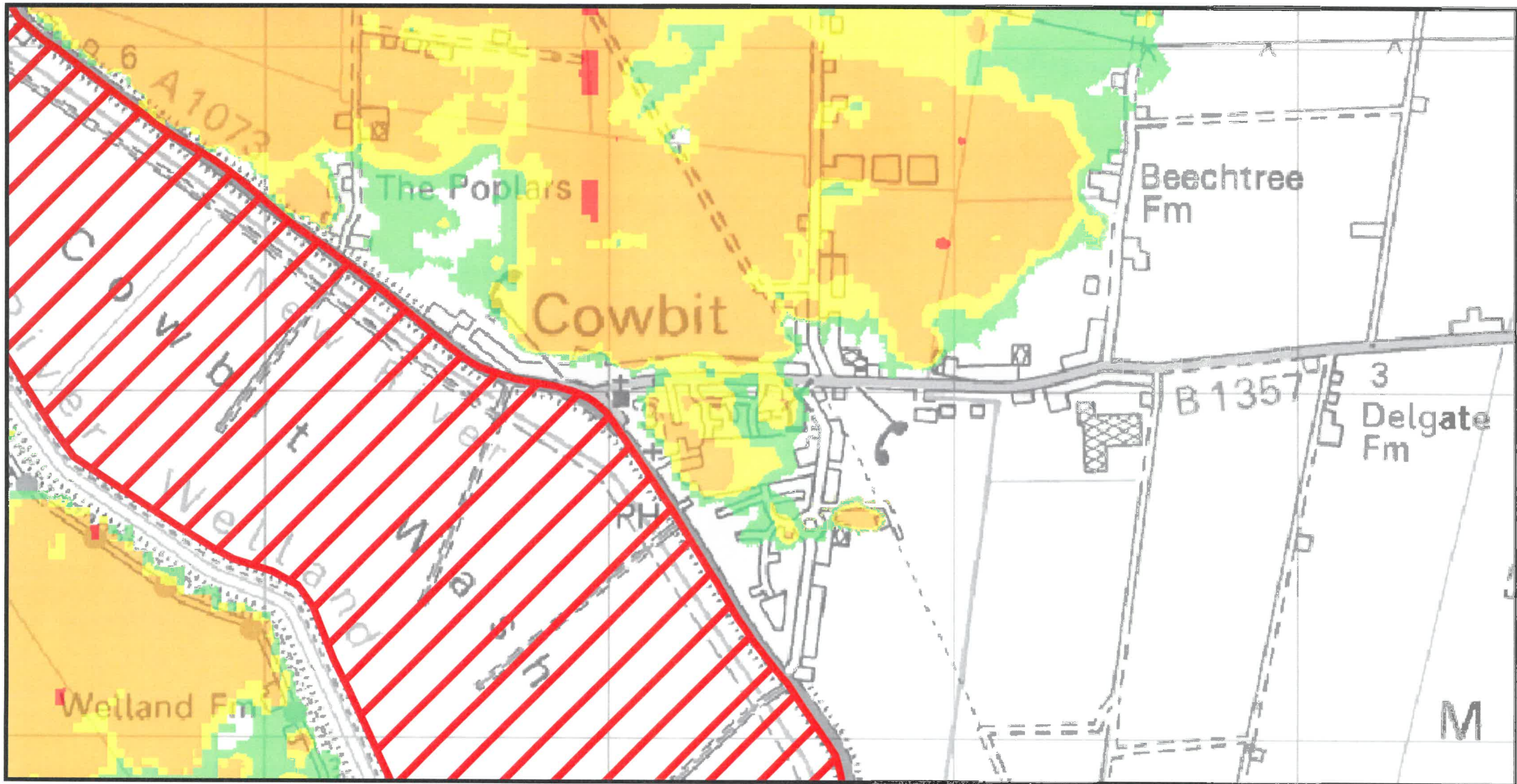
Appendix B – Consultations

Anglian Water Pre-planning assessment report (to be provided when available)
SFRA Hazard and Depth Mapping Extracts



HAZARDS ON SITE
LOW
DANGER FOR SOME
(MAX) DANGER FOR MOST

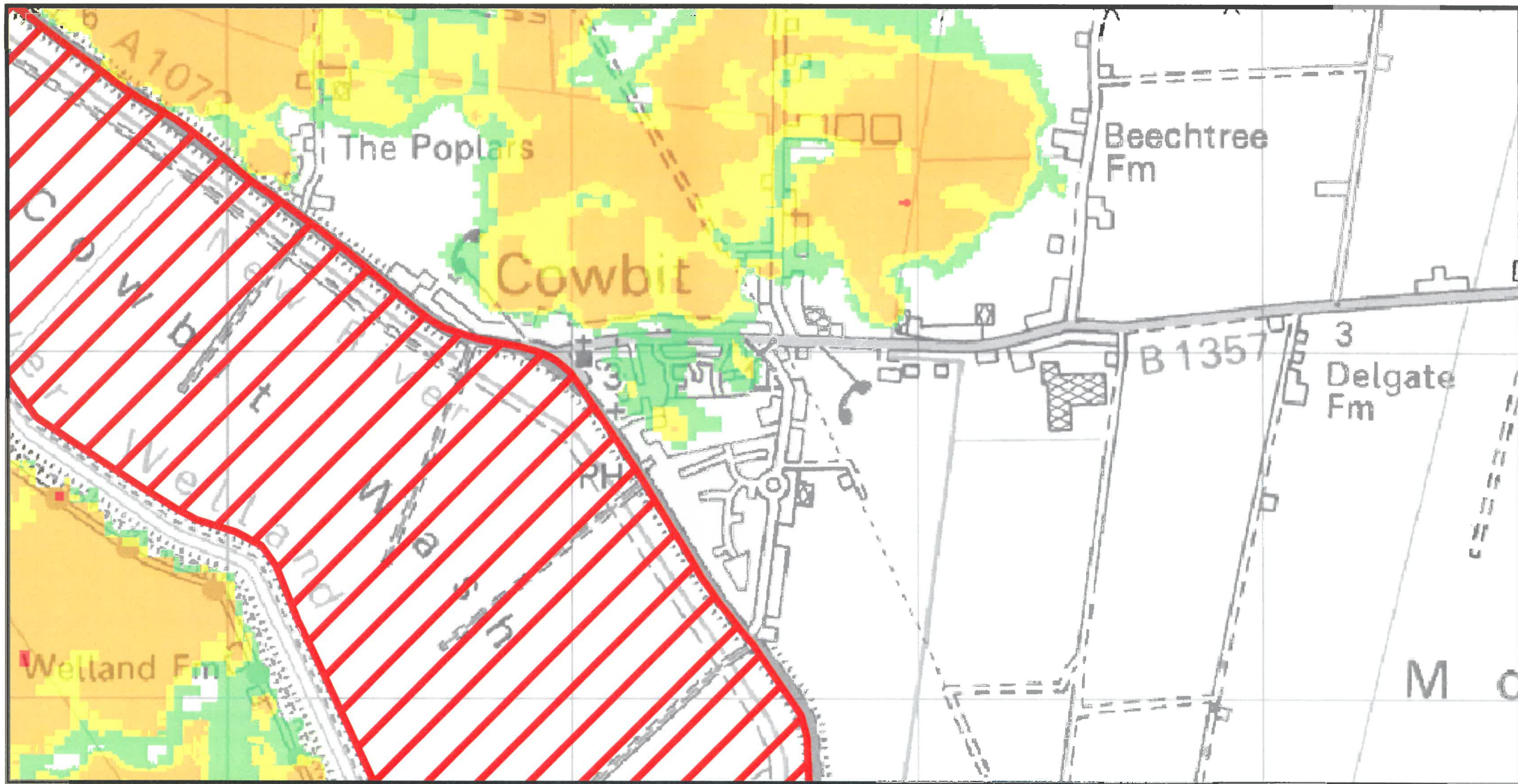
HAZARD
2116



HAZARD ON SITE

NON
LOW
DANGER FOR SOME
DANGER FOR MOST

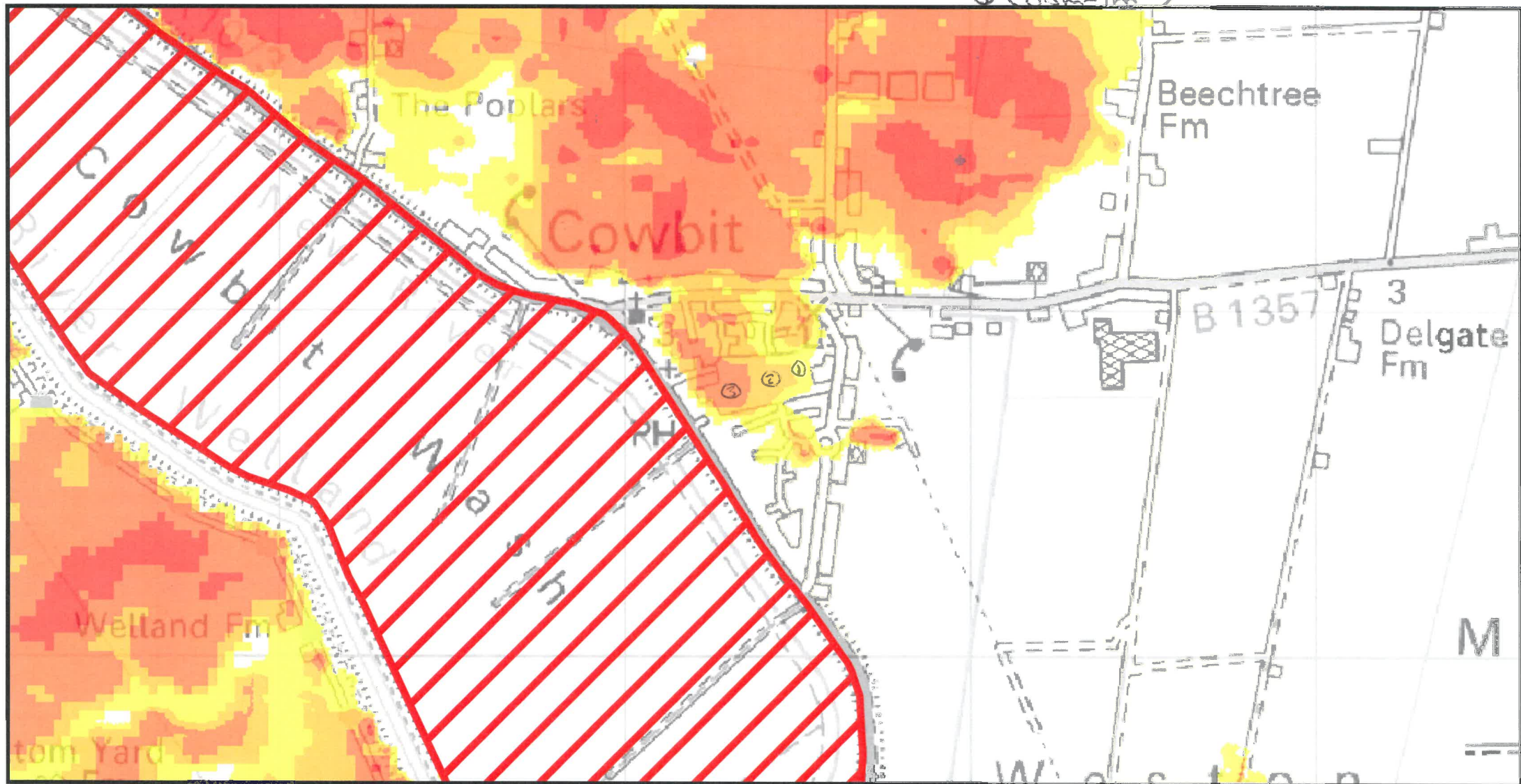
HAZARD
PRESENT DAY



RESIDUAL PEAK DEPTH
(2116)

TAKING INTO ACCOUNT FLOOD DEFENCES -

② (0-0.25m)
③ (0.25-0.5m)
① (0.5m-1m)

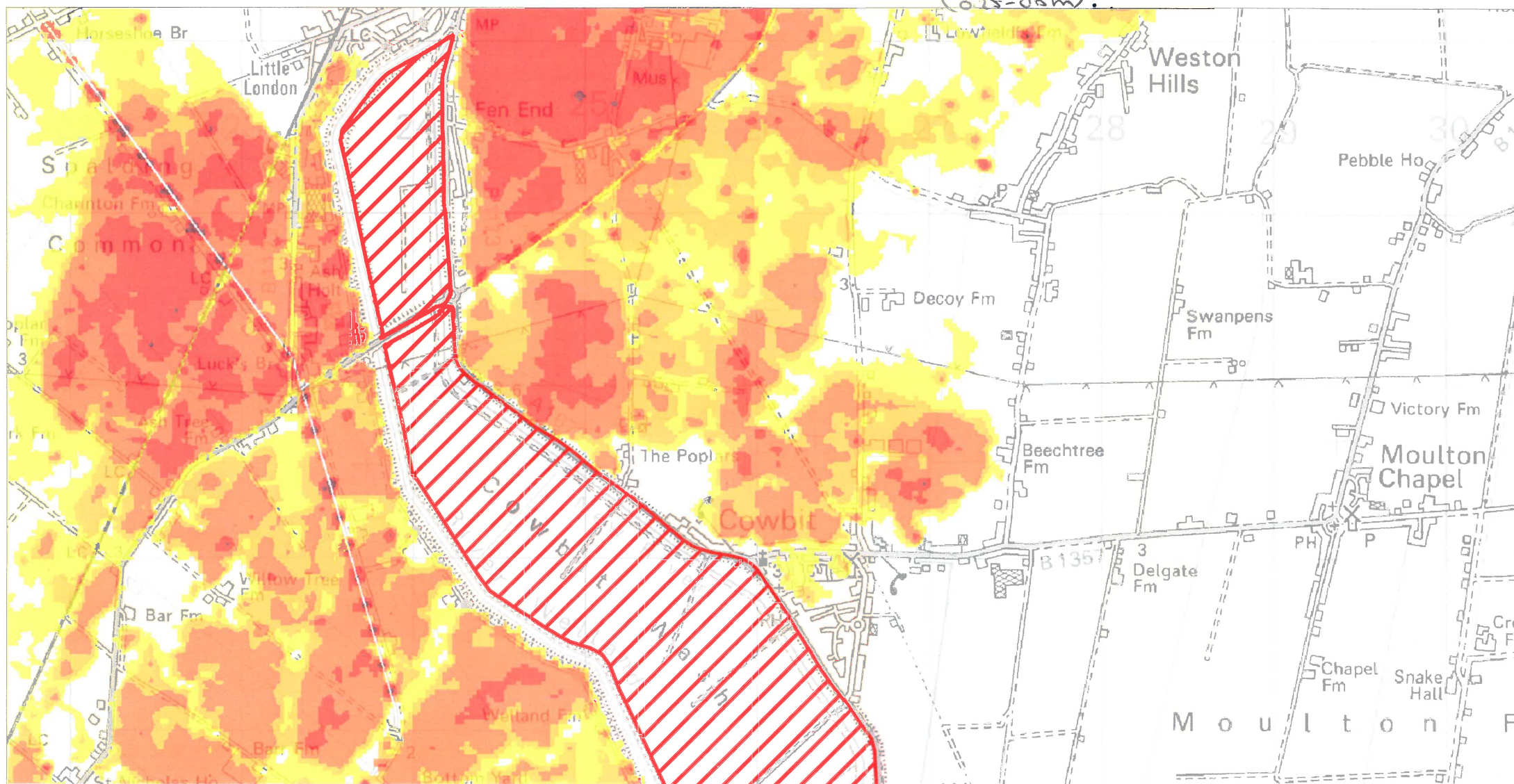


RESIDUAL PEAK DEPTH
PRESENT DAY

1% FLUVIAL / 0.5% TIDAL

TAKING INTO ACCOUNT FLOOD DIFFERENCES

(0-0.25m)
(0.25-0.5m)



The Environment Agency requires direct consultation on proposals in this hazard zone. The NPPF requires that proposals are accompanied by a Flood Risk Assessment which contains evidence that appropriate mitigation measures/flood resilience techniques have been incorporated into the development. The Environment Agency also wish to be consulted on the Sequential Test evidence. Applicants will need to demonstrate that housing proposals are required to meet an identified local housing need.

