



BRIGHT PLAN CIVILS

LAND AT WINGS NURSERY, LIDSEY ROAD

PROPOSED RESIDENTIAL DEVELOPMENT

Flood Risk Assessment & Drainage Strategy

Prepared on Behalf of
Southern Housing Group Ltd

D1757/FRA1.5

May 2021

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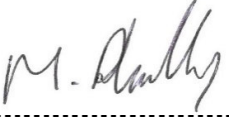
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Proposed Residential Development

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- Appendix A** Architect's Development Proposals
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1 INTRODUCTION

1.1 Background

- 1.1.1 Bright Plan Civils is instructed by Southern Housing Group Ltd to prepare a Flood Risk Assessment (FRA) and Drainage Strategy with reference to the proposed development at Wings Nursery, Lidsey Road, Woodgate, Chichester, West Sussex PO20 3SU.
- 1.1.2 This FRA has been undertaken in accordance with Planning Practice Guidance: Flood Risk and Coastal Change and National Planning Policy Framework Section 14.
- 1.1.3 The proposed development will involve the construction of 71 No. residential units, as demonstrated by the architectural development proposals contained within **Appendix A**.
- 1.1.4 In preparing this report, Bright Plan Civils has referred to the following documents and information;
- Environment Agency Flood Maps for Planning
 - Environment Agency Long-Term Flood Risk Maps
 - West Sussex County Council (WSCC) Strategic Flood Risk Assessment (SFRA)
 - Arun District Council (ADC) and WSCC Drainage Records
 - Southern Water Public Sewer Records
 - British Geological Survey (BGS) Information and Records
 - MK Surveys Topographical Survey
 - Lidsey Surface Water Management Plan (SWMP)
- 1.1.5 This report has been prepared to assess if the proposed development is suitable for the site and confirms if mitigation is required to ensure that flood risk is not increased, and that the proposed development remains safe during its design life.
- 1.1.6 This report has been prepared for the benefit of the named Client only.

1.2 Site Location and Description

- 1.2.1 A site location plan is included within this report (**PL100 – 'Site Location Plan'**).
- 1.2.2 The site is located approximately 11km south-east of the centre of Chichester and measures approximately 25,382m² (2.53Ha).
- 1.2.3 The site itself is largely undeveloped, although an existing dwelling ('Wings') is located centrally along the eastern boundary, whilst a dilapidated glasshouse is housed to the south-eastern extent.
- 1.2.4 A site-specific topographical survey has been undertaken by MK Surveys, dated August 2019, which demonstrates levels ranging from 8.04m AOD to 9.48m AOD, although there are no consistent falls across the entire site. The northern half of the site broadly falls from south-west to north-east, whilst the southern half of the site can largely be considered flat, with minimal falls from west to east generally evident.
- 1.2.5 In its current use, the site has an existing impermeable area to the order of 1,859m² as demonstrated on

drawing **PL200 – 'Existing Impermeable Area'**.

- 1.2.6 The site is bound to the north by a private drive which serves Lidsey Road Nursery whilst beyond the eastern boundary 2 No. ordinary watercourse ditches (which are linked via a culvert at the access to 'Wings') are present. There is existing residential development beyond the southern boundary whilst to the west, the site is bound by a watercourse which falls to the south.
- 1.2.7 The site currently drains to the existing ditches located within the immediate vicinity of the boundaries of the site, with minimal levels of infiltration also understood to support the site.
- 1.2.8 The topographical survey undertaken by MK Surveys indicates existing surface water drainage infrastructure supporting 'Wings', which is understood to discharge to the ordinary watercourse located to the east of the site.
- 1.2.9 Lidsey Road is served by a combination of traditional road gullies (primarily along the eastern channel of the carriageway) as well as kerb inlet gullies, located along the western extent of carriageway.

1.3 Ground Conditions

- 1.3.1 A site-specific ground appraisal report has been prepared by Geo-Environmental, dated October 2019.
- 1.3.2 The report and associated site-works extended to include ground investigation in order to establish the underlying geological composition, infiltration testing as well as a period of groundwater monitoring.
- 1.3.3 The Geo-Environmental report confirms that the ground conditions encountered were 'generally consistent with those anticipated' (Alluvium overlying River Terrace Deposits, overlying London Clay Formation).
- 1.3.4 Topsoil was encountered and recorded to depths ranging between 0.15m and 0.30m below ground level, in all locations with the exception of TP1, TP2 and WS7, consisting of *'dark brown silt sand with roots and rootlets.'*
- 1.3.5 River terrace Deposits were encountered within all locations to depths of between 2.00m and 4.00m below ground level, generally consisting of *'soft to very stiff silty sandy clay becoming silty sandy clay with occasional fine to coarse sub-angular chert, overlying fine to medium sand.'*
- 1.3.6 London Clay Formation was encountered at a depth of 3.50m below ground level within WS1 and WS7, although at no other locations across the site. This was described as *'stiff grey clay'*.
- 1.3.7 Full borehole and trial pits logs associated with the on-site investigation works undertaken are contained within **Appendix B** of this report.
- 1.3.8 In addition to the ground appraisal report produced by Geo-Environmental, reference has also been made to the BGS website in order to qualify the findings of the report.
- 1.3.9 Bedrock geology is reported by the BGS as being 'London Clay Formation – Clay, Silt and Sand'.

- 1.3.10 The associated London Clay Formation is described as 'Sedimentary Bedrock formed approximately 48 to 56 million years ago in the Palaeogene Period. Local environment previously dominated by deep seas.'

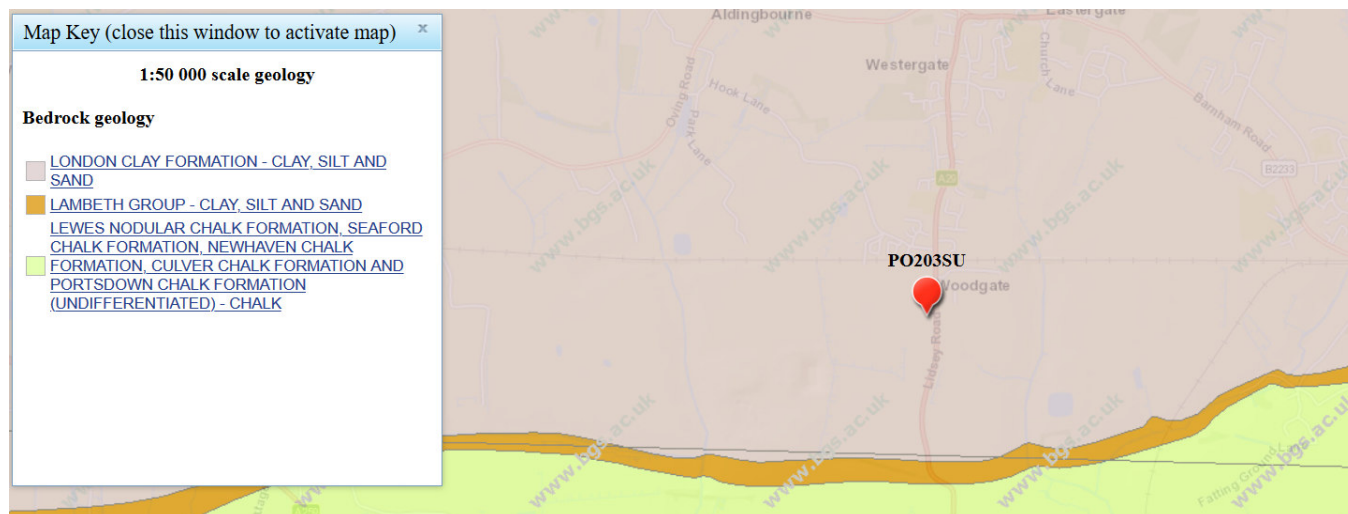


Figure 1. BGS – Bedrock Geology

- 1.3.11 Superficial Deposits are recorded as 'River Terrace Deposits (Undifferentiated) – Sand, Silt and Clay', as confirmed below, in **Figure 2**.
- 1.3.12 These River Terrace Deposits are described as 'Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by rivers (U).'

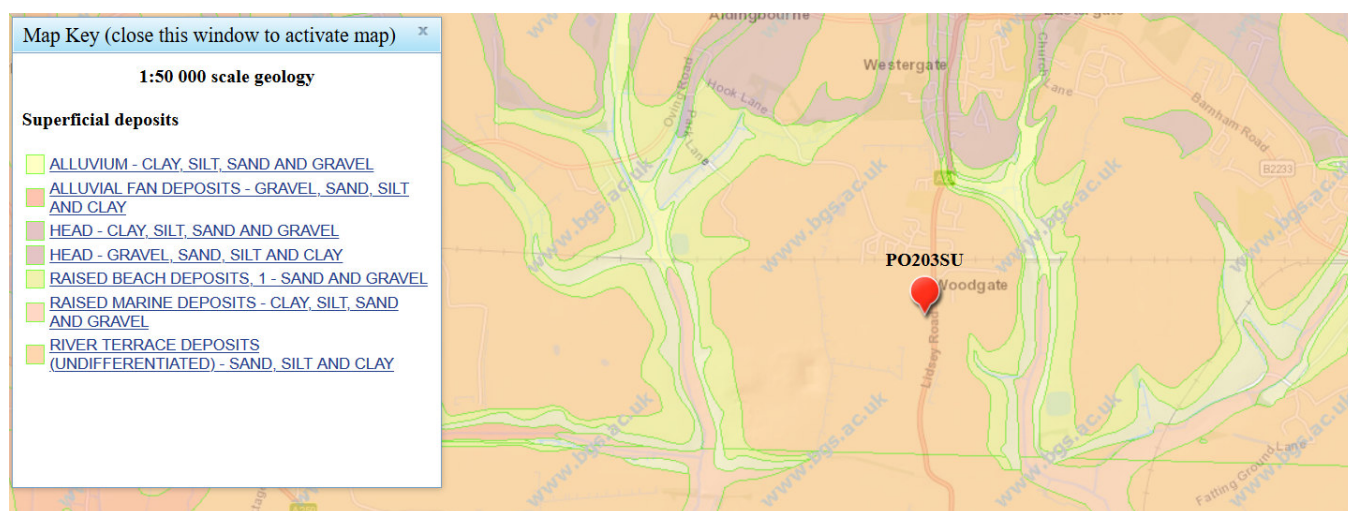


Figure 2. BGS – Superficial Deposits

- 1.3.13 BGS historic borehole records have also been reviewed in relation to the site, further to the on-site investigation undertaken.
- 1.3.14 SU90SW56 is the closest borehole located to the site, within the same geological classification as detailed, above. This borehole is located south-east of the site, to the east of Lidsey Road (A29).