The applicant is advised to refer to the following document for information on flood resilience and resistance techniques to be included: 'Improving Flood Performance of New Buildings - Flood Resilient Construction' (DCLG 2007).

Finished floor levels (FFL) should be informed by the predicted flood depth maps (refer to the relevant 2115 1% fluvial or 0.5% tidal Max Depth Map) and set as required below (single storey proposals must use the 0.1% event, 2115 scenario, for setting FFLs):

depths of >1.6m

It is unlikely that mitigation measures would prevent flood water from entering the building at ground floor level. Therefore, proposals must have a minimum of 2 storeys with no ground floor habitable accommodation. The first floor living accommodation must be above the highest predicted flood depth. *

depths of 1-1.6m

Proposals must have a minimum of 2 storeys, with FFL set a minimum of 1m above existing ground level, flood resilient construction to a height 300mm above the predicted flood depth, and demountable defences to 600mm above FFL.

✚ depths 0.5 - 1m

FFL must be set 1m above ground level, with flood resilient construction to a height of 300mm above the predicted flood depth.

✚ depths of 0.25 - 0.5

FFL must be set 500mm above ground level, with flood resilient construction to a height 300mm above the predicted flood depth.

depths 0 - 0.25

FFL must be set 300mm above ground level.

* Where there is to be no ground floor habitable accommodation, the Environment Agency requires the imposition of the following conditions in order to ensure this space is not subsequently developed:

CONDITION

The ground floor[s] of the [property][properties][plot nos. *] hereby approved shall be used as [garage][WC][utility][bath/shower room] only and as annotated on approved drawings ***, and for no other habitable accommodation.

REASON

In accordance with the details of the application and to ensure that there is no sleeping or vulnerable living accommodation on the ground floor, in order to protect the inhabitants of the property from the risk of flooding in accordance with the NPPF.

CONDITION

Notwithstanding the provision of the Town and Country Planning (General Permitted Development) Order 1995 (or any order revoking and re-enacting that Order with or without modification), no extensions to provide additional habitable/living accommodation shall be erected [other than those expressly authorised by this permission].

REASON

To reduce the risk and impact of flooding.

Appendix C – WinDES Calculation Results

Provisional WinDES model for the Surface Water Drainage System



The Millward Partnership Ltd		Page 1												
2nd Floor 3-7 Middle Pavement Nottingham NG1 7DX	Back Gate Cowbit Ph2 Surface Drainage design													
Date 20.04.2017 File Drainage Design v...	Designed By GP Checked By													
Micro Drainage Network W.12.4														
<u>Time Area Diagram for Surface</u> <table border="1"> <thead> <tr> <th>Time (mins)</th> <th>Area (ha)</th> <th>Time (mins)</th> <th>Area (ha)</th> <th>Time (mins)</th> <th>Area (ha)</th> </tr> </thead> <tbody> <tr> <td>0-4</td> <td>0.455</td> <td>4-8</td> <td>0.658</td> <td>8-12</td> <td>0.018</td> </tr> </tbody> </table> Total Area Contributing (ha) = 1.131 Total Pipe Volume (m³) = 152.736			Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	0-4	0.455	4-8	0.658	8-12	0.018
Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)									
0-4	0.455	4-8	0.658	8-12	0.018									
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2nd Floor 3-7 Middle Pavement Nottingham NG1 7DX			Back Gate Cowbit Ph2 Surface Drainage design						
Date 20.04.2017 File Drainage Design v...			Designed By GP Checked By						
Micro Drainage			Network W.12.4						
<u>Existing Network Details for Surface</u>									
PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	18.000	0.106	169.8	0.000	5.00	0.0	0.600	o	225
1.001	6.000	0.035	171.4	0.038	5.00	0.0	0.600	o	225
2.000	20.000	0.118	169.5	0.000	5.00	0.0	0.600	o	225
2.001	6.144	0.036	170.7	0.051	5.00	0.0	0.600	o	225
1.002	24.833	0.055	451.5	0.056	5.00	0.0	0.600	o	600
1.003	23.592	0.052	453.7	0.047	0.00	0.0	0.600	o	600
1.004	7.235	0.016	452.2	0.062	0.00	0.0	0.600	o	600
3.000	15.000	0.088	170.5	0.000	5.00	0.0	0.600	o	225
3.001	6.902	0.041	168.3	0.020	5.00	0.0	0.600	o	225
3.002	5.000	0.029	172.4	0.010	5.00	0.0	0.600	o	225
1.005	31.699	0.070	452.8	0.000	0.00	0.0	0.600	o	600
4.000	15.000	0.088	170.5	0.000	5.00	0.0	0.600	o	225
4.001	4.999	0.029	172.4	0.026	5.00	0.0	0.600	o	225
1.006	35.357	0.079	447.6	0.098	0.00	0.0	0.600	o	600
<u>Network Results Table</u>									
PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Vel (m/s)	Cap (l/s)				
1.000	2.313	0.000	0.0	1.00	39.8				
1.001	2.207	0.038	0.0	1.00	39.6				
2.000	2.325	0.000	0.0	1.00	39.8				
2.001	2.207	0.051	0.0	1.00	39.7				
1.002	1.797	0.145	0.0	1.14	322.2				
1.003	1.742	0.192	0.0	1.14	321.4				
1.004	1.690	0.254	0.0	1.14	321.9				
3.000	2.207	0.000	0.0	1.00	39.7				
3.001	2.119	0.020	0.0	1.00	40.0				
3.002	2.078	0.030	0.0	0.99	39.5				
1.005	1.674	0.284	0.0	1.14	321.7				
4.000	2.095	0.000	0.0	1.00	39.7				
4.001	2.007	0.026	0.0	0.99	39.5				
1.006	1.603	0.408	0.0	1.14	323.6				
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2nd Floor 3-7 Middle Pavement Nottingham NG1 7DX	Back Gate Cowbit Ph2 Surface Drainage design	
Date 20.04.2017 File Drainage Design v...	Designed By GP Checked By	
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Existing Network Details for Surface

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (1/s)	k (mm)	HYD SECT	DIA (mm)
5.000	15.781	0.035	450.9	0.082	5.00	0.0	0.600	o	600
5.001	21.897	0.049	446.9	0.070	0.00	0.0	0.600	o	600
1.007	25.891	0.058	446.4	0.039	0.00	0.0	0.600	o	600
6.000	32.034	0.188	170.4	0.000	5.00	0.0	0.600	o	225
6.001	5.043	0.030	168.1	0.077	5.00	0.0	0.600	o	225
1.008	35.976	0.080	449.7	0.020	0.00	0.0	0.600	oo	45
1.009	9.819	0.022	446.3	0.005	0.00	0.0	0.600	oo	45
7.000	15.999	0.094	170.2	0.000	5.00	0.0	0.600	o	225
7.001	5.000	0.029	172.4	0.071	5.00	0.0	0.600	o	225
1.010	30.917	0.069	448.1	0.000	0.00	0.0	0.600	oo	45
1.011	28.536	0.063	453.0	0.028	0.00	0.0	0.600	oo	45
8.000	10.001	0.059	169.5	0.000	5.00	0.0	0.600	o	225
8.001	7.000	0.041	170.7	0.042	5.00	0.0	0.600	o	225

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (1/s)	Vel (m/s)	Cap (1/s)
5.000	1.608	0.082	0.0	1.14	322.4
5.001	1.573	0.152	0.0	1.15	323.9
1.007	1.524	0.599	0.0	1.15	324.0
6.000	2.059	0.000	0.0	1.00	39.7
6.001	1.871	0.077	0.0	1.01	40.0
1.008	1.466	0.696	0.0	1.14	644.8
1.009	1.386	0.701	0.0	1.15	647.2
7.000	1.865	0.000	0.0	1.00	39.7
7.001	1.771	0.071	0.0	0.99	39.5
1.010	1.364	0.772	0.0	1.14	645.9
1.011	1.295	0.800	0.0	1.14	642.4
8.000	1.777	0.000	0.0	1.00	39.8
8.001	1.718	0.042	0.0	1.00	39.7

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2nd Floor 3-7 Middle Pavement Nottingham NG1 7DX	Back Gate Cowbit Ph2 Surface Drainage design	
Date 20.04.2017 File Drainage Design v...	Designed By GP Checked By	
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Existing Network Details for Surface

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (1/s)	k (mm)	HYD SECT	DIA (mm)
8.002	15.895	0.035	454.1	0.041	5.00	0.0	0.600	oo	45
9.000	6.877	0.015	458.5	0.030	5.00	0.0	0.600	oo	45
8.003	18.380	0.041	448.3	0.043	0.00	0.0	0.600	oo	45
1.012	35.947	0.080	449.3	0.090	0.00	0.0	0.600	o	600
1.013	8.582	0.052	165.0	0.085	0.00	0.0	0.600	o	225

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (1/s)	Vel (m/s)	Cap (1/s)
8.002	1.308	0.083	0.0	1.14	641.6
9.000	1.288	0.030	0.0	1.13	638.5
8.003	1.273	0.156	0.0	1.14	645.8
1.012	1.232	1.046	0.0	1.14	323.0
1.013	1.152	1.131	0.0	1.01	40.4

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2nd Floor 3-7 Middle Pavement Nottingham NG1 7DX				Back Gate Cowbit Ph2 Surface Drainage design						
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Manhole Schedules for Surface										
MH Name	MH CL (m)	MH Depth (m)	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
RE01	3.520	1.207	600	1.000	2.313	225				
IC01	3.520	1.313	600	1.001	2.207	225	1.000	2.207	225	
RE02	3.450	1.125	600	2.000	2.325	225				
ICS02	3.450	1.243	600	2.001	2.207	225	2.000	2.207	225	
MHS01	3.597	1.800	1800	1.002	1.797	600	1.001	2.172	225	
							2.001	2.171	225	
MHS02	3.490	1.748	1800	1.003	1.742	600	1.002	1.742	600	
MHS03	3.331	1.641	1800	1.004	1.690	600	1.003	1.690	600	
RE03	3.332	1.125	600	3.000	2.207	225				
ICS03	3.360	1.241	600	3.001	2.119	225	3.000	2.119	225	
ICS04	3.420	1.342	600	3.002	2.078	225	3.001	2.078	225	
MHS04	3.474	1.800	1800	1.005	1.674	600	1.004	1.674	600	
							3.002	2.049	225	
RE04	3.220	1.125	600	4.000	2.095	225				
ICS05	3.330	1.323	600	4.001	2.007	225	4.000	2.007	225	
MHS05	3.403	1.800	1800	1.006	1.603	600	1.005	1.604	600	
							4.001	1.978	225	
MHS06	3.033	1.425	1800	5.000	1.608	600				
MHS07	3.000	1.427	1800	5.001	1.573	600	5.000	1.573	600	
MHS08	3.324	1.800	1800	1.007	1.524	600	1.006	1.524	600	
							5.001	1.524	600	
RE05	3.324	1.265	600	6.000	2.059	225				
ICS06	3.324	1.453	600	6.001	1.871	225	6.000	1.871	225	
MHS09	3.266	1.800	1800	1.008	1.466	45	1.007	1.466	600	
							6.001	1.841	225	
MHS10	3.186	1.800	1800	1.009	1.386	45	1.008	1.386	45	
RE06	3.200	1.335	600	7.000	1.865	225				
ICS07	3.200	1.429	600	7.001	1.771	225	7.000	1.771	225	
MHS11	3.164	1.800	1800	1.010	1.364	45	1.009	1.364	45	
							7.001	1.742	225	
MHS12	3.095	1.800	1800	1.011	1.295	45	1.010	1.295	45	
RE07	3.050	1.273	600	8.000	1.777	225				
ICS08	3.050	1.332	600	8.001	1.718	225	8.000	1.718	225	
MHS13	3.108	1.800	1800	8.002	1.308	45	8.001	1.677	225	
MHS14	3.088	1.800	1800	9.000	1.288	45				
MHS15	3.073	1.800	1800	8.003	1.273	45	8.002	1.273	45	
							9.000	1.273	45	
MHS16	3.032	1.800	1800	1.012	1.232	600	1.011	1.232	45	
							8.003	1.232	45	
MHS17	2.850	1.698	2700	1.013	1.152	225	1.012	1.152	600	
	2.800	1.700	0		OUTFALL		1.013	1.100	225	
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<u>PIPELINE SCHEDULES for Surface</u>							
<u>Upstream Manhole</u>							
PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
1.000	o	225	RE01	3.520	2.313	0.982	600
1.001	o	225	IC01	3.520	2.207	1.088	600
2.000	o	225	RE02	3.450	2.325	0.900	600
2.001	o	225	ICS02	3.450	2.207	1.018	600
1.002	o	600	MHS01	3.597	1.797	1.200	1800
1.003	o	600	MHS02	3.490	1.742	1.148	1800
1.004	o	600	MHS03	3.331	1.690	1.041	1800
3.000	o	225	RE03	3.332	2.207	0.900	600
3.001	o	225	ICS03	3.360	2.119	1.016	600
3.002	o	225	ICS04	3.420	2.078	1.117	600
1.005	o	600	MHS04	3.474	1.674	1.200	1800
4.000	o	225	RE04	3.220	2.095	0.900	600
4.001	o	225	ICS05	3.330	2.007	1.098	600
<u>Downstream Manhole</u>							
PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
1.000	18.000	169.8	IC01	3.520	2.207	1.088	600
1.001	6.000	171.4	MHS01	3.597	2.172	1.200	1800
2.000	20.000	169.5	ICS02	3.450	2.207	1.018	600
2.001	6.144	170.7	MHS01	3.597	2.171	1.201	1800
1.002	24.833	451.5	MHS02	3.490	1.742	1.148	1800
1.003	23.592	453.7	MHS03	3.331	1.690	1.041	1800
1.004	7.235	452.2	MHS04	3.474	1.674	1.200	1800
3.000	15.000	170.5	ICS03	3.360	2.119	1.016	600
3.001	6.902	168.3	ICS04	3.420	2.078	1.117	600
3.002	5.000	172.4	MHS04	3.474	2.049	1.200	1800
1.005	31.699	452.8	MHS05	3.403	1.604	1.199	1800
4.000	15.000	170.5	ICS05	3.330	2.007	1.098	600
4.001	4.999	172.4	MHS05	3.403	1.978	1.200	1800
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<u>PIPELINE SCHEDULES for Surface</u>							
<u>Upstream Manhole</u>							
PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
8.000	o	225	RE07	3.050	1.777	1.048	600
8.001	o	225	ICS08	3.050	1.718	1.107	600
8.002	oo	45	MHS13	3.108	1.308	1.200	1800
9.000	oo	45	MHS14	3.088	1.288	1.200	1800
8.003	oo	45	MHS15	3.073	1.273	1.200	1800
1.012	o	600	MHS16	3.032	1.232	1.200	1800
1.013	o	225	MHS17	2.850	1.152	1.473	2700
<u>Downstream Manhole</u>							
PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
8.000	10.001	169.5	ICS08	3.050	1.718	1.107	600
8.001	7.000	170.7	MHS13	3.108	1.677	1.206	1800
8.002	15.895	454.1	MHS15	3.073	1.273	1.200	1800
9.000	6.877	458.5	MHS15	3.073	1.273	1.200	1800
8.003	18.380	448.3	MHS16	3.032	1.232	1.200	1800
1.012	35.947	449.3	MHS17	2.850	1.152	1.098	2700
1.013	8.582	165.0		2.800	1.100	1.475	0

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Micro Drainage			Network W.12.4			
<u>Setting Out Information - Site Coordinates (Surface)</u>						
PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
1.000	RE01	600		526558.950	317777.996	
1.001	IC01	600		526541.340	317774.267	
2.000	RE02	600		526534.984	317753.874	
2.001	ICS02	600		526530.828	317773.437	
1.002	MHS01	1800		526535.930	317776.861	
1.003	MHS02	1800		526530.293	317801.046	
1.004	MHS03	1800		526507.165	317796.392	
3.000	RE03	600		526487.684	317813.782	
3.001	ICS03	600		526491.034	317799.161	
3.002	ICS04	600		526496.804	317795.374	
1.005	MHS04	1800		526500.984	317792.631	
4.000	RE04	600		526488.405	317746.716	
4.001	ICS05	600		526484.749	317761.264	
1.006	MHS05	1800		526483.593	317766.128	
5.000	MHS06	1800		526440.816	317795.278	
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<u>Setting Out Information - Site Coordinates (Surface)</u>						
PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
5.001	MHS07	1800		526444.272	317779.880	
1.007	MHS08	1800		526449.066	317758.514	
6.000	RE05	600		526416.463	317788.794	
6.001	ICS06	600		526422.871	317757.443	
1.008	MHS09	1800		526423.873	317752.544	
1.009	MHS10	1800		526388.626	317745.339	
7.000	RE06	600		526375.002	317768.976	
7.001	ICS07	600		526378.280	317753.316	
1.010	MHS11	1800		526379.304	317748.422	
1.011	MHS12	1800		526349.043	317742.089	
8.000	RE07	600		526291.362	317712.111	
8.001	ICS08	600		526289.194	317721.874	
8.002	MHS13	1800		526287.676	317728.707	
9.000	MHS14	1800		526301.574	317738.942	
8.003	MHS15	1800		526303.170	317732.253	
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Setting Out Information - Site Coordinates (Surface)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
1.012	MHS16	1800		526321.157	317736.034	
1.013	MHS17	2700		526313.688	317771.197	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
1.013		0		526316.898	317779.156	

Free Flowing Outfall Details for Surface

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.013		2.800	1.100	0.000	0	0

Simulation Criteria for Surface

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	8
Number of Online Controls	8	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.403		

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<u>Orifice Manhole: IC01, DS/PN: 1.001, Volume (m³): 1.1</u>																																																																															
Diameter (m) 0.065 Discharge Coefficient 0.600 Invert Level (m) 2.207																																																																															
<u>Orifice Manhole: ICS02, DS/PN: 2.001, Volume (m³): 1.1</u>																																																																															
Diameter (m) 0.070 Discharge Coefficient 0.600 Invert Level (m) 2.207																																																																															
<u>Orifice Manhole: ICS03, DS/PN: 3.001, Volume (m³): 0.9</u>																																																																															
Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 2.119																																																																															
<u>Orifice Manhole: ICS05, DS/PN: 4.001, Volume (m³): 0.9</u>																																																																															
Diameter (m) 0.055 Discharge Coefficient 0.600 Invert Level (m) 2.007																																																																															
<u>Orifice Manhole: ICS06, DS/PN: 6.001, Volume (m³): 1.7</u>																																																																															
Diameter (m) 0.080 Discharge Coefficient 0.600 Invert Level (m) 1.871																																																																															
<u>Orifice Manhole: ICS07, DS/PN: 7.001, Volume (m³): 1.0</u>																																																																															
Diameter (m) 0.080 Discharge Coefficient 0.600 Invert Level (m) 1.771																																																																															
<u>Orifice Manhole: ICS08, DS/PN: 8.001, Volume (m³): 0.8</u>																																																																															
Diameter (m) 0.070 Discharge Coefficient 0.600 Invert Level (m) 1.718																																																																															
<u>Depth/Flow Relationship Manhole: MHS17, DS/PN: 1.013, Volume (m³): 19.2</u>																																																																															
Invert Level (m) 1.152																																																																															
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Storage Structures for Surface Porous Car Park Manhole: IC01, DS/PN: 1.001 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>8.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>8.0</td></tr><tr><td>Max Percolation (l/s)</td><td>17.8</td><td>Slope (1:X)</td><td>350.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>3.020</td><td>Cap Volume Depth (m)</td><td>0.200</td></tr></table> Porous Car Park Manhole: ICS02, DS/PN: 2.001 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>6.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>20.0</td></tr><tr><td>Max Percolation (l/s)</td><td>33.3</td><td>Slope (1:X)</td><td>350.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>2.950</td><td>Cap Volume Depth (m)</td><td>0.200</td></tr></table> Porous Car Park Manhole: ICS04, DS/PN: 3.002 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>5.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>29.0</td></tr><tr><td>Max Percolation (l/s)</td><td>40.3</td><td>Slope (1:X)</td><td>350.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>2.620</td><td>Cap Volume Depth (m)</td><td>0.200</td></tr></table> Porous Car Park Manhole: ICS05, DS/PN: 4.001 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>5.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>22.0</td></tr><tr><td>Max Percolation (l/s)</td><td>30.6</td><td>Slope (1:X)</td><td>350.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>2.830</td><td>Cap Volume Depth (m)</td><td>0.200</td></tr></table> Porous Car Park Manhole: ICS06, DS/PN: 6.001 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>5.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>41.0</td></tr><tr><td>Max Percolation (l/s)</td><td>56.9</td><td>Slope (1:X)</td><td>350.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>2.624</td><td>Cap Volume Depth (m)</td><td>0.200</td></tr></table>			Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.0	Membrane Percolation (mm/hr)	1000	Length (m)	8.0	Max Percolation (l/s)	17.8	Slope (1:X)	350.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	3.020	Cap Volume Depth (m)	0.200	Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0	Membrane Percolation (mm/hr)	1000	Length (m)	20.0	Max Percolation (l/s)	33.3	Slope (1:X)	350.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	2.950	Cap Volume Depth (m)	0.200	Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0	Membrane Percolation (mm/hr)	1000	Length (m)	29.0	Max Percolation (l/s)	40.3	Slope (1:X)	350.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	2.620	Cap Volume Depth (m)	0.200	Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0	Membrane Percolation (mm/hr)	1000	Length (m)	22.0	Max Percolation (l/s)	30.6	Slope (1:X)	350.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	2.830	Cap Volume Depth (m)	0.200	Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0	Membrane Percolation (mm/hr)	1000	Length (m)	41.0	Max Percolation (l/s)	56.9	Slope (1:X)	350.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	2.624	Cap Volume Depth (m)	0.200
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<u>Porous Car Park Manhole: ICS07, DS/PN: 7.001</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>6.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>27.0</td></tr><tr><td>Max Percolation (l/s)</td><td>45.0</td><td>Slope (1:X)</td><td>350.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>2.600</td><td>Cap Volume Depth (m)</td><td>0.200</td></tr></table> <u>Porous Car Park Manhole: ICS08, DS/PN: 8.001</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>5.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>16.0</td></tr><tr><td>Max Percolation (l/s)</td><td>22.2</td><td>Slope (1:X)</td><td>350.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>2.250</td><td>Cap Volume Depth (m)</td><td>0.200</td></tr></table> <u>Cellular Storage Manhole: MHS17, DS/PN: 1.013</u> <table><tr><td>Invert Level (m)</td><td>1.152</td><td>Safety Factor</td><td>2.0</td></tr><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Porosity</td><td>0.95</td></tr><tr><td>Infiltration Coefficient Side (m/hr)</td><td>0.00000</td><td></td><td></td></tr></table> <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>316.0</td><td>0.0</td><td>5.200</td><td>0.0</td><td>0.0</td></tr><tr><td>0.400</td><td>316.0</td><td>0.0</td><td>5.600</td><td>0.0</td><td>0.0</td></tr><tr><td>0.800</td><td>316.0</td><td>0.0</td><td>6.000</td><td>0.0</td><td>0.0</td></tr><tr><td>1.200</td><td>316.0</td><td>0.0</td><td>6.400</td><td>0.0</td><td>0.0</td></tr><tr><td>1.201</td><td>0.0</td><td>0.0</td><td>6.800</td><td>0.0</td><td>0.0</td></tr><tr><td>2.000</td><td>0.0</td><td>0.0</td><td>7.200</td><td>0.0</td><td>0.0</td></tr><tr><td>2.400</td><td>0.0</td><td>0.0</td><td>7.600</td><td>0.0</td><td>0.0</td></tr><tr><td>2.800</td><td>0.0</td><td>0.0</td><td>8.000</td><td>0.0</td><td>0.0</td></tr><tr><td>3.200</td><td>0.0</td><td>0.0</td><td>8.400</td><td>0.0</td><td>0.0</td></tr><tr><td>3.600</td><td>0.0</td><td>0.0</td><td>8.800</td><td>0.0</td><td>0.0</td></tr><tr><td>4.000</td><td>0.0</td><td>0.0</td><td>9.200</td><td>0.0</td><td>0.0</td></tr><tr><td>4.400</td><td>0.0</td><td>0.0</td><td>9.600</td><td>0.0</td><td>0.0</td></tr><tr><td>4.800</td><td>0.0</td><td>0.0</td><td>10.000</td><td>0.0</td><td>0.0</td></tr></table>			Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0	Membrane Percolation (mm/hr)	1000	Length (m)	27.0	Max Percolation (l/s)	45.0	Slope (1:X)	350.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	2.600	Cap Volume Depth (m)	0.200	Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0	Membrane Percolation (mm/hr)	1000	Length (m)	16.0	Max Percolation (l/s)	22.2	Slope (1:X)	350.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	2.250	Cap Volume Depth (m)	0.200	Invert Level (m)	1.152	Safety Factor	2.0	Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95	Infiltration Coefficient Side (m/hr)	0.00000			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	316.0	0.0	5.200	0.0	0.0	0.400	316.0	0.0	5.600	0.0	0.0	0.800	316.0	0.0	6.000	0.0	0.0	1.200	316.0	0.0	6.400	0.0	0.0	1.201	0.0	0.0	6.800	0.0	0.0	2.000	0.0	0.0	7.200	0.0	0.0	2.400	0.0	0.0	7.600	0.0	0.0	2.800	0.0	0.0	8.000	0.0	0.0	3.200	0.0	0.0	8.400	0.0	0.0	3.600	0.0	0.0	8.800	0.0	0.0	4.000	0.0	0.0	9.200	0.0	0.0	4.400	0.0	0.0	9.600	0.0	0.0	4.800	0.0	0.0	10.000	0.0	0.0
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3.200	0.0	0.0	8.400	0.0	0.0																																																																																																																																													
3.600	0.0	0.0	8.800	0.0	0.0																																																																																																																																													
4.000	0.0	0.0	9.200	0.0	0.0																																																																																																																																													
4.400	0.0	0.0	9.600	0.0	0.0																																																																																																																																													
4.800	0.0	0.0	10.000	0.0	0.0																																																																																																																																													
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The Millward Partnership Ltd		Page 15
2nd Floor 3-7 Middle Pavement Nottingham NG1 7DX	Back Gate Cowbit Ph2 Surface Drainage design	
Date 20.04.2017 File Drainage Design v...	Designed By GP Checked By	
Micro Drainage		Network W.12.4