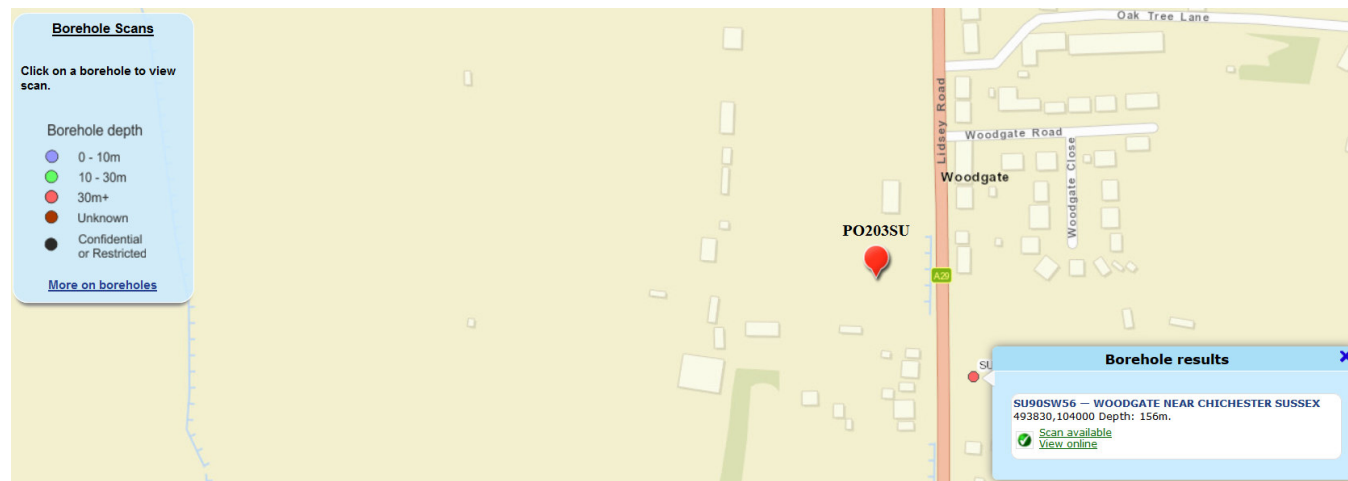


Figure 3. BGS Historic Borehole Location

- 1.3.15 The borehole extends to a depth of 156m below ground level, with the encountered geology recognised as being consistent with the findings of the on-site investigation.
- 1.3.16 The BGS borehole record reviewed confirms the presence of topsoil (500mm thick), beneath which 'sandy brown clay', 'clay with stones' and 'bed of gravel' was encountered to depths up to 3.00m below ground level. London Clay Formation recorded as 'sandy blue clay' from 3.00m below ground level to a depth of 12.00m below ground level.
- 1.3.17 A copy of the BGS records reviewed can be found within **Appendix C** of this report.

1.4 Groundwater

- 1.4.1 The ground appraisal report prepared by Geo-Environmental included groundwater investigation and a period of subsequent groundwater monitoring.
- 1.4.2 Groundwater was encountered at depths of between 1.85m below ground level whilst siteworks were being undertaken, with standing water levels obtained ranging from 1.20m and 2.50m below ground level after a period of twenty minutes.
- 1.4.3 Groundwater monitoring wells remain in situ at present, within WS1, WS2, WS3 and WS6, to depths ranging from 2.50m and 3.70m below ground level.
- 1.4.4 At present, based on the groundwater monitoring results obtained to date, groundwater is confirmed as peaking at 0.41m below ground level, at WS1 (reading obtained on 25th November 2019). For the winter period recorded to date, groundwater levels have ranged between 1.24m below ground level and 0.41m below ground level.
- 1.4.5 Following consultation, WSCC Drainage Team has confirmed that the site is shown to be at 'Moderate' risk of groundwater flooding, based on current JBA mapping. 'Moderate' risk of groundwater flooding is determined as groundwater levels reaching between 0.025m and 0.5m below ground level.
- 1.4.6 WSCC has confirmed in their consultation response that they are aware of known groundwater flooding issues north of the railway, although they hold no records of issues of this nature to the south.
- 1.4.7 Mapping managed by MAGIC (magic.defra.gov.uk) provides geographic information concerning the natural environment from across government. This mapping tool has been referred to in order to confirm whether the site is located within either any groundwater source protection zones or groundwater

vulnerability zones.

- 1.4.8 The Aquifer Designation Map (Bedrock) confirms that the site is located within an 'Unproductive' aquifer, as demonstrated in **Figure 4**, below.
- 1.4.9 'Unproductive' aquifers are determined as rock layers with low permeability that have negligible significance for water supply or river base flow.

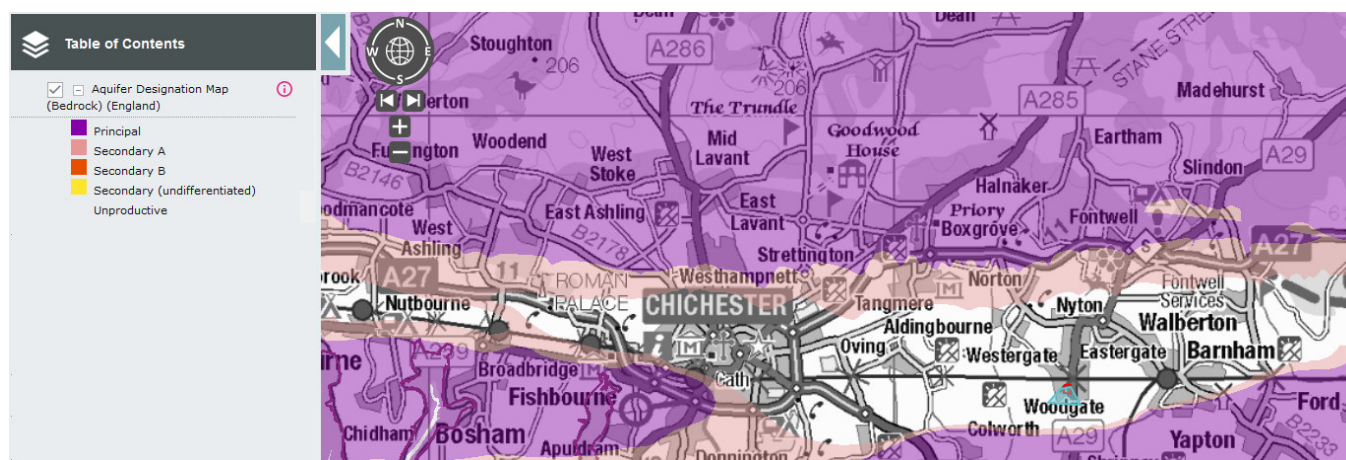


Figure 4. DEFRA Aquifer Designation Map (Bedrock)

- 1.4.10 The Aquifer Designation Map (Superficial Drift) confirms that the site is located within a 'Secondary A' aquifer, as shown in **Figure 5**.
- 1.4.11 Secondary A aquifers are identified as 'permeable layers that can support local water supplies and may form an important source of base flow to rivers.'

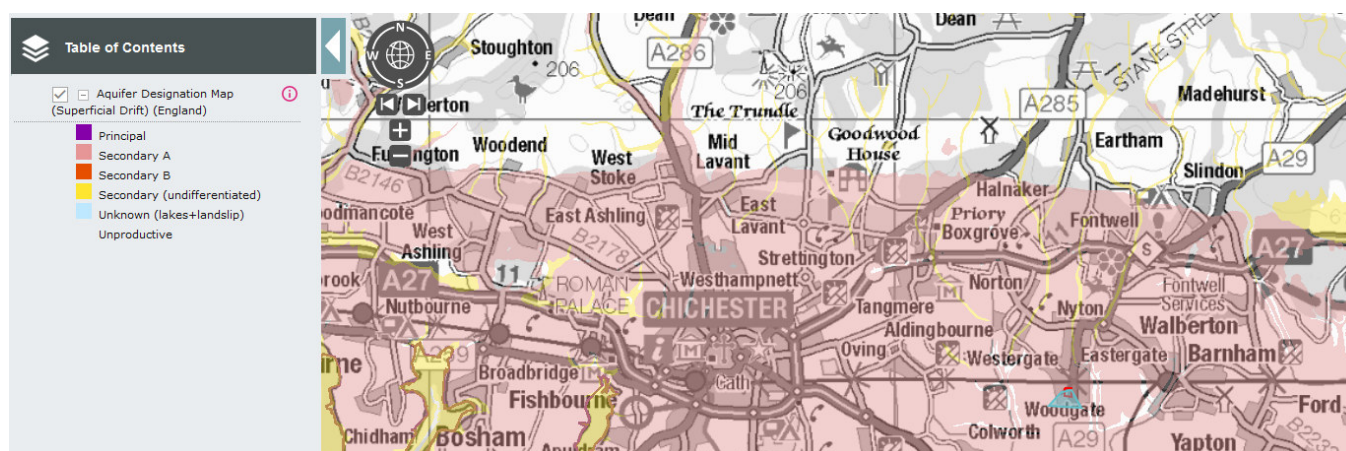


Figure 5. DEFRA Aquifer Designation Map (Superficial Drift)

- 1.4.12 The Groundwater Vulnerability Map, **Figure 6**, confirms that the site falls fully within a 'Medium – Low' Groundwater Vulnerability Zone.
- 1.4.13 A 'Medium - Low' Groundwater Vulnerability Zone is determined as 'areas that offer some groundwater protection', and/or 'areas that provide the greatest protection to groundwater from pollution. They are likely to be characterised by low-leaching soils and/or the presence of low-permeability superficial deposits.'