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

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+40%	100/15 Summer				
1.001	15 Winter	100	+40%	100/15 Summer				
2.000	30 Winter	100	+40%	100/15 Summer				
2.001	30 Winter	100	+40%	100/15 Summer				
1.002	180 Winter	100	+40%					
1.003	180 Winter	100	+40%	100/180 Winter				
1.004	180 Winter	100	+40%	100/120 Winter				
3.000	15 Winter	100	+40%	100/15 Summer				
3.001	15 Winter	100	+40%	100/15 Summer				
3.002	180 Winter	100	+40%	100/120 Winter				
1.005	180 Winter	100	+40%	100/120 Winter				
4.000	15 Winter	100	+40%	100/15 Summer				
4.001	15 Winter	100	+40%	100/15 Summer				
1.006	180 Winter	100	+40%	100/120 Winter				
5.000	180 Winter	100	+40%	100/120 Winter				
5.001	180 Winter	100	+40%	100/120 Winter				
1.007	180 Winter	100	+40%	100/60 Winter				
6.000	30 Winter	100	+40%	100/15 Summer				
6.001	30 Winter	100	+40%	100/15 Summer				
1.008	180 Winter	100	+40%	100/60 Winter				
1.009	180 Winter	100	+40%	100/60 Summer				
7.000	30 Winter	100	+40%	100/15 Summer				
7.001	30 Winter	100	+40%	100/15 Summer				
1.010	180 Winter	100	+40%	100/60 Summer				
1.011	180 Winter	100	+40%	100/60 Summer				
8.000	15 Winter	100	+40%	100/15 Summer				
8.001	15 Winter	100	+40%	100/15 Summer				
8.002	180 Winter	100	+40%	100/60 Summer				
9.000	180 Winter	100	+40%	100/30 Winter				
8.003	180 Winter	100	+40%	100/30 Winter				
1.012	180 Winter	100	+40%	100/30 Winter				
1.013	180 Winter	100	+40%	100/15 Summer				

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The Millward Partnership Ltd		Page 16
2nd Floor 3-7 Middle Pavement Nottingham NG1 7DX	Back Gate Cowbit Ph2 Surface Drainage design	
Date 20.04.2017 File Drainage Design v...	Designed By GP Checked By	
Micro Drainage	Network W.12.4	

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

PN	US/MH Name	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	RE01	3.362	0.824	0.000	0.06	0.0	2.2	FLOOD RISK
1.001	IC01	3.367	0.935	0.000	0.31	0.0	9.2	FLOOD RISK
2.000	RE02	3.159	0.609	0.000	0.05	0.0	1.7	FLOOD RISK
2.001	ICS02	3.159	0.727	0.000	0.33	0.0	9.8	FLOOD RISK
1.002	MHS01	2.397	0.000	0.000	0.08	0.0	20.3	OK
1.003	MHS02	2.346	0.004	0.000	0.10	0.0	25.3	SURCHARGED
1.004	MHS03	2.345	0.055	0.000	0.18	0.0	32.8	SURCHARGED
3.000	RE03	3.202	0.770	0.000	0.03	0.0	1.2	FLOOD RISK
3.001	ICS03	3.202	0.858	0.000	0.37	0.0	11.0	FLOOD RISK
3.002	ICS04	2.345	0.042	0.000	0.15	0.0	4.3	SURCHARGED
1.005	MHS04	2.345	0.071	0.000	0.14	0.0	36.1	SURCHARGED
4.000	RE04	2.938	0.618	0.000	0.04	0.0	1.5	FLOOD RISK
4.001	ICS05	2.938	0.706	0.000	0.21	0.0	6.0	SURCHARGED
1.006	MHS05	2.344	0.141	0.000	0.18	0.0	50.0	SURCHARGED
5.000	MHS06	2.343	0.135	0.000	0.06	0.0	10.9	SURCHARGED
5.001	MHS07	2.343	0.170	0.000	0.08	0.0	20.1	SURCHARGED
1.007	MHS08	2.342	0.218	0.000	0.28	0.0	72.4	SURCHARGED
6.000	RE05	2.880	0.596	0.000	0.03	0.0	1.1	SURCHARGED
6.001	ICS06	2.880	0.784	0.000	0.44	0.0	12.9	SURCHARGED
1.008	MHS09	2.340	0.274	0.000	0.16	0.0	84.6	SURCHARGED
1.009	MHS10	2.338	0.352	0.000	0.26	0.0	85.4	SURCHARGED
7.000	RE06	2.850	0.760	0.000	0.04	0.0	1.4	SURCHARGED
7.001	ICS07	2.850	0.854	0.000	0.45	0.0	13.1	SURCHARGED
1.010	MHS11	2.337	0.373	0.000	0.18	0.0	94.3	SURCHARGED
1.011	MHS12	2.336	0.441	0.000	0.18	0.0	93.3	SURCHARGED
8.000	RE07	2.909	0.907	0.000	0.04	0.0	1.4	FLOOD RISK
8.001	ICS08	2.915	0.972	0.000	0.34	0.0	10.3	FLOOD RISK
8.002	MHS13	2.334	0.426	0.000	0.03	0.0	11.1	SURCHARGED
9.000	MHS14	2.334	0.446	0.000	0.01	0.0	4.0	SURCHARGED
8.003	MHS15	2.334	0.461	0.000	0.05	0.0	20.8	SURCHARGED
1.012	MHS16	2.334	0.502	0.000	0.42	0.0	112.8	SURCHARGED
1.013	MHS17	2.330	0.953	0.000	0.68	0.0	22.0	SURCHARGED

Appendix D – Ground Investigation

Extracts from the GeoDyne Geo Environmental Report



Report Phase II - Backgate, Cowbit
Client Ashwood Homes
Project No. D37036
Status DRAFT
Date 13th April 2017

The recommendations made in this preliminary report are based on the review of the existing report for the adjacent site GeoDyne report, 'Backgate, Cowbit – Combined Phase I Desk Study & Phase II Exploratory Investigation', prepared for Ashle King Developments Ltd, reference D3500, dated April 2015 and visual evidence from the explorator holes on site. We have not yet received the soil test results or completed the programme of ground gas/water monitoring. Therefore, these recommendations are preliminary and GeoDyne reserves the right to amend our recommendations upon completion of our works.

These comments have been prepared on the understanding that it is currently proposed to redevelop the site for a residential end-use. With regard to the proposed development the following comments and recommendations apply.

SITE WORKS

Exploratory investigation works were undertaken between 27th and 31st March 2017 and comprised the following:

- A sub-contracted sub-surface scan of explorator hole locations, undertaken to attempt to avoid buried services and to ensure the health and safety of site operatives.
- Excavation of thirteen trial pits (TP1 to TP13) to depths ranging between 2.00m and 3.40m below existing ground level (begl).
- Excavation of three soakaway pits (SA1 to SA3) to depths ranging between 1.00m and 2.30m begl, which were filled and allowed to drain three times over a period of three days. One shallow soakaway pit (SA2) was excavated to assess the infiltration rate of strata directly beneath the topsoil to assess the suitability of permeable driveways.
- Advancement of three cable percussive boreholes (BH1 to BH3) each to a depth of 20.00m begl.
- Installation of three ground gas/water monitoring points, each to a depth of 5.00m begl.

The approximate explorator hole locations are indicated on the attached draft plan (Figure No. PRELIM01). Draft explorator hole logs are also attached for your information.

GROUND CONDITIONS

Topsoil

TOPSOIL was encountered at the surface of all explorator holes to depths of between 0.30m and 0.70m begl. The topsoil was typically sand, silt and clay in composition.

Natural Strata

Beneath the Topsoil in just under half of the explorator holes, an initial layer of typically firm SILT with varying amounts of Clay and Sand was encountered to depths of between 0.60m and 1.00m begl. In an area within the east of the site, medium dense very silt fine to medium SAND was encountered directly below Topsoil to depths of between 0.70m and 0.90m begl. Underlying the Topsoil in the remaining holes and beneath the Sand where present firm CLAY with varying amounts of Silt, Sand and Gravel was encountered to depths of between 1.20m and 2.30m begl.

Underlying the near surface Clay where penetrated, very soft to locally soft CLAY was encountered. This Clay layer incorporated laminations/interbeds of spongy fibrous PEAT. A thicker layer 0.10m of spongy fibrous PEAT was observed in TP1, overlying the Clay. The cable percussive boreholes revealed the Clay with Peat interbeds to depths of between 6.10m and 9.00m begl.

The Clay was underlain by granular soils typically comprising medium dense clayey silt SAND and dense very sandy GRAVEL, which were encountered to depths of between 10.10m and 11.50m begl.

The cable percussive boreholes encountered glacial deposits consisting of stiff slightly sandy gravelly CLAY, with gravel predominantly comprising chalk and flint, to depths of between 15.10m and 17.30m begl. Strata of the Oxford Clay Formation, comprising stiff CLAY was then encountered to the base of the boreholes.

FOUNDATION DESIGN

Foundation recommendations for the proposed dwellings will be confirmed within our final report upon receipt of laboratory soil test results. The explorator holes revealed the near surface Natural Strata to be visually more peaty in composition than the soils encountered on the adjacent Phase I site. The presence of low strength, potentially compressible peaty Clay deposits encountered across the site may preclude the use of traditional footings and rafts at the site.

Therefore, a deeper foundation solution i.e. piles may be required for the proposed dwellings at the site. Advice from a specialist piling contractor should be sought to confirm the depths of the piles and the most feasible and cost efficient type of pile to be used at the site.

FLOOR SLAB DESIGN & GROUND GAS PRECAUTIONS

A programme of ground gas monitoring is currently being undertaken at the site as part of our works. Gas precautions and floor slab design are subject to confirmation upon completion of the monitoring programme with recommendations being made within our final report.

BUILDING NEAR TREES

Foundation and floor slab designs may need to be adjusted when building near existing, proposed or recently removed trees due to the presence of potentially shrinkable soils at the site. Geotechnical soil testing has been commissioned on soil samples obtained from the site works, which will assist in determining the shrinkage potential of the near surface soils. The findings of this testing will be detailed within our final report for the site.

RADON

Based on the review of the existing Desk Study information for the adjacent site, no radon precautions are required within the proposed development.

WATER

Within the majority of trial pits, slight water seepages were observed at high variable depths typically in the region of 1.20m to 2.90m bgl. Less common moderate water seepages were encountered within three of the trial pits at variable depths of between 0.90m and 2.50m bgl.

Water was typically encountered at depths of between 0.00m and 10.00m bgl during the advancement of the boreholes.

Groundwater monitoring will be undertaken during the ground gas visits to assist in determining the groundwater regime at the site.

STABILITY

The sides of the majority of trial pits were found to be stable during excavation and for the short period of time the excavations remained open after completion. Localised instability and pit collapse was observed in shallow Silt and locally encountered Sand from depths of approximately 0.40m bgl.

On the basis of the exploratory works, shallow excavations may locally require trench support, in particular where shallow Sand and/or Silt is encountered.

The natural cohesive soils may be subject to deterioration and softening if excavations are left open and exposed to wet weather. Any softened soils should be removed from excavations prior to the pouring of concrete where applicable.

COAL MINING ISSUES

Based on the review of the existing Desk Study information for the adjacent site, no coal mining associated precautions are required at the site.

CBRs

Subject to laboratory soil test results.

SULPHATE CLASSIFICATION

Subject to laboratory soil test results.

SURFACE WATER DRAINAGE

TABLE 1 – SOIL INFILTRATION RATE CALCULATIONS				
Soakaway Pit	Max Pit Depth (m begl)	Test No.	Duration of Test (mins)	Soil Infiltration Rate (m/s)
SA1	2.30	1	360	3.04×10^{-6}
		2	352	2.48×10^{-6}
		3	342	NO SIGNIFICANT DROP IN WATER LEVEL
SA2	1.00	1	354	1.43×10^{-5}
		2	355	7.98×10^{-6}
		3	360	6.32×10^{-6}
SA3	2.80	1	350	NO SIGNIFICANT DROP IN WATER LEVEL

Soakaway testing undertaken at the site has revealed variable but typically poor soil infiltration rates ranging between 1.43×10^{-5} m/s (fastest) and 2.4×10^{-6} m/s (slowest). An infiltration rate was not calculated for SA3 as the water level failed to drop at all over a 350 minute period. An infiltration rate was also not calculated for the third test in SA1 as the water level only dropped 0.02m during the 352 minute testing period.

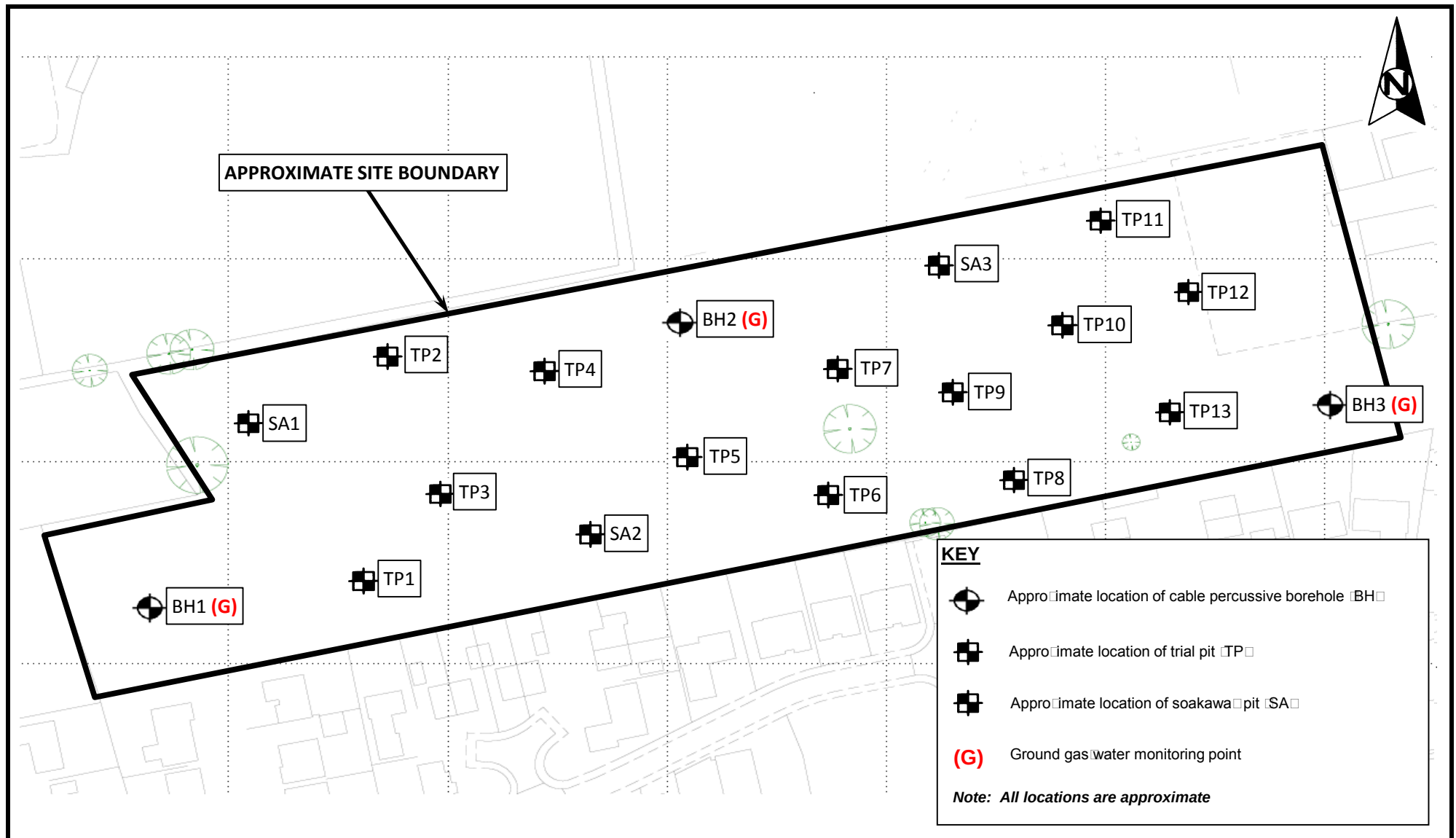
Where applicable, we would recommend that the appropriate infiltration rate for the proposed soakaway locations should be used to assist in soakaway design. Where more than one infiltration rate is given for a pit, we would recommend that the slowest value is used for a conservative assessment.