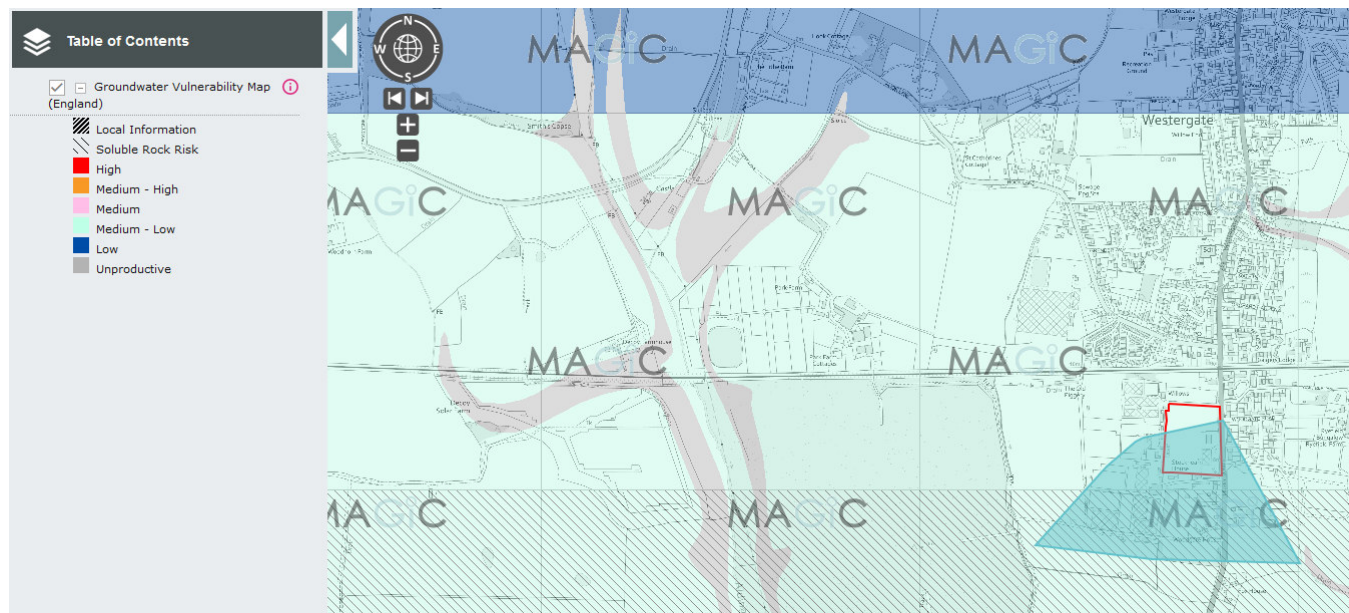


Figure 6. DEFRA Groundwater Vulnerability Map

1.4.14 The site is not classified as falling within a Groundwater Source Protection Zone, as confirmed in **Figure 7**.



Figure 7. DEFRA Groundwater Source Protection Zone Map

1.5 Existing Drainage

1.5.1 The site falls within the Lidsey Foul Water Treatment Catchment Area, as confirmed by ADC. This area is recognised as being a sensitive area in terms of drainage whereby both foul and surface water is concerned. 'The Lidsey Surface Water Management Plan' (SWMP) largely covers the same area as the Lidsey Foul Water Treatment Catchment Area.

1.5.2 Surface Water:

- The Southern Water public sewer records (**Appendix D**) do not indicate any public surface water sewers within the bounds of the site, or within the immediate surrounding areas.
- As identified in 1.2.7 and 1.2.8, the site currently drains to the existing ordinary watercourse network within the vicinity of the site (to the east and west). It is also likely that limited infiltration will occur.
- There are 2 No. open ditches adjacent to the eastern boundary of the site, which are linked by a 150mm culvert at the access to 'Wings'. There is a further open ditch upstream of the site, which is again linked via a culvert, adjacent to the access to Lidsey Road Nursery.
- The topographical survey undertaken by MK Surveys identifies surface water drainage infrastructure supporting the existing property ('Wings') on site. It is understood that this infrastructure discharges to the watercourse adjacent to the eastern boundary of the site and Lidsey Road.
- MK Surveys' topographical survey also identifies a 150mm outfall to the ditch to the north of the site, adjacent to the access to Lidsey Road Nursery (private road). Investigation should be undertaken to establish whether this serves to drain the site, or an associated upstream catchment.
- Following review of the Flood Estimation Handbook (FEH) website, it is evident that the site does not fall directly within any significant upstream catchment.
- Greenfield run-off rate (Q_{bar}) has been calculated to be 9.5l/s ($Q_1 = 8.11/s$, $Q_{30} = 21.6l/s$ and $Q_{100} = 30.4l/s$)
- The greenfield run-off volume is calculated to be 631.983m³ (based on FEH, SPR of 37% and 1-in-100 year, 360-minute event). The percentage run-off is calculated to be 38.36%.
- There is an existing impermeable area at the site, totalling approximately 1859m² (0.19Ha), associated with the existing development. In view of this, that the rate, and volume of run-off, is will to exceed that of the greenfield rates established, above.
- An assessment has been made in order to establish the 'true' rate of run-off associated with the existing impermeable area of the site, or a fairer reflection, which has been determined to be in the region of 25.82l/s (based on 50mm rainfall per hour).

1.5.3 Foul Water:

- The Southern Water public sewer records (**Appendix D**) demonstrate existing public foul water sewers located within the bounds of the site. This is also confirmed following review of the topographical survey undertaken by MK Surveys.
- The public foul water sewer onsite is located at the southern boundary of the site and flows in an easterly direction before diverting to the north (parallel to the eastern boundary). The sewer then diverts to the east, and follows down Woodgate Road, to the east of the site. This sewer has a depth in the range of 2.07m to 2.39m, as confirmed onsite by MK Surveys.
- The existing property ('Wings') utilises a connection to the public foul water sewer network, although the point of connection has not currently been confirmed.

1.5.4 Highway Drainage:

- Lidsey Road is served by a combination of traditional road gullies as well as kerb inlet gullies, as stated in 1.2.9. Records have been provided by WSCC confirming the positions of such, whilst MK Surveys' topographical survey also captures this information.
- Although not confirmed, it is anticipated that Lidsey Road drains to the existing ditch network adjacent to the eastern boundary of the site, which in turn discharges to a piped highway drainage system to the south-east of the site.

2 PROBABILITY

2.1 Sources of Information

- 2.1.1 The NPPF requires that all sources of flooding are considered being Tidal, Fluvial, Pluvial, Groundwater, Sewers and Man-made reservoirs/canals.
- 2.1.2 The likelihood of the site flooding has been established by reviewing the following information:
- Environment Agency Flood Maps for Planning
 - Long Term Flood Risk Assessment Surface Water Flood Risk Maps
 - Long Term Flood Risk Assessment Reservoir Flood Risk Maps
 - WSCC SFRA
 - Consultation with ADC, EA and WSCC
 - Lidsey SWMP

2.2 Flood Maps and Modelling

- 2.2.1 The Environment Agency's on-line Flood Maps for Planning (Rivers and Sea) confirms that the site is located fully within Flood Zone 1.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

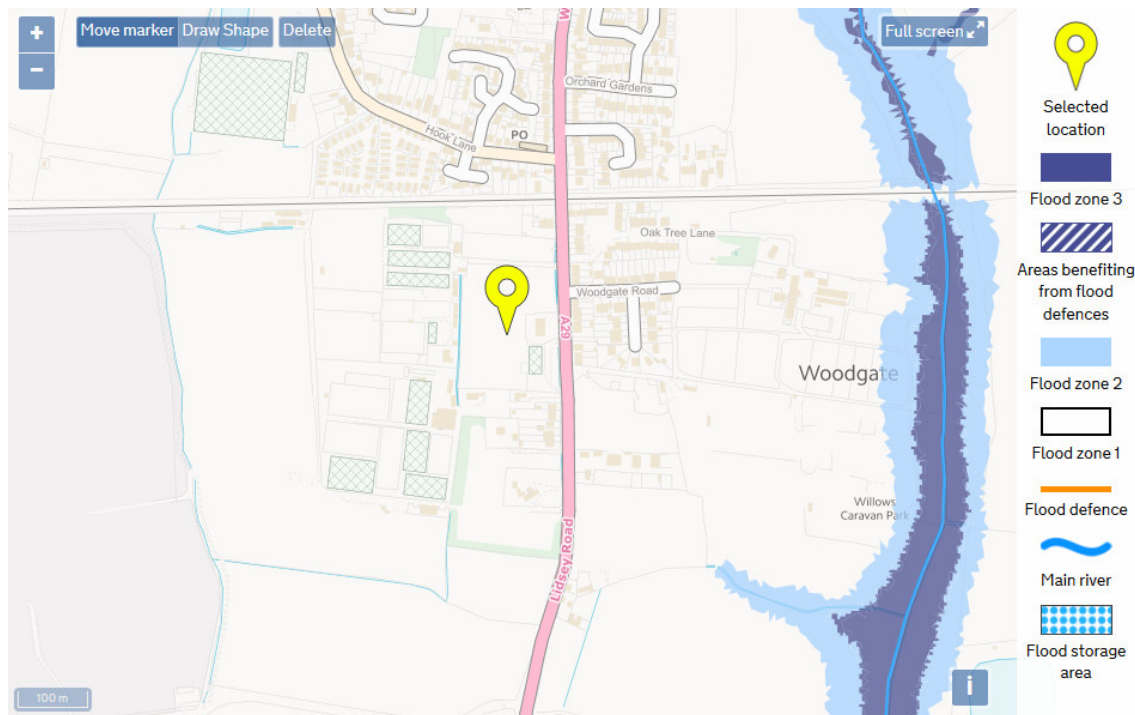


Figure 8. Flood Maps for Planning

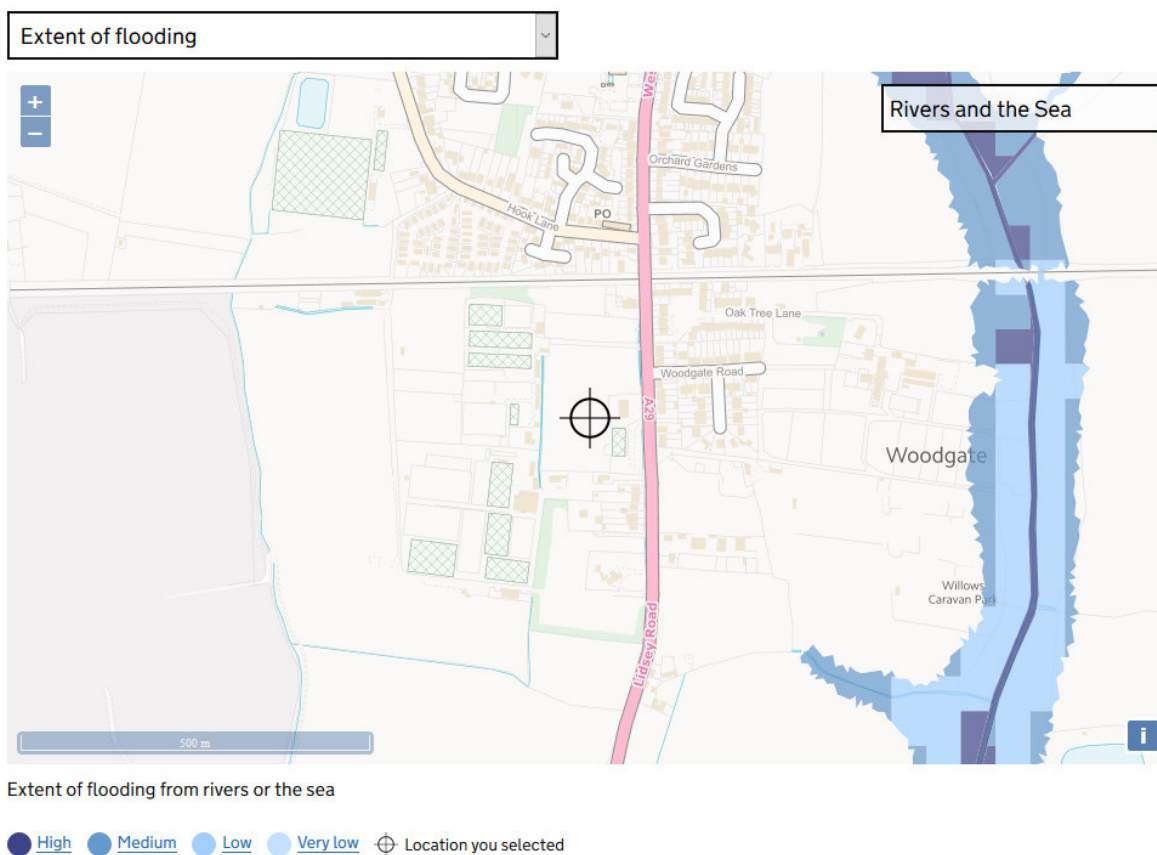


Figure 9. Long-Term Flood Risk Map - Rivers or the Sea (.Gov.uk)

- 2.2.2 The Long-Term Flood Risk Map for Rivers or the Sea confirms that the site is not at risk of flooding from either source (Rivers or the Sea). The nearest risk of flooding from this source is located some 500m east of the site.

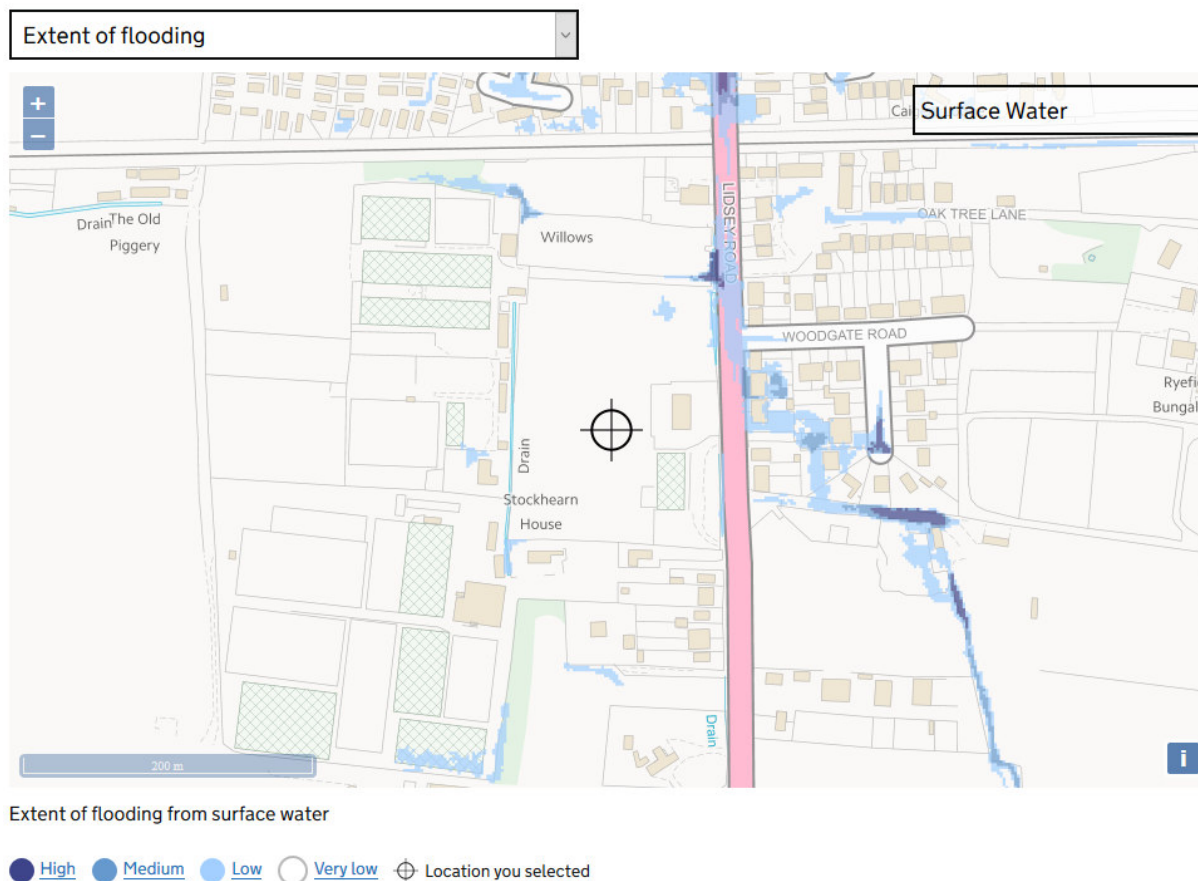


Figure 10. Long-Term Flood Risk Map - Surface Water (.Gov.uk)

- 2.2.3 The Long-Term Flood Risk Map for Surface Water confirms that the site is largely at 'Very Low' risk of surface water flooding. A small area to the north-east corner of the site is indicated as being at 'Low' risk of surface water flooding. Lidsey Road and the ordinary watercourse located towards the north-east corner of the site are also demonstrated as being at 'Low' risk of surface water flooding. Areas to the south-west of the site, adjacent to the watercourse in this area, are also indicated as being at 'Low' risk of surface water flooding.
- 2.2.4 Following review of the Long-Term Flood Risk Map associated with surface water flooding (2.2.3), the associated depths of surface water flooding have also been reviewed, as demonstrated below in **Figures 11**. The area to the north-east corner of the site stated to be susceptible to 'Low' risk of surface water flooding, has anticipated associated surface water flood depths of 'Below 300mm'. The areas within the vicinity of the watercourse(s) which abut the eastern boundary of the site are indicative of having associated depths of flooding in the range of '300 - 900mm' in 'Low' risk scenarios. Given that the Long-Term Flood Risk Map for Surface Water identifies low points within the local topography, it is evident that these areas are associated with the existing ditches, within which surface water will be contained.

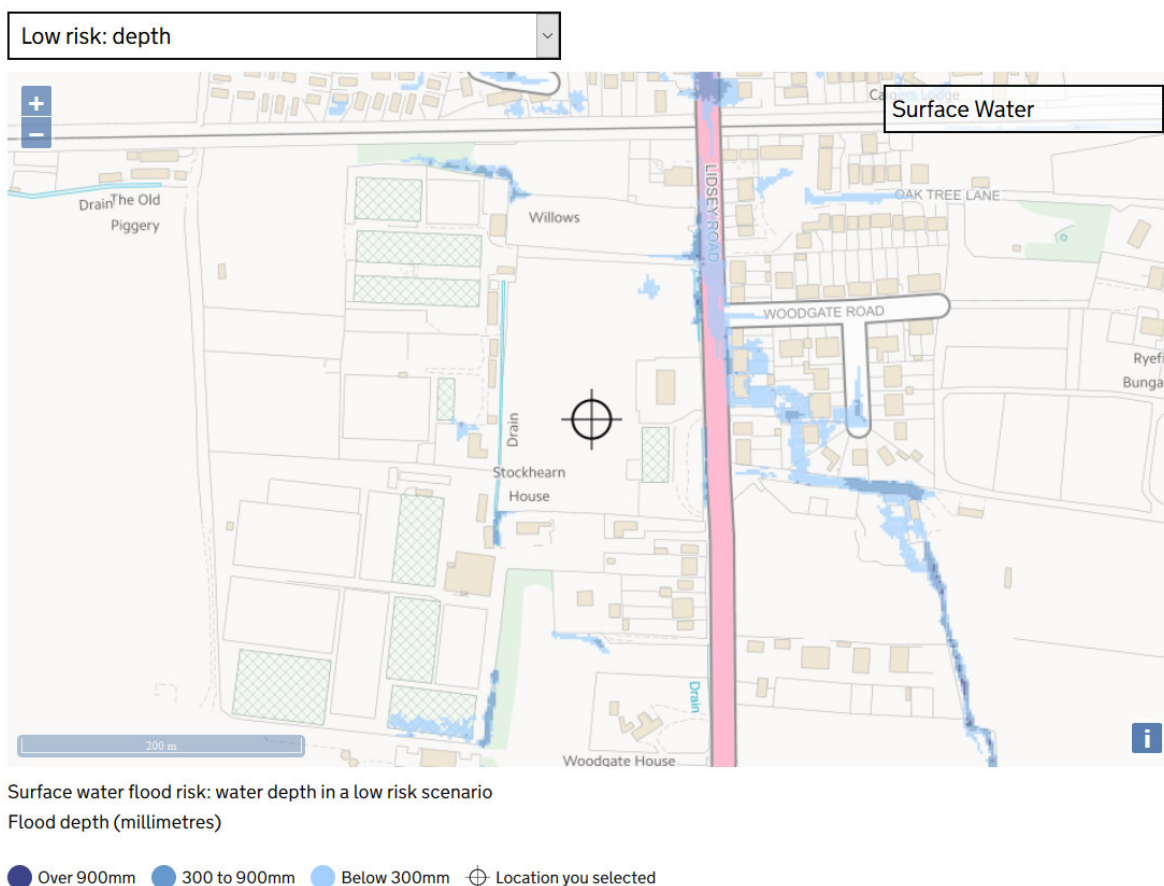


Figure 11. Long-Term Flood Risk Map - Surface Water, 'Low' Risk Depths (.Gov.uk)