Soakaways should always be designed in accordance with appropriate good practice to include Environment Agency guidance, BRE 365 etc.

CONTAMINATION ASSESSMENT

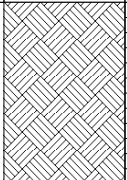
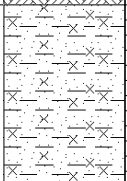
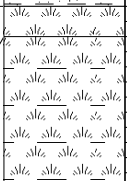
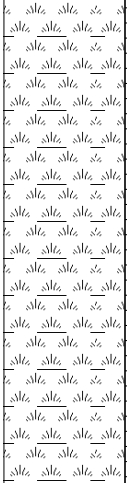
The recommended chemical soil analysis as detailed within our quotation is considered sufficient to provide an initial assessment of the chemical status of the soils at the site from a human health perspective. Further testing may be recommended if the initial soil testing reveals the presence of contamination. We would note that there was no visual or olfactor evidence of contamination encountered within the explorator holes during the course of the site works.

Encs: Explorator Hole Location Plan (PRELIM)01
Draft Explorator Hole Logs (TP1 to TP13, SA1 to SA3 and BH1 to BH3)
Soil Infiltration Rate Calculations
Conditions and Limitations



DRAWING ADAPTED FROM THE NKW DESIGN PLAN TITLED 'LAND OFF BACKGATE, COWBIT PH 2 PRELIMINARY PLANNING LAYOUT' REFERENCED '1205-003' AND DATED APRIL 2017. USED, EDITED AND REPRODUCED WITH PERMISSION FROM THE CLIENT.

Project No.	D37036	Title	Exploratory Hole Location Plan	Drawn	CB	
Client	Ashwood Homes			Checked	DRAFT	
Project	Phase II	Date Drawn	11/04/2017	Approved	DRAFT	
	Backgate	Scale	NTS	Figure No. PRELIM/01		
	Cowbit	Revision				

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy slightly clayey very silty TOPSOIL (TOPSOIL)		0.10	T1	D	In-Situ SV	30 50 55	
Soft to firm dark blue-grey mottled orange sandy silty CLAY (TERRINGTON BEDS)		0.60 0.70 0.80	T2	D			
Spongy dark brown fibrous PEAT (TERRINGTON BEDS)		1.20 1.25 1.30	T3	D			
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		2.00			Ex-Situ SV	10 12 15	 
End of Trial Pit at 3.40m		3.40					

Remarks:

- Sides generally stable.
- Slight water seepage encountered at 1.50m and moderate seepage encountered at 1.70m.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project:

Phase 2 - Backgate, Cowbit

Logged:

CB

Checked:

DRAFT

Field Book Ref:

CB17/02

Date:

27/03/2017

Approved:

DRAFT

Client:

Ashwood Homes

Plant:

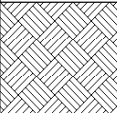
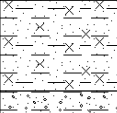
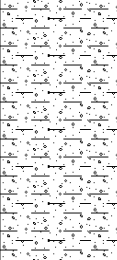
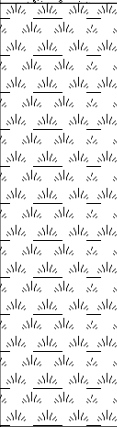
360 Excavator

Scale:

1:25

Drawing No.

TP1

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy slightly silty very clayey TOPSOIL (TOPSOIL)							
Soft to firm blue-grey mottled brown sandy clayey SILT (TERRINGTON BEDS)		0.40 0.45 0.50 0.70	T7	D	In-Situ SV	100 110 96	
Soft to firm blue-grey mottled orange slightly gravelly slightly sandy and occasionally peaty CLAY. Gravel is predominantly fine to medium subangular mudstone to sandstone (TERRINGTON BEDS)		1.00	B3	B			
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		1.60 1.70	T8	D			
End of Trial Pit at 3.00m		3.00					

Remarks:

- Sides generally stable.
- No water encountered.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project:

Phase 2 - Backgate, Cowbit

Logged:

CB

Checked:

DRAFT

Field Book Ref:

CB17/02

Date:

27/03/2017

Approved:

DRAFT

Client:

Ashwood Homes

Plant:

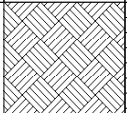
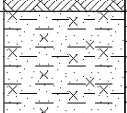
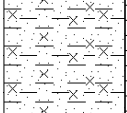
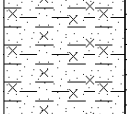
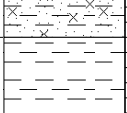
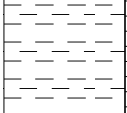
360 Excavator

Scale:

1:25

Drawing No.

TP2

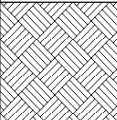
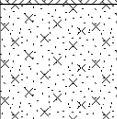
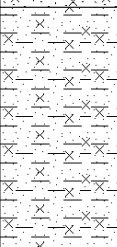
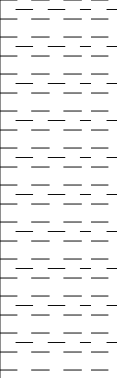
Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)		0.20	T12	D	In-Situ SV	75 80 85	
Firm to stiff blue-grey mottled orange slightly sandy silty CLAY (TERRINGTON BEDS)		0.40 0.40 0.50	LB2	B			
...slightly gravelly below 1.10m		1.00	T13	D			
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		1.60 1.60	B6	B			
		2.80			Ex-Situ SV	12 15 18	
End of Trial Pit at 3.10m		3.10					

Remarks:

- Sides generally stable.
- Slight water seepages encountered at 1.20m and 2.50m.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit			Client: Ashwood Homes	
Logged: CB	Checked: DRAFT	Field Book Ref: CB17/02	Plant: 360 Excavator	Drawing No. TP3
Date: 28/03/2017	Approved: DRAFT		Scale: 1:25	

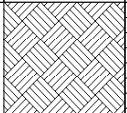
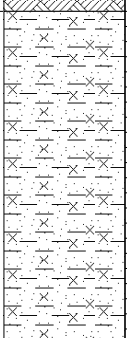
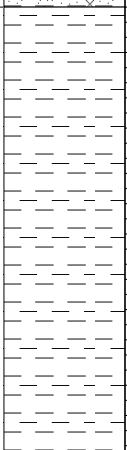
Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)		0.40					
Firm blue-grey mottled orange slightly clayey very sandy SILT (TERRINGTON BEDS)		0.80					
Firm blue-grey mottled orange sandy silty CLAY (TERRINGTON BEDS)		1.10 1.10	T11	D	In-Situ SV	46 50 65	
...slightly gravelly below 1.50m		1.60	B5	B			
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		1.60					
End of Trial Pit at 2.90m		2.90					

Remarks:

- Sides generally stable.
- Slight water seepage encountered at 2.50m.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit			Client: Ashwood Homes	
Logged: CB	Checked: DRAFT	Field Book Ref: CB17/02	Plant: 360 Excavator	Drawing No. TP4
Date: 28/03/2017	Approved: DRAFT		Scale: 1:25	

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)		0.30	T13	D			
Firm to stiff blue-grey mottled orange slightly sandy silty CLAY (TERRINGTON BEDS)		0.40 0.40 0.90	LB3	B	In-Situ SV	55 60 65	
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		1.50 1.50 2.00 2.30 3.00	B6 T14a	B D	Ex-Situ SV	10 12 30	
End of Trial Pit at 3.00m							

Remarks:

- Sides generally stable.
- No water encountered.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project:

Phase 2 - Backgate, Cowbit

Client:

Ashwood Homes

Logged:

CB

Checked:

DRAFT

Field Book Ref:

CB17/02

Plant:

360 Excavator

Scale:

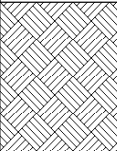
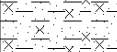
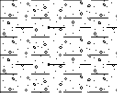
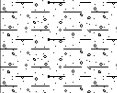
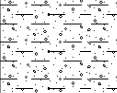
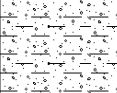
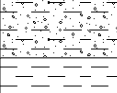
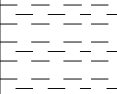
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Drawing No.

TP5

Date:
28/03/2017

Approved:
DRAFT

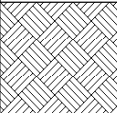
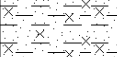
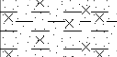
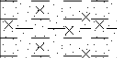
Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown sandy silty very clayey TOPSOIL (TOPSOIL)		0.50					
Firm grey-brown slightly clayey sandy SILT (TERRINGTON BEDS)		0.70					
Firm orange-brown slightly sandy slightly gravelly CLAY. Gravel is predominantly fine to medium subangular sandstone and mudstone (TERRINGTON BEDS)		0.80			In-Situ SV	40 50 55	
		1.50	B9	B			
		2.10	T19	D			
		2.20					
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		2.50			Ex-Situ SV	16 16 18	
End of Trial Pit at 3.00m		3.00					

Remarks:

1. Eastern and western pit sides collapsed upon completing excavation.
2. Slight water seepage encountered at 1.30m and moderate water seepages encountered at 2.00m and 2.40m.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit			Client: Ashwood Homes	
Logged: CB	Checked: DRAFT	Field Book Ref: CB17/02	Plant: 360 Excavator	Drawing No. TP6
Date: 29/03/2017	Approved: DRAFT		Scale: 1:25	

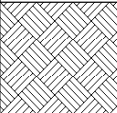
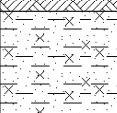
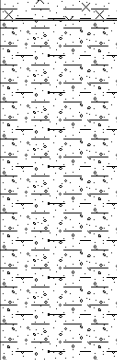
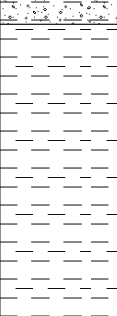
Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)							
Firm blue-grey mottled orange slightly clayey very sandy SILT (TERRINGTON BEDS)		0.40	B7	B			
		0.40	T15	D			
		0.50	LB4	B			
Firm blue-grey mottled orange slightly sandy silty CLAY (TERRINGTON BEDS)		0.60					
		0.60			In-Situ SV	58	
		0.80				64	
...occasional plant remains from 1.50m						64	
		1.70					
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		2.00			Ex-Situ SV	14	
						20	
						22	
End of Trial Pit at 3.00m		3.00					

Remarks:

- Southern pit side collapsed upon completing excavation.
- Slight water seepage encountered at 2.40m.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit			Client: Ashwood Homes	
Logged: CB	Checked: DRAFT	Field Book Ref: CB17/02	Plant: 360 Excavator	Drawing No. TP7
Date: 28/03/2017	Approved: DRAFT		Scale: 1:25	

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)							
Firm grey mottled brown slightly clayey very sandy SILT (TERRINGTON BEDS)		0.40 0.50	B10	B			
Firm blue-grey mottled orange slightly sandy slightly gravelly CLAY. Gravel is predominantly fine to medium subangular mudstone (TERRINGTON BEDS)		0.80 0.80			In-Situ SV	52 60 62	▽
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		2.00 2.30 2.50	T20	D	Ex-Situ SV	10 8 8	▽
End of Trial Pit at 3.00m		3.00					

Remarks:

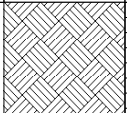
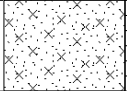
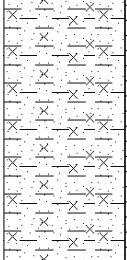
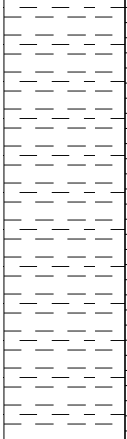
- Sides generally stable.
- Moderate water seepages encountered at 0.90m and 2.50m.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample ▽ = Water Strike (m) ▼ = Steady Water Level (m)

Project:

Phase 2 - Backgate, Cowbit

Logged: CB	Checked: DRAFT	Field Book Ref: CB17/02	Client: Ashwood Homes	Drawing No. TP8
Date: 29/03/2017	Approved: DRAFT		Plant: 360 Excavator	
			Scale: 1:25	

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)		0.20	T16	D	In-Situ SV	60 80 82	
Medium dense blue-grey mottled orange slightly clayey very silty fine to medium SAND (TERRINGTON BEDS)		0.40 0.40	LB5	B			
Firm to stiff blue-grey mottled orange slightly sandy very silty CLAY (TERRINGTON BEDS)		0.70 0.70 0.80	B8	B			
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		1.60 1.90			Ex-Situ SV	12 12 12	
End of Trial Pit at 3.10m		3.10					

Remarks:

- Western pit side collapsed upon completing excavation
- Slight water seepage encountered at 1.60m.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project:

Phase 2 - Backgate, Cowbit

Client:

Ashwood Homes

Logged:

CB

Checked:

DRAFT

Field Book Ref:

CB17/02

Plant:

360 Excavator

Scale:

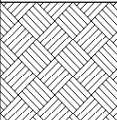
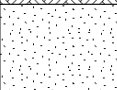
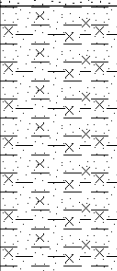
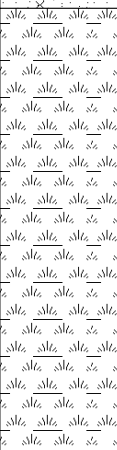
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Drawing No.

TP9

Date:
29/03/2017

Approved:
DRAFT

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)							
Medium dense grey mottled orange very silty fine to medium SAND (TERRINGTON BEDS)		0.40 0.40 0.50	LB6 T17	B D			
Firm blue-grey mottled orange slightly sandy silty CLAY (TERRINGTON BEDS)		0.70 0.75			In-Situ SV	70 75 75	
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		1.60 1.80			Ex-Situ SV	10 12 12	
End of Trial Pit at 3.10m		3.10					

Remarks:

- Sides generally stable.
- Slight water seepage encountered at 2.90m.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project:

Phase 2 - Backgate, Cowbit

Logged:

CB

Checked:

DRAFT

Field Book Ref:

CB17/02

Client:

Ashwood Homes

Plant:

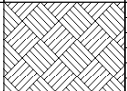
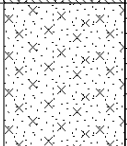
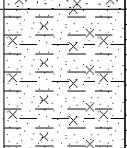
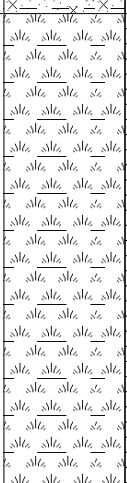
360 Excavator

Scale:

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Drawing No.

TP10

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)		0.20 0.30	T18	D	In-Situ SV	30 35 36	
Medium dense grey mottled orange very silty fine to medium SAND (TERRINGTON BEDS)		0.80 0.90					
Soft to firm blue-grey sandy silty CLAY (TERRINGTON BEDS)		1.30					
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		2.90					
End of Trial Pit at 2.90m							

Remarks:

- Sides generally stable.
- No water encountered.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project:

Phase 2 - Backgate, Cowbit

Client:

Ashwood Homes

Logged:

CB

Checked:

DRAFT

Field Book Ref:

CB17/02

Plant:

360 Excavator

Scale:

1:25

Drawing No.

TP11

Date:

29/03/2017

Approved:

DRAFT

**Project No:** D37036

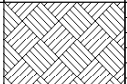
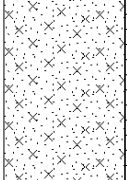
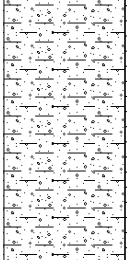
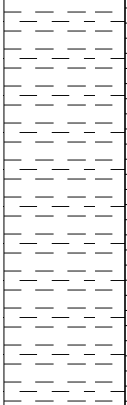
Sheet 1 of 1

Remarks:

1. Sides generally stable.
2. Moderate water seepage encountered at 2.50m.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
 J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit			Client: Ashwood Homes	
Logged: CB	Checked: DRAFT	Field Book Ref: CB17/02	Plant: 360 Excavator	Drawing No. TP12
Date: 28/03/2017	Approved: DRAFT		Scale: 1:25	

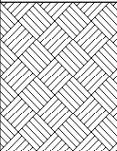
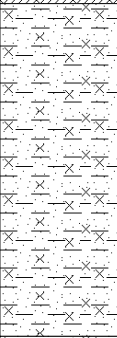
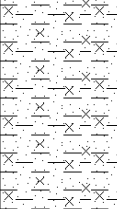
Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)							
Medium dense blue-grey mottled orange very silty fine to medium SAND (TERRINGTON BEDS)		0.30 0.35 0.40	LB2	B	In-Situ SV	34 36 38	
Firm blue-grey mottled orange slightly sandy slightly gravelly CLAY. Gravel is predominantly fine to medium subangular silt (TERRINGTON BEDS)		0.90 1.30	T21	D			
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		1.80 2.30 2.30	B11	B	Ex-Situ SV	10 12 14	
End of Trial Pit at 3.20m		3.20					

Remarks:

- Sides generally stable.
- Slight water seepages encountered at 1.70m and 2.80m.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit			Client: Ashwood Homes	
Logged: CB	Checked: DRAFT	Field Book Ref: CB17/02	Plant: 360 Excavator	Drawing No. TP13
Date: 29/03/2017	Approved: DRAFT		Scale: 1:25	

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)		0.10	T4	D			
Firm to stiff orange-brown mottled brown slightly sandy slightly silty CLAY (TERRINGTON BEDS)		0.50 0.50 0.60	B1	B	In-Situ SV	58 80 85	
Very soft to soft dark blue grey mottled orange sandy silty CLAY (TERRINGTON BEDS)		1.60 2.00			Ex-Situ SV	14 14 20	
End of Trial Pit at 2.30m		2.30					

Remarks:

- Sides generally stable.
- Slight water seepage encountered at 1.90m.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit			Client: Ashwood Homes	
Logged: CB	Checked: DRAFT	Field Book Ref: CB17/02	Plant: 360 Excavator	Drawing No. SA1
Date: 27/03/2017	Approved: DRAFT		Scale: 1:25	

**Project No:** D37036

Sheet 1 of 1

Remarks:

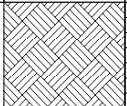
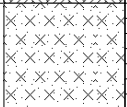
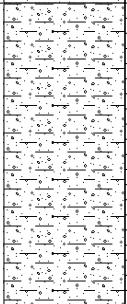
1.Sides generally stable.

2.No water encountered.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)

J = Jar Sample V = Vial Sample ▽ = Water Strike (m) ▼ = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit			Client: Ashwood Homes	
Logged: CB	Checked: DRAFT	Field Book Ref: CB17/02	Plant: 360 Excavator	Drawing No. SA2
Date: 27/03/2017	Approved: DRAFT		Scale: 1:25	

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)		0.35					
Firm to stiff blue-grey mottled brown very sandy SILT (TERRINGTON BEDS)		0.60	T5	D	In-Situ SV	100 70 85	
		0.60	B2	B			
Firm to stiff blue-grey mottled orange slightly sandy slightly gravelly CLAY. Gravel is predominantly fine to medium subrounded to subangular mudstone and sandstone (TERRINGTON BEDS)		0.70					
		0.70					
Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		1.70	T6	D			
End of Trial Pit at 1.75m		1.75					
		1.75					

Remarks:

- Sides generally stable.
- No water encountered.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m²) P = Penetrometer (kN/m²)
J = Jar Sample V = Vial Sample  = Water Strike (m)  = Steady Water Level (m)

Project:

Phase 2 - Backgate, Cowbit

Logged:

CB

Checked:

DRAFT

Field Book Ref:

CB17/02

Date:

27/03/2017

Approved:

DRAFT

Client:

Ashwood Homes

Plant:

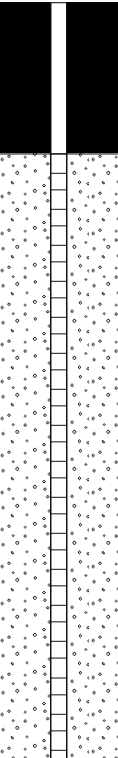
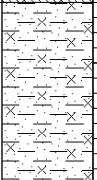
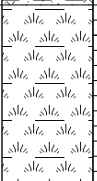
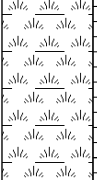
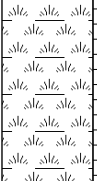
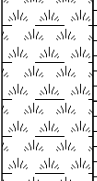
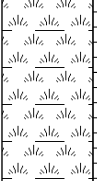
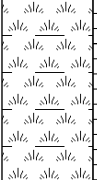
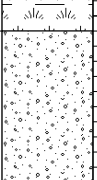
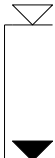
360 Excavator

Scale:

1:25

Drawing No.

SA3

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
1.00 1.00 - 1.45	D S	S1	1	Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)		(0.60)			
				Firm brown slightly sandy slightly silty CLAY (TERRINGTON BEDS)		0.60 (1.20)			
2.00 2.00 - 2.45	D S	S2	0	Very soft blue-grey very peaty CLAY (TERRINGTON BEDS) ...becoming very soft		1.80			
3.00 3.00 - 3.45	D S	S3	0						
4.00 4.00 - 4.45	D S	S4	0						
5.00 5.00 - 5.45	D S	S5	0			(7.30)			
6.50 6.50 - 6.95	D S	S6	0						
8.00 8.00 - 8.45	D S	S7	8						
9.50 9.50 - 9.95	D S	S8	39	Dense orange-brown very sandy fine to coarse subrounded to subangular flint GRAVEL (TERRINGTON BEDS)		9.10 (1.50)			

Remarks

1.Sides generally stable.
2.Water encountered at approximately 9.10m which rose to 8.20m after 20 minutes.
3.Plain pipe installed from ground level to 1.00m with a bentonite surround. Slotted pipe installed from 1.00m to 5.00m with a gravel surround.
4.Bung, valve and lockable cover installed.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample

S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit

Client: Ashwood Homes

Logged: CB

Checked: DRAFT

Field Book Ref:

Plant: Pilcon Rig

Drawing Ref:

Date: 28/03/2017

Approved: DRAFT

CB17/02

Scale: 1:50

BH1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
11.00 11.00 - 11.45	D S	S9	25	Dense orange-brown very sandy fine to coarse subrounded to subangular flint GRAVEL (TERRINGTON BEDS) Stiff blue-grey slightly sandy gravelly CLAY. Gravel is predominantly fine to medium subrounded to subangular chalk and flint (GLACIAL TILL)		10.60			
12.50 12.50 - 12.95	D S	S10	32			(4.90)			
14.00 - 14.45	S		50/255mm						
15.50 15.50 - 15.95	D S	S11	47	Stiff blue grey CLAY (OXFORD CLAY)		15.50			
17.00 17.00 - 17.45	D S	S12	50/225mm				17.00		
18.50 18.50 - 18.95	D S	S13	50/225mm			(4.50)			
20.00 20.00 - 20.45	D S	S14	50/180mm	End of Borehole at 20.00m		20.00			

Remarks

1.Sides generally stable.
2.Water encountered at approximately 9.10m which rose to 8.20m after 20 minutes.
3.Plain pipe installed from ground level to 1.00m with a bentonite surround. Slotted pipe installed from 1.00m to 5.00m with a gravel surround.
4.Bung, valve and lockable cover installed.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
 = Water Strike (m)
 = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit

Client: Ashwood Homes

Logged: CB

Checked: DRAFT

Field Book Ref: CB17/02

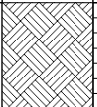
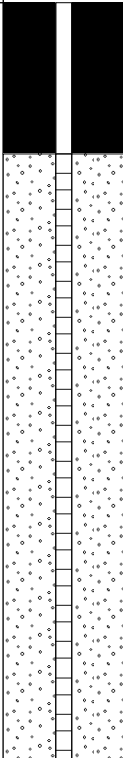
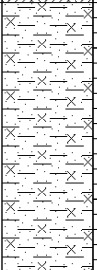
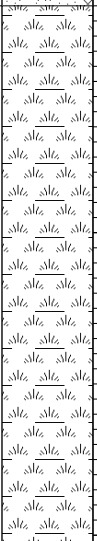
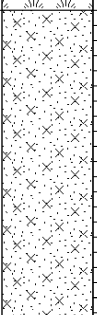
Plant: Pilcon Rig

Drawing Ref: BH1

Date: 28/03/2017

Approved: DRAFT

Scale: 1:50

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
1.00 1.00 - 1.45	D S	S1	1	Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL) ...very silty from 0.40m to 0.80m		(0.70) 0.70			
2.00 2.00 - 2.45	D S	S2	1	Soft to firm blue-grey mottled orange slightly sandy slightly silty CLAY (TERRINGTON BEDS) ...becoming very soft		(1.80) 2.50			
3.00 3.00 - 3.45	D S	S3	0	Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		(3.60) 6.10			
4.00 4.00 - 4.45	D S	S4	4						
5.00 5.00 - 5.45	D S	S5	0						
6.50 6.50 - 6.95	D S	S6	10	Medium dense blue-grey slightly clayey silty fine to medium SAND (TERRINGTON BEDS) ...wet from 6.50m		(4.00) 10.10			
8.00 8.00 - 8.45	D S	S7	9						
9.50 9.50 - 9.95	D S	S8	28						

Remarks

1.Sides generally stable.
2.Water encountered at approximately 8.00m which rose to 7.90m after 20 minutes.
3.Plain pipe installed from ground level to 1.00m with a bentonite surround. Slotted pipe installed from 1.00m to 5.00m with a gravel surround.
4.Bung, valve and lockable cover installed.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
 = Water Strike (m)
 = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit

Client: Ashwood Homes

Logged: CB

Checked: DRAFT

Field Book Ref:

Plant: Pilcon Rig

Drawing Ref:

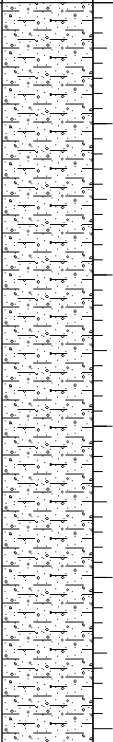
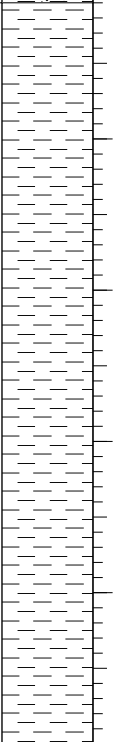
Date: 27/03/2017