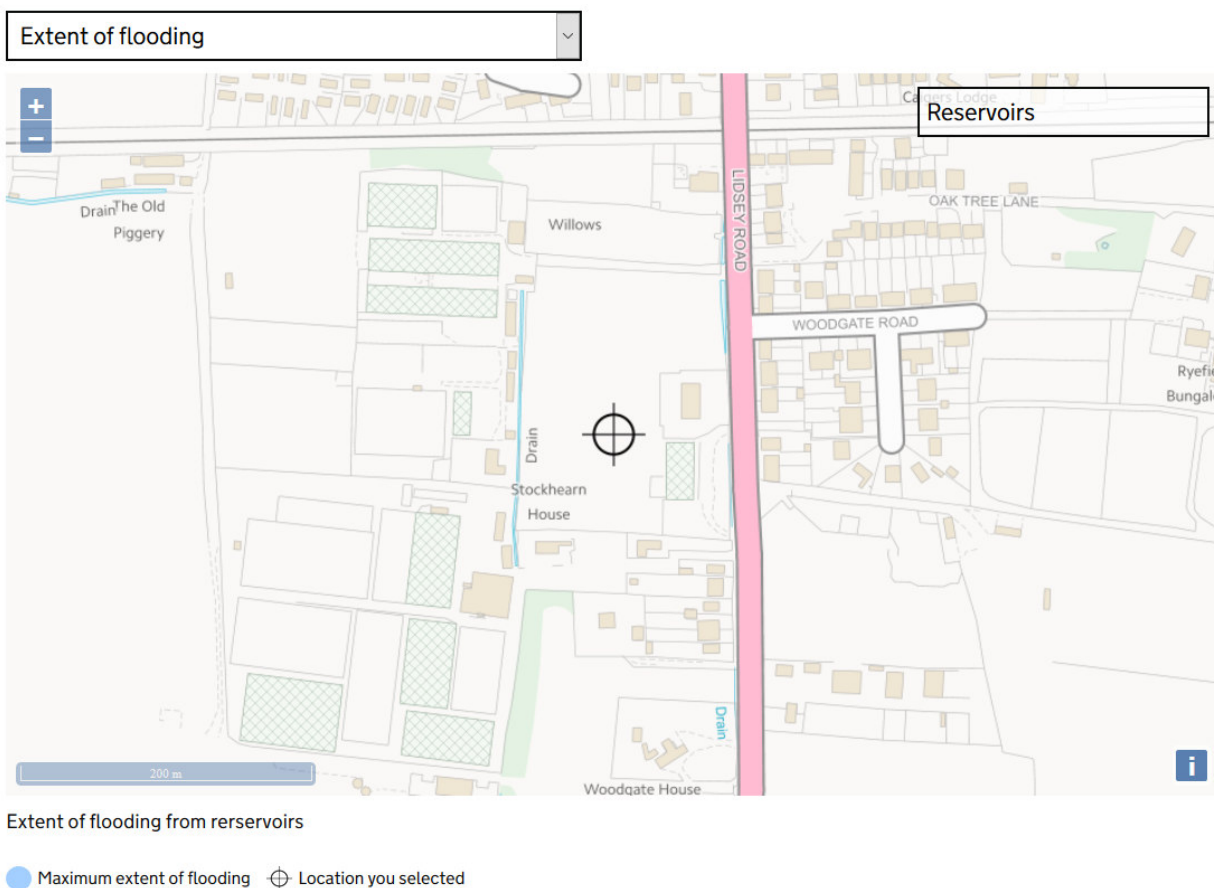


Figure 12. Long Term Flood Risk Map - Reservoirs

2.2.5 The Long-Term Flood Risk Map for Reservoirs confirms that the site is not at risk of flooding from this source.

2.3 Strategic Flood Risk Assessment

- 2.3.1 The site falls under the jurisdiction of ADC and WSCC.
- 2.3.2 WSCC has a published SFRA, dated January 2010, along with Local Flood Risk Management Strategy, published in May 2014.
- 2.3.3 Flood mapping and information contained within the SFRA is consistent with other flood maps reviewed and detailed within this report. The site is not specifically referenced within the SFRA.

2.4 Lidsey Surface Water Management Plan (SWMP)

- 2.4.1 As has been confirmed earlier in this report, the site falls within the Lidsey Foul Water Treatment Catchment Area and is therefore covered by the Lidsey Surface Water Management Plan (SWMP).
- 2.4.2 The report confirms that the SWMP covers generally the same areas as Southern Water's Lidsey wastewater drainage catchment, which covers Barnham, Eastergate, Elmer, Felpham, Middleton-on-Sea, Walberton, Woodgate and Yapton.
- 2.4.3 The report, and specifically the mapping contained within its appendices, refers to the site, whilst it is noted that the mapping contained within is again consistent with that as obtained from other sources.
- 2.4.4 Within the SWMP, 'Local Flood Risk Zones' are determined. In view of such, the site falls outside of LFRZ_018 (Oak Tree Lane, Woodgate).
- 2.4.5 Plan 3 ('Historic Flooding', contained within **Appendix G** of this report) indicates surface water flooding within the immediate vicinity of the site, and potentially affecting 'Wings' (the existing property on site). In addition to this, the same map demonstrates sewer flooding within close proximity of the site, within Oak Tree Lane, to the east of the site.
- 2.4.6 Plan 6 ('Flood Risk from Groundwater Sources', contained within **Appendix G** of this report) indicates that the site is at an equal to or greater than 75% risk of groundwater flooding.
- 2.4.7 Plan 11 ('Modelled Flood Depths 1% AEP 1 in 100 Year Event', contained within **Appendix G** of this report) is consistent with the Long-Term Flood Risk Map for Surface Water – demonstrating surface water flooding not exceeding 300mm in depth for the areas indicated as being susceptible to this source of flooding.
- 2.4.8 Extracts from the Lidsey SWMP can be found within **Appendix G** of this report.

2.5 Historic Flooding

- 2.5.1 WSCC has confirmed that they hold no records of historic flooding directly affecting the site.
- 2.5.2 WSCC has confirmed, however, that historic flooding has occurred within close proximity of the site, and within the public highway. This historic flooding is said to have occurred at the junction of Oak Tree Lane and Lidsey Road, affecting No. 1 and No. 2 Lidsey Road. It has been stated that this was as a result of surface water run-off from Lidsey Road not draining away once it flows onto the existing grass verge.
- 2.5.3 As confirmed in Section 2.4, mapping contained within the Lidsey SWMP confirms that historic surface water flooding and sewer flooding has occurred within the vicinity of the site. Confirmation of such can be found within **Appendix G** of this report ('Historic Flooding – Plan 3' mapping).

2.6 Summary of Flood Risk

2.6.1 The potential sources of flooding are:

Source of Flooding	Level of Risk
Rivers and Coastal	Very Low The site is located fully within Flood Zone 1 and there are no Main Rivers or Tidal Waters located within the immediate vicinity of the site.
Surface Water	Very Low to Low The site is confirmed as being almost entirely at 'Very Low' risk of surface water flooding, with the exceptions being to the north-eastern corner of the site, along the eastern boundary (within the vicinity of the existing ditches) as well as to the south-west corner of the site, which are indicated as being at 'Low' risk of surface water flooding. The anticipated depths of surface water flooding in 'Low' risk scenarios is stated to be 'Below 300mm'.
Groundwater	Medium to High WSCC has confirmed that current JBA groundwater mapping indicates a 'moderate' risk of groundwater flooding occurring at the site, although no known instances of groundwater flooding have been recorded south of the railway lines located to the north of the site. The Lidsey SWMP indicates an equal to or greater than 75% risk of groundwater flooding at the site, whilst current groundwater monitoring results indicate groundwater at depths as shallow as 410mm below ground level.
Sewers	Low The Lidsey SWMP indicates historic sewer flooding within the vicinity of the site, understood to have occurred in Oak Tree Lane. Southern Water has been consulted in relation to historic as well as potential current issues regarding the public sewer network, and a response is currently outstanding.
Artificial Sources	None The site is not identified as being at risk of flooding from artificial sources.

2.6.2 The site is located within the Lidsey Foul Water Treatment Catchment Area, this area forming part of the Lidsey SWMP.

- 2.6.3 The greatest risks of flooding to the site are presented by groundwater, although there are known issues associated with surface water within the vicinity of the site, understood to be associated with the ditches located to the east, which serve to assist in draining Lidsey Road. This information should be considered in view of the proposed drainage strategy to ensure that sufficient, effective mitigation is provided to the development, whilst also ensuring that the risk of flooding occurring elsewhere, offsite, is not increased.

3 PROPOSED DEVELOPMENT

3.1 Description of Development

- 3.1.1 The proposed develop will involve the construction of 71 No. residential units, as demonstrated by the design proposals, contained within **Appendix A**.
- 3.1.2 The type of development falls within the 'More Vulnerable' classification ('Flood Risk and Coastal Change', Table 2) and is appropriate in Flood Zone 1 ('Flood Risk and Coastal Change', Table 3).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	Exception Test Required	✓	✓	✓
Flood Zone 3a†	Exception Test Required †	✗	Exception Test Required	✓	✓
Flood Zone 3b*	Exceptions Test Required *	✗	✗	✗	✓*
✓ = Development is appropriate ✗ = Development should not be permitted					

- 3.1.3 The post-development impermeable area has been determined to be 10,232m² (1.02Ha) an increase of 8,430m² (0.84Ha) compared with the existing impermeable area at the site which totals approximately 1,802m².
- 3.1.4 The use of Sustainable Drainage System (SuDS) methods and techniques (where site conditions and constraints allow) within the bounds of the site (whilst adhering to the SuDS hierarchy as stated within Building Regulations (Part H) and The CIRIA SuDS Manual C753) will be used to provide a betterment of surface water run-off compared to the existing site.
- 3.1.5 The specific foul and surface water drainage proposals are detailed in **Section 4** of this report.

4 PROPOSED DRAINAGE STRATEGY

4.1 Surface Water

4.1.1 The SUDS manual and Building Regulations set out a hierarchy of drainage methods to ensure that developments maximise the use of sustainable drainage techniques. The hierarchy favours infiltration methods of disposal over other methods such as watercourse and sewers, as detailed below;

- i. Utilise infiltration techniques
- ii. Attenuate rainwater in ponds or open water features for gradual release
- iii. Attenuate rainwater by storing in tanks or sealed water features for gradual release
- iv. Discharge rainwater direct to a watercourse
- v. Discharge rainwater to a surface water sewer/drain
- vi. Discharge rainwater to a combined sewer

SUDS Technique	Suitable	Comments
Living Roof	No	Unlikely to be viable in view of client's development proposals.
Basins and Ponds (such as Constructed Wetlands, Balancing Ponds, Detention Basins, Retention Ponds)	Yes	No current constraints identified limiting the use of such measures, although the presence of groundwater will need to be considered in their design. Anticipated 'land take' will also need to be considered.
Filter strips and swales	Yes	No current constraints associated with such methods although, again, the presence of groundwater will need to be considered.
Infiltration Devices - Soakaways - Infiltration trenches and basins	No	Geo-Environmental has undertaken infiltration testing at the site, in accordance with BRE Digest 365. 'Relatively poor' infiltration rates were recorded within the River Terrace Deposits, whilst high groundwater identified during

		monitoring means such methods are unviable.
Permeable surfaces and filter drains - Gravelled areas - Porous block paving	Yes	It is possible permeable paving may be viable, if tanked, given the presence of shallow groundwater on site. The storage volume, and therefore the ability to infiltrate, would therefore be heavily restricted in view of such.
Tanked systems - Oversized pipes - Cellular tanks	Yes	No initial constraints identified.