Approved: DRAFT

CB17/02

Scale: 1:50

BH2

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
11.00 11.00 - 11.45	D S	S9	33	Stiff blue-grey mottled brown slightly sandy gravelly CLAY. Gravel is fine to coarse subrounded to subangular quartzite chalk and flint (GLACIAL TILL)		(5.00)			
12.50 12.50 - 12.95	D S	S10	35						
14.00 14.00 - 14.45	D S	S11	44						
15.50 15.50 - 15.95	D S	S12	50/220mm	Stiff blue-grey CLAY (OXFORD CLAY)		15.10	17.00		
17.00 17.00 - 17.45	D S	S13	50/235mm			(4.90)			
18.50 18.50 - 18.95	D S	S14	50/230mm						
20.00 20.00 - 20.45	D S	S15	50/150mm	End of Borehole at 20.00m		20.00			

Remarks

1.Sides generally stable.
2.Water encountered at approximately 8.00m which rose to 7.90m after 20 minutes.
3.Plain pipe installed from ground level to 1.00m with a bentonite surround. Slotted pipe installed from 1.00m to 5.00m with a gravel surround.
4.Bung, valve and lockable cover installed.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample

S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)

 = Water Strike (m)
 = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit

Client: Ashwood Homes

Logged: CB

Checked: DRAFT

Field Book Ref: CB17/02

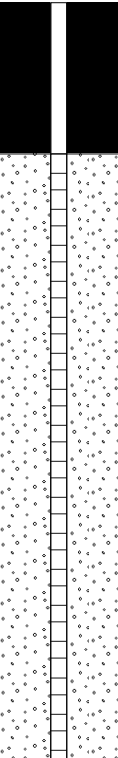
Plant: Pilcon Rig

Drawing Ref: BH2

Date: 27/03/2017

Approved: DRAFT

Scale: 1:50

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
1.20	D	S1	3	Dark brown slightly sandy silty very clayey TOPSOIL (TOPSOIL)		(0.30)			
1.20 - 1.65	S			Firm blue-grey mottled orange slightly clayey very sandy SILT (TERRINGTON BEDS)		0.30			
				Firm blue-grey mottled orange slightly silty CLAY (TERRINGTON BEDS)		(0.70)			
				Firm blue-grey mottled orange slightly silty CLAY (TERRINGTON BEDS)		1.00			
				Very soft grey CLAY interbedded with spongy dark brown fibrous PEAT (TERRINGTON BEDS)		(0.50)			
2.00	D	S2	1			1.50			
2.00 - 2.45	S								
3.00	D	S3	0						
3.00 - 3.45	S								
4.00	D	S4	0						
4.00 - 4.45	S								
5.00	D	S5	1						
5.00 - 5.45	S								
6.50	D	S6	1						
6.50 - 6.95	S								
8.00	D	S7	1						
8.00 - 8.45	S								
9.50	D	S8	17						
9.50 - 9.95	S								
				Medium dense brown clayey fine to coarse SAND (TERRINGTON BEDS)		9.80			

Remarks

1.Sides generally stable.
2.Water encountered at approximately 10.00m and remained at 10.00m after 20 minutes.
3.Plain pipe installed from ground level to 1.00m with a bentonite surround. Slotted pipe installed from 1.00m to 5.00m with a gravel surround.
4.Bung, valve and lockable cover installed.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample

S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▲ = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit

Client: Ashwood Homes

Logged: CB

Checked: DRAFT

Field Book Ref:

Plant: Pilcon Rig

Drawing Ref:

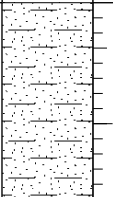
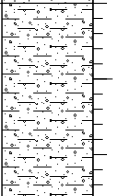
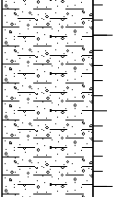
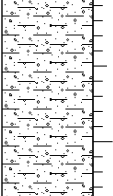
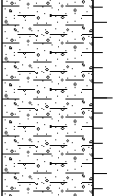
Date: 30/03/2017

Approved: DRAFT

CB17/02

Scale: 1:50

BH3

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
11.00 11.00 - 11.45	D S	S9	15	Medium dense brown clayey fine to coarse SAND (TERRINGTON BEDS)		(1.70)			
12.00 - 12.50	B	B12		Stiff grey-brown slightly sandy gravelly CLAY. Gravel is fine to coarse subrounded to subangular chalk, flint and mudstone (GLACIAL TILL)		11.50			
12.50 12.50 - 12.95	D S	S10	26						
14.00 14.00 - 14.45	D S	S11	35			(5.80)			
15.50 15.50 - 15.95	D S	S12	44						
17.00 17.00 - 17.45	D S	S13	48			17.30			
17.50 - 18.00	B	B13		Stiff blue-grey CLAY (OXFORD CLAY)			18.00		
18.50 18.50 - 18.95	D S	S14	50/190mm			(2.70)			
20.00 20.00 - 20.45	D S	S15	50/185mm	End of Borehole at 20.00m		20.00			

Remarks

1.Sides generally stable.
2.Water encountered at approximately 10.00m and remained at 10.00m after 20 minutes.
3.Plain pipe installed from ground level to 1.00m with a bentonite surround. Slotted pipe installed from 1.00m to 5.00m with a gravel surround.
4.Bung, valve and lockable cover installed.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample

S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
 = Water Strike (m)
 = Steady Water Level (m)

Project: Phase 2 - Backgate, Cowbit

Client: Ashwood Homes

Logged: CB

Checked: DRAFT

Field Book Ref:

Plant: Pilcon Rig

Drawing Ref:

Date: 30/03/2017

Approved: DRAFT

CB17/02

Scale: 1:50

BH3

SOIL INFILTRATION RATE CALCULATIONS



SA1 Soakaway Test 1

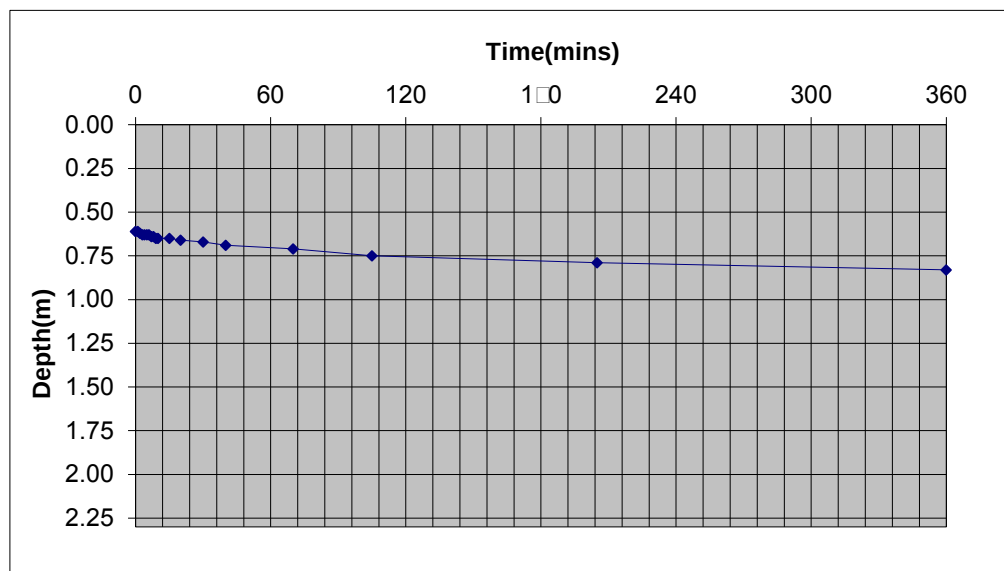
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0	0.61
1	0.61
2	0.62
3	0.63
4	0.63
5	0.63
6	0.63
7	0.64
8	0.64
9	0.65
10	0.65
15	0.65
20	0.66
30	0.67
40	0.69
70	0.71
105	0.75
205	0.79
360	0.83

Client :	Ashwood Homes
Site :	Phase II - Backgate, Cowbit
Site ref :	D37036
Status:	DRAFT

Trial pit dimensions		
Width m	Length m	Depth m
0.70	2.00	2.30

Depth from water level at start of test to bottom of pit	1.69
--	------

Enter Assumed Void Ratio (fraction of 1, where 1 equates to open pit and 0 equates to no voids)	1
---	---



75% effective depth m	0.67
25% effective depth m	0.70

Time at 75% effective depth mins	30
Time at 25% effective depth mins	100

Volume outflowing, V_{p75-25} 0.2156

Area, a_{p50} 7.750

Time, T_{75-25} 150.0

Infiltration Rate, F 3.04E-06 m/s

SOIL INFILTRATION RATE CALCULATIONS



SA1 Soakaway Test 2

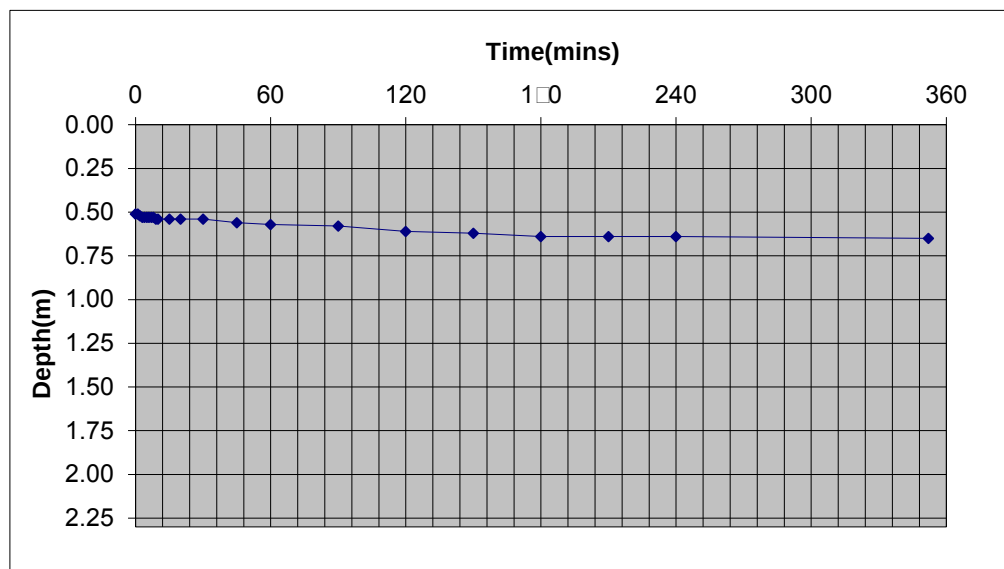
Time mins	Depth m
0	0.51
1	0.51
2	0.52
3	0.53
4	0.53
5	0.53
6	0.53
7	0.53
8	0.53
9	0.54
10	0.54
15	0.54
20	0.54
30	0.54
45	0.56
60	0.57
90	0.58
120	0.61
150	0.62
180	0.64
210	0.64
240	0.64
352	0.65

Client :	Ashwood Homes
Site :	Phase II - Backgate, Cowbit
Site ref :	D37036
Status:	DRAFT

Trial pit dimensions		
Width m	Length m	Depth m
0.70	2.00	2.30

Depth from water level at start of test to bottom of pit	1.79
--	------

Enter Assumed Void Ratio (fraction of 1, where 1 equates to open pit and 0 equates to no voids)	1
---	---



75% effective depth m	0.55
25% effective depth m	0.62

Time at 75% effective depth mins	3
Time at 25% effective depth mins	150

Volume outflowing, V_{p75-25}	0.1372
---------------------------------	--------

Area, a_{p50}	0.2250
-----------------	--------

Time, T_{75-25}	112.0
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Infiltration Rate, F	2.4×10^{-6} m/s
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SOIL INFILTRATION RATE CALCULATIONS



SA1 Soakaway Test 3

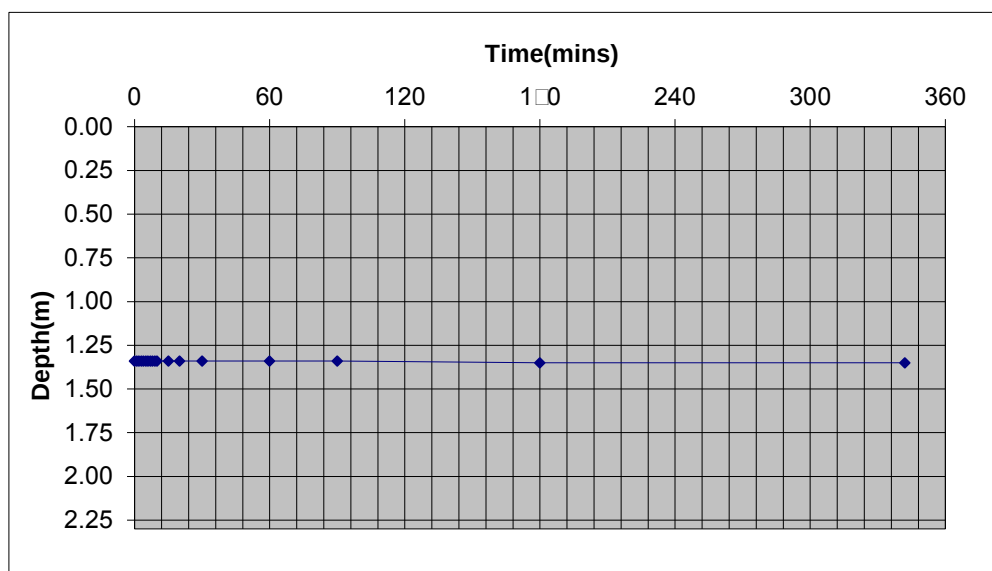
Time mins	Depth m
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1	1.34
2	1.34
3	1.34
4	1.34
5	1.34
6	1.34
7	1.34
	1.34
9	1.34
10	1.34
15	1.34
20	1.34
30	1.34
60	1.34
90	1.34
100	1.35
342	1.35

Client :	Ashwood Homes
Site :	Phase II - Backgate, Cowbit
Site ref :	D37036
Status:	DRAFT

Trial pit dimensions		
Width m	Length m	Depth m
0.70	2.00	2.30

Depth from water level at start of test to bottom of pit	0.96
--	------

Enter Assumed Void Ratio (fraction of 1, where 1 equates to open pit and 0 equates to no voids)	1
---	---