- 4.1.2 Infiltration rates of 5.4×10^{-6} (TP2), 5.1×10^{-6} (TP3), 9.4×10^{-6} (TP5) and 5.7×10^{-6} (TP6) have been established on site further to testing undertaken in accordance with BRE Digest 365, which indicate 'relatively poor' drainage capabilities of the soils on site.
- 4.1.3 In addition to 4.1.2, groundwater has also been recorded at shallow depths (as shallow as 410mm below ground level, as determined by monitoring undertaken to date) therefore also impacting upon the ability of the ground to accept surface water run-off through infiltration methods and techniques.
- 4.1.4 In view of the constraints associated with the underlying geological conditions, it is proposed that attenuated storage will be introduced on site, with a controlled discharge to the adjacent watercourse network provided in order to manage surface water run-off generated by the development. Run-off will be restricted to mimic greenfield run-off rates, whilst a betterment will be sought, where possible.
- 4.1.5 Permeable paving will be introduced on site in order to provide high-level attenuation, as well as a level of treatment in accordance with The CIRIA SuDS Manual C753.
- 4.1.6 Following discussions with ADC as well as WSCC, it is proposed that clearance works will be undertaken in relation to the existing network of ditches within the vicinity of the site, with specific attention to the ditches to the east of the site, adjacent to Lidsey Road. These receiving ditches will be re-graded, re-profiled and in certain areas re-aligned, in order to improve the conveyance of flows. These works are also in recognition of the recommendations as detailed within the Lidsey SWMP.
- 4.1.7 In addition to 4.1.6, a section of the watercourse which is currently culverted (at the access to 'Wings') will be reinstated as 'open ditch'.
- 4.1.8 The site will be supported by a split catchment surface water drainage system. The primary system will support an impermeable area of 8,829m² (0.89Ha), whilst the secondary system will cater for the additional 1,403m² impermeable area (serving Plots 63-71).
- 4.1.9 A pond measuring 650m² (1.50m depth, 1:3 side-slopes) is proposed to support the primary network, which will be supplemented by permeable paving to provide attenuation on-site.
- 4.1.10 The extents of permeable paving associated with the primary system amounts to 1716m², which – with a sub-base depth of 450mm and 32% voids, will provide a volume of storage to the order of 247.10m³.
- 4.1.11 The pond will discharge to the ditch adjacent to Lidsey Road, to the east of the site, at a controlled rate. Flows will be restricted to a maximum of 5.00l/s, whilst the network has been designed to

accommodate up to and including a 1-in-100-year storm event, with an allowance for both climate change (40%) and urban creep (10%).

- 4.1.12 The secondary system, supporting units 63-71, will consist of permeable paving (249.96m²) providing a volume of storage totalling 35.994m³ (based on a 450mm sub-base and 32% voids), supported by a 20m² shallow cellular storage tank (400mm deep structure) providing a volume of storage totalling 7.60m³. This system will discharge, again at a controlled rate, to an upstream section of the same ditch as the primary network, located on Lidsey Road to the east of the site. Flows for the secondary network will be restricted in this instance to 1.5l/s.
- 4.1.13 Total discharge from the development will amount to 6.5l/s.
- 4.1.14 It is proposed that existing ground levels will be raised on site, to the order of up to 600mm, in order to mitigate the risk of potential groundwater flooding.
- 4.1.15 The existing topography of the site, and overland (exceedance) flow routes have been considered and will be honoured in view of the proposed development to ensure that there is no increase in the risk of flooding on, or off site.
- 4.1.16 An allowance in view of urban creep has been provided, in the event that an increase in areas of hardstanding occurs across the design-life of the development. An additional allowance of 10% in view of the proposed impermeable area has been allowed for in design calculations and storage provision.
- 4.1.17 The strategy above will ensure that there is no increase in the rate of run-off leaving the site, therefore no increase in the risk of flooding from this source.
- 4.1.18 The proposed surface water drainage strategy is demonstrated on drawing **PL300 – 'Proposed Drainage Strategy'**.

4.2 Treatment

- 4.2.1 The use of permeable paving will ensure that run-off from the site receives a level of treatment required by the SuDS manual, with hydrocarbons being filtered by the aggregate and geotextile layers.
- 4.2.2 In accordance with the CIRIA SuDS Manual C753 regarding methods for managing pollution risks, the risk posed by surface water run-off to the receiving environment depends on the pollution hazard at the site (the source), SuDS treatment techniques (the pathway), and the sensitivity of the environment (the receptor).
- 4.2.3 The simple index approach considers whether SuDS techniques are appropriate for the site. The states that for SuDS components to deliver adequate treatment, the total pollution mitigation index for each contaminant type should equal or exceed the pollution hazard index.
- 4.2.4 The SuDS Manual outlines three categories of pollution hazard identification, which vary depending on proposed land use, which are as follows:
 - Total Suspended Solids (TSS).
 - Metals (M).
 - Hydrocarbons (H).

4.2.5 In accordance with C753 Table 26.2, the proposed land uses at the site are categorised as follows:

- Residential Roofs and non-trafficked areas – very low/TSS=0.2/M=0.2/H=0.05

4.2.6 In accordance with C753 Table 26.3, the values of SuDS Mitigation indices are provided for permeable paving:

- Permeable Pavement – TSS=0.7/M=0.6/H=0.7
- Pond - TSS=0.7/M=0.7/H=0.5

4.2.7 As the pollution hazard index does not exceed any pollution mitigation index for any contaminant type, the proposed SuDS methods will provide sufficient treatment for the proposed development.

4.3 Foul Water Drainage

4.3.1 It is proposed that the development will utilise a connection to the existing public foul water sewer network.

4.3.2 As confirmed in 1.5.3, there is a 150mm dia. public foul water sewer located within the bounds of the site, with a depth in the region of 2.07m to 2.39m deep. It is proposed that this sewer will serve the development.

4.3.3 It is understood that the existing property on site ('Wings') benefits from a connection to this sewer, although the point of connection has not been confirmed.

4.3.4 Investigation in relation to the existing foul water drainage infrastructure located on site should be undertaken prior to any development works being undertaken, as it is possible existing connections could be retained, and utilised, where appropriate.

4.3.5 Based on the residual design guidance provided in Design and Construction Guidance (2020), post development, it is anticipated that total peak foul water flows will be 3.29l/s.

4.3.6 Recent changes to infrastructure and connection charges (OFWAT Charging Rules) place the onus on the sewerage undertaker to reinforce their network should there no longer be sufficient capacity to serve the new development. Funding for this is provided by revised charging arrangements for infrastructure and connection charges for each dwelling constructed comprising a Network Reinforcement Charge and Site-Specific Charges. The revised charging arrangement (funded by the developer) covers alterations to the Existing Sewer Network and the sewerage undertaker remains responsible for the cost of reinforcing their Strategic Assets. The developer is responsible for connecting the development to the public sewer network.

4.3.7 A connection to the public sewer network will require consent from Southern Water in conjunction with a Section 106 approval.

4.3.8 As confirmed by ADC, the site falls within the Lidsey Foul Water Treatment Catchment Area. Given the sensitivity of drainage matters within this catchment area, Southern Water has been consulted in relation to the development proposals. Their response is included in the appendices.

4.4 Climate Change

4.4.1 In December 2019 the Environment Agency updated the latest climate change allowances (available online at <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>), which supports the NPPF in making an allowance for climate change within flood risk assessment. The allowances provide predictions of anticipated change for peak river flow by river basin district and peak rainfall intensity.

4.4.2 The table below shows the anticipated changes in extreme rainfall intensity. For flood risk assessments, both the central and upper end allowances should be assessed to understand the range of impact.

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

4.4.3 Based on the latest allowances, an increase of 20% should be applied to peak rainfall to this development, with a review undertaken to determine the impact of a 40% increase.

5 RESIDUAL RISK AND MITIGATION

5.1 Residual Risk

5.1.1 The following residual risks have been identified in relation to the proposed development:

- i. Extreme rainfall events that exceed the design criteria used for the drainage system causing surface water flooding.
- ii. Blockage of the receiving ordinary watercourse(s) resulting in flooding on site.
- iii. Blockage/failure of the proposed drainage system causing flooding to the site.
- iv. Flooding in the event of high groundwater levels.
- v. Flooding in the event of blockage/failure/surcharging of the public sewer network.

5.2 Mitigation

5.2.1 Consideration has been taken to the residual risks stated in Section 5.1, and the following mitigation measures are proposed:

- The proposed drainage strategy has been developed to accommodate a 1-in-100-year storm event, inclusive of an allowance for the effect of climate change (40%) as well as Urban Creep (10%), should the impermeable area at the site increase across its design life. Should a rainfall event occur which exceeds this design criteria, there is potential for the drainage system to be inundated, and exceedance to occur, potentially resulting in flooding. Exceedance flows would follow the existing topography of the site with post-development flow routes mimicking the existing situation, as so not to increase the risk of flooding elsewhere, either on, or off-site. The Long-Term Flood Risk Maps for Surface Water indicate 'Very Low' and at worse a 'Low' risk of surface water flooding, with anticipated depths of surface water flooding stated to be 'Below 300mm'. On-site levels shall be engineered to ensure that any exceedance flows are directed away from buildings, and in particular, thresholds.
- Improvements are proposed in relation to the existing watercourse network within the vicinity of the site. The ditches along the eastern boundary of the site will be cleared, re-graded, re-profiled and re-aligned, with a section which is currently culverted to be re-instated as 'open ditch'. These measures will ensure a greater ability for the channel(s) to convey flows, whilst also reducing the risk of blockage. Maintenance is critical in ensuring flood risk is managed effectively – the required actions in relation to the maintenance of the ordinary watercourse network is detailed within **Section 8 – 'Maintenance'**.