SOIL INFILTRATION RATE CALCULATIONS



SA2 Soakaway Test 1

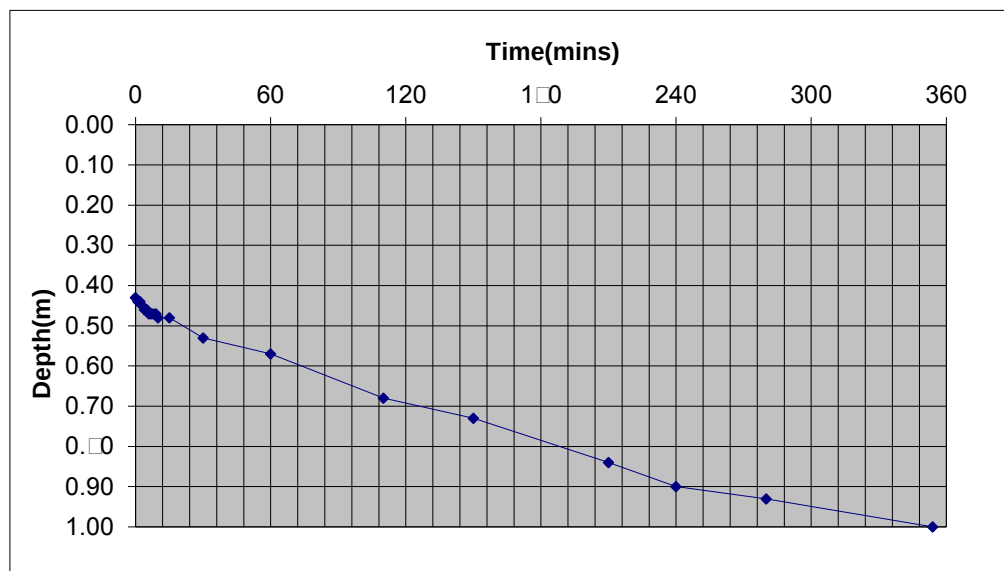
Time mins	Depth m
0	0.43
1	0.44
2	0.44
3	0.45
4	0.46
5	0.46
6	0.47
7	0.47
8	0.47
9	0.47
10	0.48
15	0.48
30	0.53
60	0.57
110	0.68
150	0.73
210	0.84
240	0.90
270	0.93
354	1.00

Client :	Ashwood Homes
Site :	Phase II - Backgate, Cowbit
Site ref :	D37036
Status:	DRAFT

Trial pit dimensions		
Width m	Length m	Depth m
0.70	2.20	1.00

Depth from water level at start of test to bottom of pit	0.57
--	------

Enter Assumed Void Ratio (fraction of 1, where 1 equates to open pit and 0 equates to no voids)	1
---	---



75% effective depth	0.57
25% effective depth	0.68

Time at 75% effective depth	60
Time at 25% effective depth	220

Volume outflowing, V_{p75-25} 0.43 m³

Area, a_{p50} 3.1930 m²

Time, T_{75-25} 160.0 mins

Infiltration Rate, F 1.43E-05 m/s

SOIL INFILTRATION RATE CALCULATIONS



SA2 Soakaway Test 2

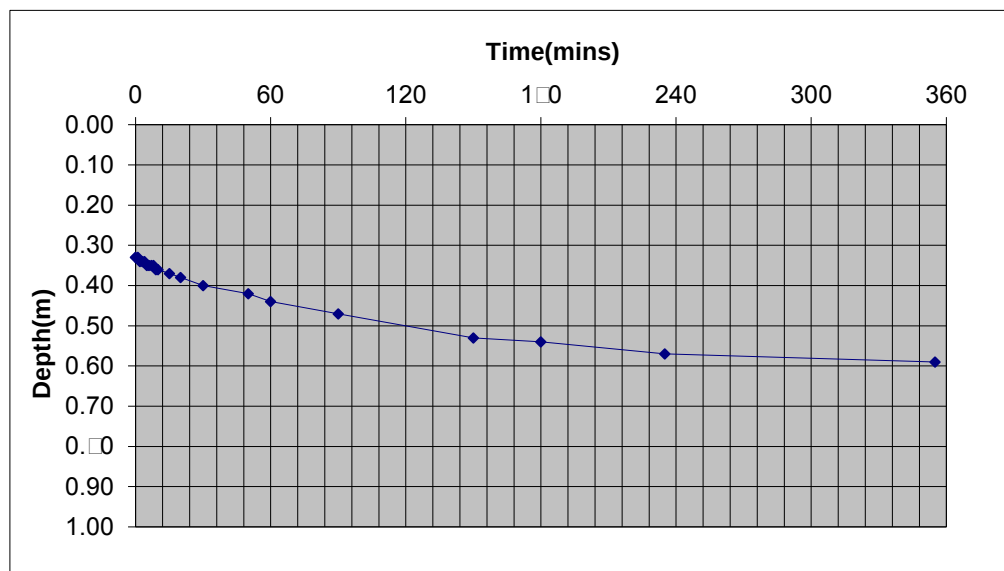
Time mins	Depth m
0	0.33
1	0.33
2	0.34
3	0.34
4	0.34
5	0.35
6	0.35
7	0.35
8	0.35
9	0.36
10	0.36
15	0.37
20	0.38
30	0.40
50	0.42
60	0.44
90	0.47
150	0.53
180	0.54
235	0.57
355	0.59

Client :	Ashwood Homes
Site :	Phase II - Backgate, Cowbit
Site ref :	D37036
Status:	DRAFT

Trial pit dimensions		
Width m	Length m	Depth m
0.70	2.20	1.00

Depth from water level at start of test to bottom of pit	0.67
--	------

Enter Assumed Void Ratio (fraction of 1, where 1 equates to open pit and 0 equates to no voids)	1
---	---



75% effective depth m	0.40
25% effective depth m	0.53

Time at 75% effective depth mins	30
Time at 25% effective depth mins	150

Volume outflowing, V_{p75-25} 0.2002

Area, a_{p50} 3.430

Time, T_{75-25} 120.0

Infiltration Rate, F 7.9E-06 m/s

SOIL INFILTRATION RATE CALCULATIONS



SA2 Soakaway Test 3

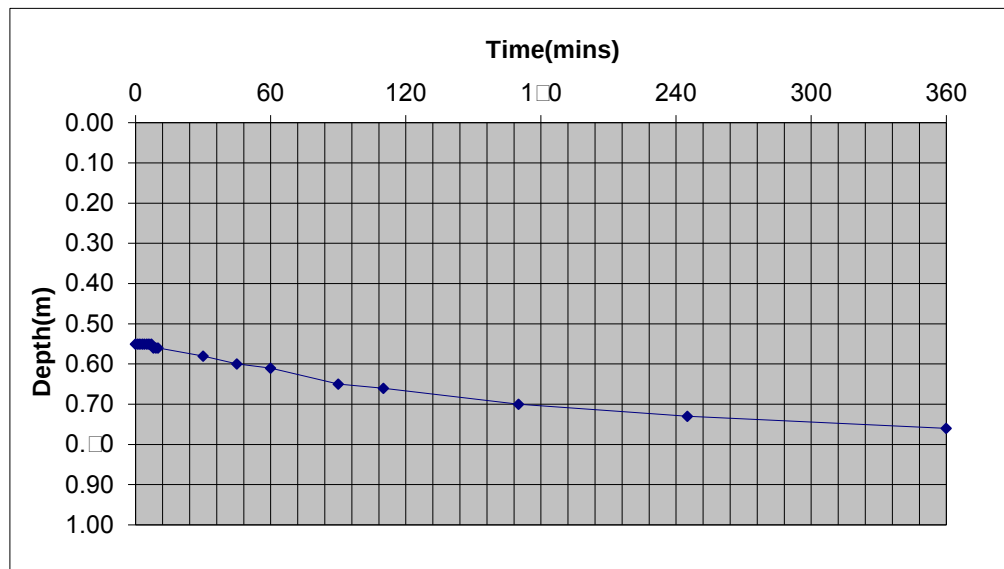
Time mins	Depth m
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1	0.55
2	0.55
3	0.55
4	0.55
5	0.55
6	0.55
7	0.55
	0.56
9	0.56
10	0.56
30	0.5
45	0.60
60	0.61
90	0.65
110	0.66
170	0.70
245	0.73
360	0.76

Client :	Ashwood Homes
Site :	Phase II - Backgate, Cowbit
Site ref :	D37036
Status:	DRAFT

Trial pit dimensions		
Width m	Length m	Depth m
0.70	2.20	1.00

Depth from water level at start of test to bottom of pit	0.45
--	------

Enter Assumed Void Ratio fraction of 1, where 1 equates to open pit and 0 equates to no voids	1
---	---



75 effective depth m	0.60
25 effective depth m	0.71

Time at 75 effective depth mins	45
Time at 25 effective depth mins	195

Volume outflowing, V_{p75-25}	0.1617
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Area, a_{p50}	2.450
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Time, T_{75-25}	150.0
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Infiltration Rate, F	6.32E-06 m/s
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SOIL INFILTRATION RATE CALCULATIONS



SA3 Soakaway Test 1

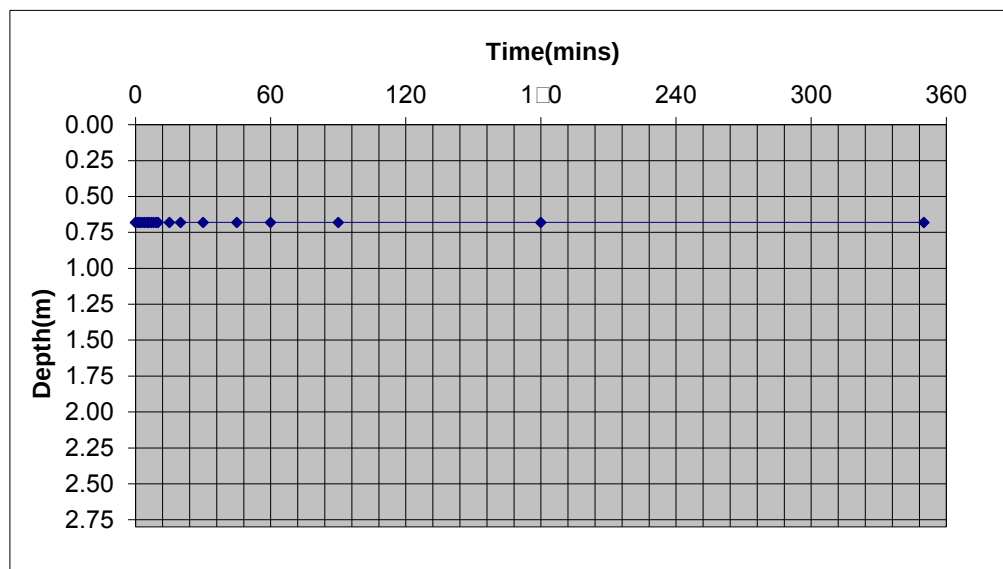
Time mins	Depth m
0	0.6
1	0.6
2	0.6
3	0.6
4	0.6
5	0.6
6	0.6
7	0.6
	0.6
9	0.6
10	0.6
15	0.6
20	0.6
30	0.6
45	0.6
60	0.6
90	0.6
100	0.6
350	0.6

Client :	Ashwood Homes
Site :	Phase II - Backgate, Cowbit
Site ref :	D37036
Status:	DRAFT

Trial pit dimensions		
Width m	Length m	Depth m
0.70	1.75	2.00

Depth from water level at start of test to bottom of pit	2.12
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Enter Assumed Void Ratio fraction of 1, where 1 equates to open pit and 0 equates to no voids	1
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Conditions & Limitations

Phase I Desk Studies

1. Works undertaken to provide the basis of the Phase I Desk Study report comprise a review of information available from a number of sources/parties (potential) also including the Client together with a walk over of the site (where applicable and included within the quotation). The opinions given in the Phase I Desk Study are based on the information available from third parties/sources that has been obtained within the available timeframe. GeoDyne Limited assumes all third party information to be true and correct and therefore cannot accept liability for the accuracy of such information supplied.
2. Should additional information become available that may affect the comments and opinions made within the Phase I Desk Study, GeoDyne Limited reserves the right to review such information and make modifications to comments/opinions as appropriate.
3. It should be borne in mind that a Phase I Desk Study collates available information to generate a conceptual model of the site. The actual geotechnical and environmental considerations can only be fully quantified by intrusive investigation works to confirm the accuracy of the conceptual site model.

Phase II Intrusive Investigations

1. Our quotation assumes that access to the site will be arranged by others at no cost to ourselves.
 2. We have assumed that free access is available throughout to the entire site and that works can be undertaken during a single mobilisation. Where restricted access is encountered, or where additional unscheduled mobilisations are required, additional costs may be incurred to the client.
 3. We have assumed that all available information relating to buried services will be supplied by the Client at no cost to ourselves. No responsibility will be accepted for damage to underground services that have not been brought to our prior attention by the Client.
 4. All excavations/boreholes will be backfilled with compacted arisings upon completion, with any excess arisings left proud of ground levels. Excess arisings will not be removed from the site unless specifically requested by the Client. Where we are requested to remove excess arisings, all associated costs will be passed to the Client.
 5. We will attempt to leave the site in a clean and tidy state, however, it must be understood that some disturbance of the site is unavoidable during intrusive works.
 6. Exploratory holes are positioned approximately on site by GeoDyne Limited. Should the client require precise locations of all exploratory points, additional fees will be incurred. It must be borne in mind that backfilled trial pits can create 'soft spots'; therefore, should the Client wish to designate 'no dig' zones, for example under the footprint of proposed structures, these must be brought to our attention prior to commencement of works.
 7. Groundwater observations relate to conditions encountered at the time of investigation. It must be understood that groundwater levels may vary as a result of recent climatic conditions or seasonal variation.
- Trial pits and boreholes examine only a small proportion of the total site area. No liability can be accepted for conditions not revealed in exploratory holes, particularly between positions. All extrapolations of available data are given in good faith.

Payment

1. Payment terms are strictly 2 weeks from the invoice date.
2. Prior to commencement of works, we require receipt of formal written instruction from the party accepting full financial responsibility for the work. In the absence of such an instruction, we would expect the instructing Consulting Engineers/Architects to accept full financial responsibility for the works.
3. Receipt of instruction to commence work shall be taken as acceptance and compliance of the foregoing conditions.

Liability

1. GeoDyne Limited offer £5,000,000.00 Professional Indemnity Insurance (in aggregate over the year). This shall be the limit of our liability for works undertaken. No individual liability shall be implied to, or accepted by, any employee for works undertaken for and on the behalf of GeoDyne Limited.