- The proposed drainage system will attenuate run-off up to a 1-in-100-year storm event, inclusive of allowances for climate change and urban creep (40% and 10%, respectively). Blockages to the components of the drainage system has the potential to cause flooding to proposed development. Surcharged flows will likely follow the local natural topography, before being intercepted by either private drainage infrastructure or that which supports the public highway. Maintenance plays an essential role in managing flood risk and ensuring the drainage system is kept operating to its peak capacity. **Section 8 – 'Maintenance'** will mitigate the risk of the system becoming blocked.
- WSCC state that there is a 'moderate' risk of groundwater flooding at the site, whilst the Lidsey SWMP indicates a risk of groundwater flooding equal to or greater than 75% probability. Groundwater monitoring undertaken to date confirms the presence of groundwater at depths as shallow as 410mm below ground level. It is proposed the levels on site will be raised, up to 600mm to limit the impact of potential groundwater flooding. In addition to this, levels will be designed in order to ensure any flows are directed away from dwellings, and specifically, thresholds.
- Southern Water has been consulted in relation to the development proposals, with acknowledgement of an increase in foul water flows generated in association with the development, which will discharge to the public sewer network. Following recent changes to infrastructure and connection charges (OFWAT Charging Rules), it is the responsibility of Southern Water to ensure that their network is reinforced sufficiently in order to support development should capacity not exist already. This is funded through the revised charging arrangement. At present, a response from Southern Water has not yet been received. An update will be provided, in due course, once a response has been received.

6 SEQUENTIAL AND EXCEPTION TESTS

6.1 Sequential Test

- 6.1.1 The proposed development and site is located fully within Flood Zone 1 and is therefore at 'Low' risk of flooding. In view of this, the application of the Sequential Test is not required.

6.2 Exception Test

- 6.2.1 The proposed development fall within the 'More Vulnerable' classification as specified in 'Flood Risk and Coastal Change', Table 2.
- 6.2.2 Table 3, 'Flood Risk and Coastal Change' confirms that 'More Vulnerable' development is compatible with Flood Zone 1.
- 6.2.3 In view of the above, application of the Exception Test is not required.

7 FLOOD RISK MANAGEMENT

7.1 Safe Access and Egress

- 7.1.1 Pedestrian and vehicular access to the site will be available directly off of Lidsey Road.
- 7.1.2 The proposed development falls entirely within Flood Zone 1 and is expected to remain for its intended design life.
- 7.1.3 The site is confirmed as being at 'Very Low' to 'Low' risk of surface water flooding. The areas at perceived increased risk of surface water flooding ('Low' risk) have associated anticipated depths of flooding not exceeding 300mm ('Below 300mm'). Should surface water flooding occur to such depths, it is not envisaged that Emergency Service vehicles would be restricted in terms of their ability to safely access or egress from the site.
- 7.1.4 Further to 7.1.3, it is not envisaged either that standard vehicles would be impeded by depths of flooding 'Below 300mm'.
- 7.1.5 In view of the above, it is deemed that safe access and egress from the proposed development can be provided.

8 MAINTENANCE

8.1 Proposed Maintenance Regime

- 8.1.1 Maintenance is required to ensure the long-term operational performance of the proposed surface water drainage system.
- 8.1.2 The drainage system has been designed to minimise maintenance requirements; however, a number of key tasks will need to be undertaken so that the system remains in optimum condition. These operations are summarised in the table below, along with the required frequency of works.

Drainage System feature	Proposed maintenance / remedial works	Required frequency of works
Permeable Paving	Surface sweeping to reduce silt and debris accumulation.	Every 8 to 12 weeks
	Removal / management of weed growth	At least once a year
	Silt removal from permeable surfaces, possibly involving raking out of joints, redressing, removal and remedial works.	As required / to be specified by manufacturer
Inlet, Outfall and Existing Watercourses	Inspection, vegetation clearance and additional clearing/cleansing of potential outfall blockages	At least once a year
	Desilting	Year 1, Year 3, then every 5 years
Diffuser units & catch pits, gully sumps and drains	Inspection and additional cleansing as required.	Annual
	Desilting	Year 1, Year 3, then every 5 years
Pipework	Jetting to clear blockages	As required

- 8.1.3 The responsibility of any drainage infrastructure supporting a single dwelling/plot will be the sole responsibility of the owner/occupier of the associated dwelling.
- 8.1.4 Additional maintenance activities beyond this will be the responsibility of a nominated management company, to be appointed by the developer upon completion of the development.
- 8.1.5 A detailed maintenance document shall be established prior to appointment in order to detail the roles and responsibilities where maintenance is concerned.

Permeable Paving / Diffuser Units

- 8.1.6 The areas of permeable paving are designed to allow surface water run-off to percolate through the joints in the block paving surface course and into the sub-base below. This provides a volume of attenuated storage (as it is proposed that the permeable paving will be tanked in view of site constraints) before collected run-off is discharged, at a control rate, to the receiving outfall(s).
- 8.1.7 As part of the permeable paving system, diffuser units are used to discharge surface water run-off from roof areas into the sub-base, as well as forming links between areas of permeable paving. These diffuser units are small heavy-duty cellular units which allow more efficient discharge of surface water into the sub-base base of the permeable paved areas.
- 8.1.8 The areas of permeable paving will require additional maintenance measures to ensure they operate

as designed. Failure in carrying out this maintenance, could increase the risk of flooding. The additional measures are as follow:

- Periodic surface sweeping to reduce silt and debris accumulation. The permeable surfaces should be swept at least every 8 to 12 weeks with additional sweeps in the autumn to clear fallen leaves
- Removal / management of weed growth, as required. Typically, once or twice a year for regularly used areas
- Periodic silt removal from permeable surfaces as described by the manufacturer. If any areas are showing signs of ponding, they shall be dealt with by raking out the joints and redressing. The entire surface shall be monitored and when there are signs of excessive siltation resulting in poor drainage over the whole area, the blocks shall be taken up and a replacement of bedding layer and geotextile shall be undertaken
- Redressing of joints on the block paving as required
- Catchpits upstream of diffuser units should be emptied and inspected on the same regime as all catchpits specified previously set out in this document

Flow Control Chambers/Devices

- 8.1.9 A flow control chamber (such as a HydroBrake or Crown Vortex Flow Control) or device is self-activating, relying on upstream hydraulic head to generate an air-filled vortex within the centre of the casing. Once the vortex is initiated water drains down through a small opening in the back of the device at the designed restricted flow rate.
- 8.1.10 The flow control device has two measures in case of emergency (i.e. blockage). The first is a door situated in the front of the unit itself, this can be operated from the surface by a release cable situated just under the manhole cover which closes under its own weight and does not require any mechanism to operate. The second is a high-level overflow pipe situated within the flow control manhole. Both measures allow the system to drain down freely, until the blockage can be cleared.
- 8.1.11 The flow control chamber will require additional maintenance measures to ensure it operates as designed. The additional measures are as follows:
 - The sump within the flow control chamber should be monitored for build-up of silts and should be emptied, as a minimum, on the same regime as specified for catchpits previously within this document
 - The drain down door located on the centre of the unit will require inspection and opening annually, to ensure it is operating as intended.

Dry Pond

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass in and around pond	Monthly (during growing season) or as required
	Manage other vegetation and remove nuisance plants	Monthly at start and then as required
	Inspect inlets and outlets for blockages and clear as required	Monthly
	Inspect banks for damage and repair as required	Monthly
	Inspect inlets and pond surface for silt accumulation. Establish silt removal frequency	Monthly for first year then annually or as required
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlet	Annually or as required
Occasional Maintenance	Reseed areas of poor growth	As required
	Trim overhanging trees and remove cuttings	Every 2 years
Remedial Actions	Repair erosion or other damage by reseeding or returfing	As required
	Repair inlets and outlets	As required
	Relevel uneven surfaces and reinstate design levels	As required

Remedial/Repair Actions

- 8.1.12 Significant storm events may cause considerable damage to SuDS and their associated components. As such, it may be necessary to inspect and carry out essential recovery works to return the feature to full working order.
- 8.1.13 Resetting of uneven blocks by lifting block area, removing bedding material and relaying to match original design are all actions which may need to be undertaken.

Accidental Spillages

- 8.1.14 It is not envisaged that any materials are to be stored onsite once the development has been completed, which could cause major spills and potential pollution issues within the drainage system. If this situation alters in the future consultation with a specialist will be required in order to confirm if any

upgrades to the existing system are necessary.

- 8.1.15 Minor spillages of fuels and oils will be dealt with by the permeable paving and deep trapped gullies, by biodegrading and collecting the hydrocarbons respectively.

Future Alterations to the Development

- 8.1.16 Any future alterations to the permeable paving should be confirmed by a specialist. Where possible any future services are to avoid being located through areas of permeable paving. If new services are required to run through areas of permeable paving, services should be installed below the depth of permeable paving with the permeable system reinstalled above.

9 OFFSITE IMPACTS

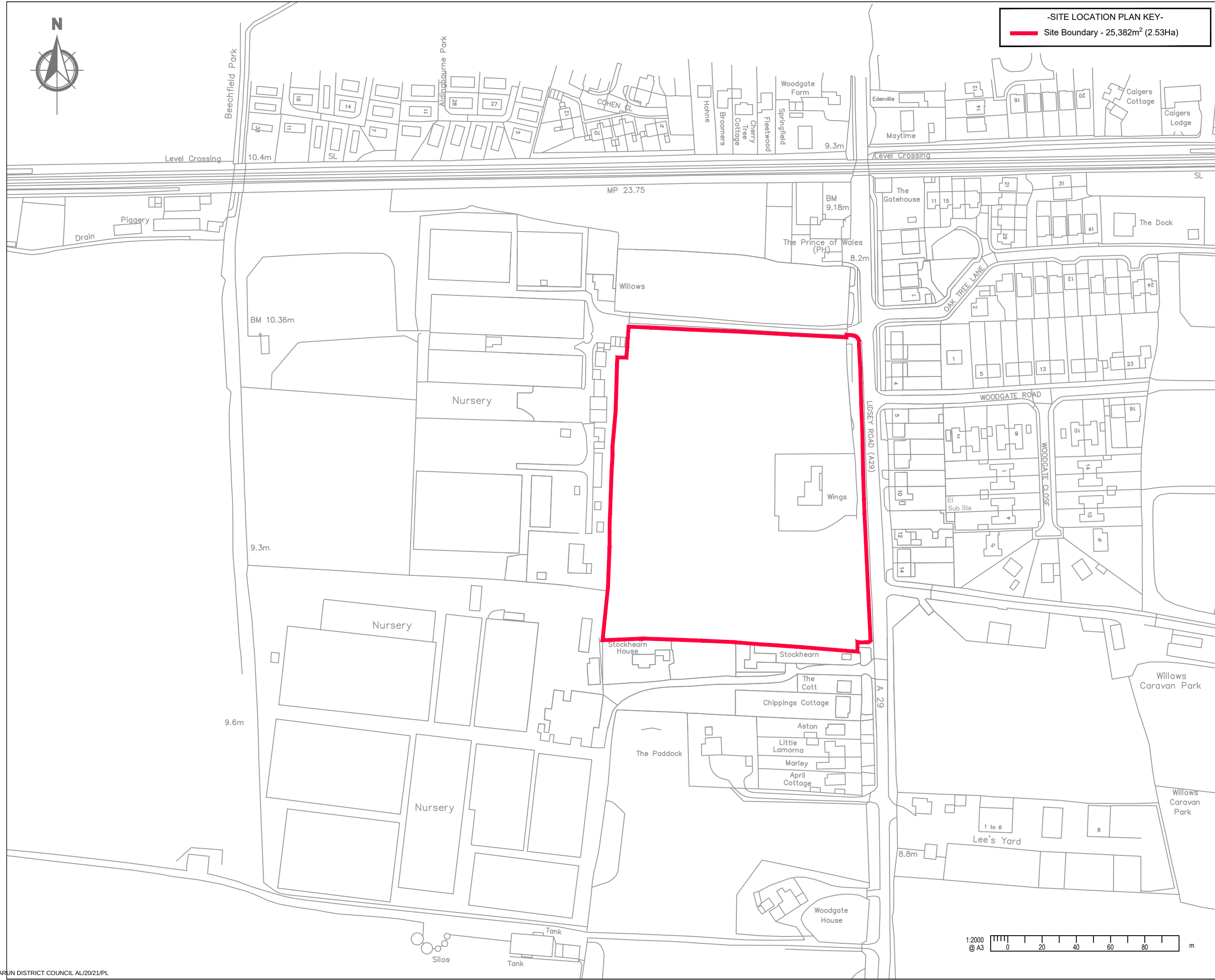
- 9.1.1 As established already within this report, offsite improvement works are proposed in relation to the watercourses within the vicinity of the site, which will serve to provide surface water drainage functionality to the development.
- 9.1.2 The existing watercourses will be cleared, re-graded, re-profiled and re-aligned, with a section which is currently culverted also being reinstated as 'open ditch' in order to provide an overall betterment, and improved conveyance of flows.
- 9.1.3 There will be no increase in the rate of run-off leaving the site, as flows will be restricted to pre-development greenfield run-off rates as a minimum, although betterment will be sought, where possible.
- 9.1.4 There will be an increase in foul water flows presented to the public sewer network, however, in view of revised charging arrangements, it is Southern Water's responsibility to provide reinforcement to their assets in order to provide capacity to support development.
- 9.1.5 The effects of climate change along with urban creep have both been considered in the overall drainage strategy for the site, with allowances of 40% and 10% made, respectively, in view of each.
- 9.1.6 In view of the above, there will be no adverse off-site impacts as a result of the development being completed.

10 SUMMARY

- 10.1.1 This site-specific flood risk assessment is based on Flood Maps for Planning, Long-Term Flood Risk Maps, WSCC SFRA, ADC, WSCC and Southern Water Drainage Records, Geo-Environmental Ground Appraisal Report, BGS Information and Records and the Lidsey SWMP.
- 10.1.2 Levels on site range from 8.04m AOD to 9.48m AOD, although there are no consistent falls across the site as a whole. The northern half of the site broadly falls from south-west to north-east, whilst the southern half of the site can largely be considered flat, with minimal falls from west to east generally evident.
- 10.1.3 The pre-development impermeable area totals approximately 1859m² (0.19Ha).
- 10.1.4 The proposed development consists of 71 No. residential units, with an associated impermeable area totalling 10,289m² (1.02Ha).
- 10.1.5 The site, and proposed development, falls entirely within Flood Zone 1, and is at 'Very Low' to 'Low' risk of flooding from all sources, with the exception of groundwater flooding ('Medium' to 'High').
- 10.1.6 Post-development surface water run-off will be managed via sustainable means. Infiltration has been confirmed to be unviable, in view of infiltration rates determined on site as well as because of the presence of groundwater at shallow depths. Surface water will discharge, to the existing ordinary watercourse network, at a controlled rate, to mimic greenfield run-off rates.
- 10.1.7 Improvement works will be undertaken in relation to the existing ordinary watercourse network to provide betterment.
- 10.1.8 The proposed drainage system has been designed to accommodate a 1-in-100-year storm event, whilst both climate change (40%) and urban creep (10%) have been considered.
- 10.1.9 Foul water will discharge to the Southern Water public foul water sewer network. Post-development peak foul flows have been determined to be in the region of 3.29l/s (based on Design and Construction Guidance (2020), 4000l/day). Any connection will be subject to approval from Southern Water, following a Section 106 application.
- 10.1.10 Following completion of the development, there will be no increase in the overall flood risk either on, or off-site.
- 10.1.11 In conclusion, the development is deemed to be suitable from a flood risk and drainage perspective.

DRAWINGS

- PL100** Site Location Plan
- PL200** Existing Impermeable Area
- PL201** Proposed Impermeable Area
- PL301** Proposed Drainage Strategy Sht 1
- PL302** Proposed Drainage Strategy Sht 2
- PL303** Proposed Floor Levels & Road Levels Sht 1
- PL304** Proposed Floor Levels & Road Levels Sht 2



-SITE LOCATION PLAN KEY-

Site Boundary - 25,382m² (2.53Ha)

NOTES

A3

- This drawing is to be read in conjunction with all other BPC drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.
- BPC accepts no responsibility for inaccuracies in data provided by third parties such as topographic surveys or Ordnance Survey mapping.
- Do not scale, work to figured dimensions only. All dimensions are in millimeters unless noted otherwise and all levels are in metres from the topographic survey datum.
- Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

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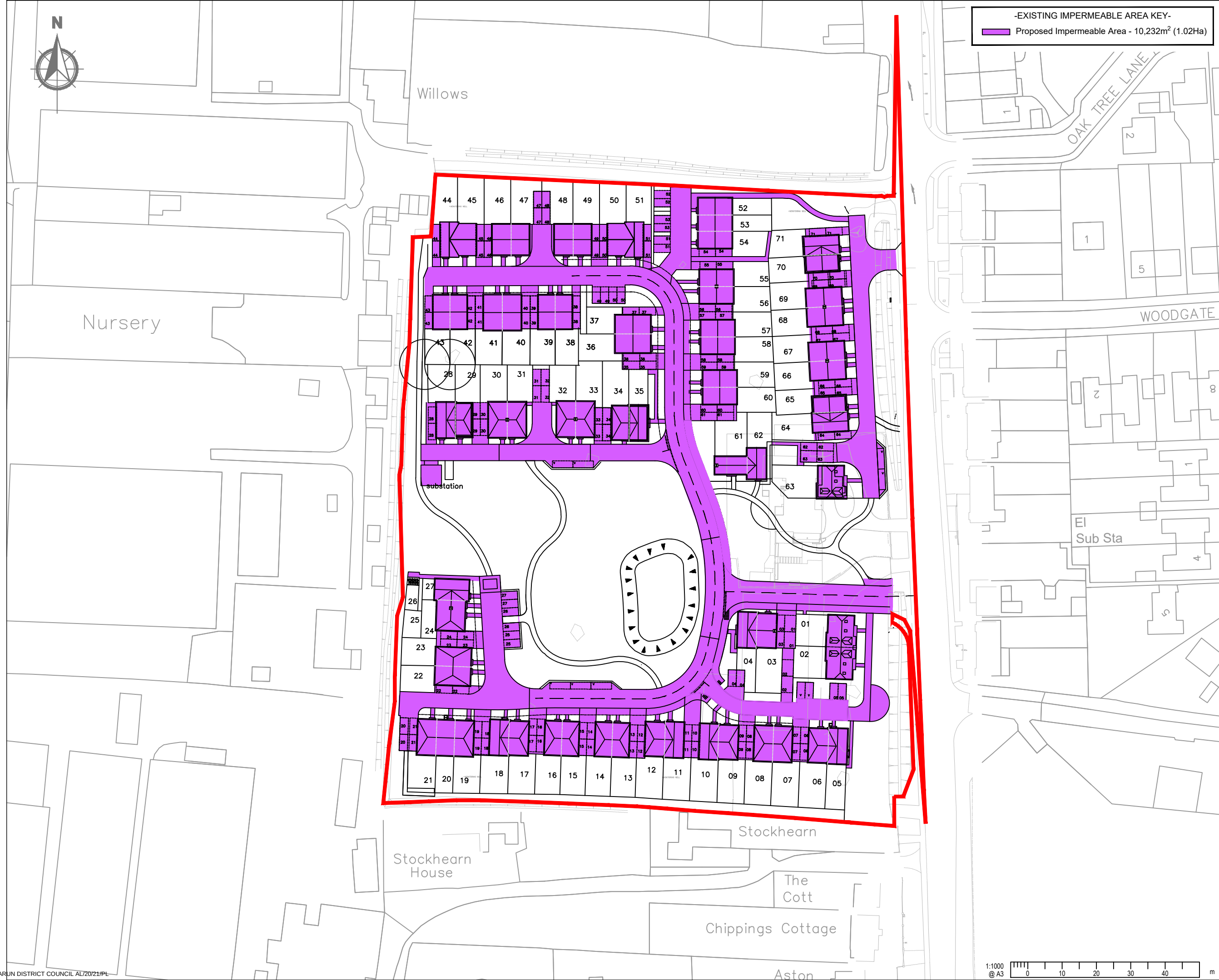
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	Original issue	29/01/2020
Rev	Amendments	Date



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Drawing Status	PLANNING		
Client	Southern Housing Group Ltd		
Drawing Title	Site Location Plan		
Project	Land at Wings Nursery Lidsey Road		
Scale	1:2000	Date	Jan 2020
Drawn By	SPB	Checked By	MJA
Drawing No.	D1757-PL100		Rev.
		-	



-EXISTING IMPERMEABLE AREA KEY-

Proposed Impermeable Area - 10,232m² (1.02Ha)

- NOTES
1.

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2.

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3.

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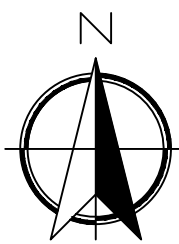
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B	Revised site layout	12/05/2021
A	Revised site layout	22/01/2021
-	Original issue	29/01/2020
Rev	Amendments	Date



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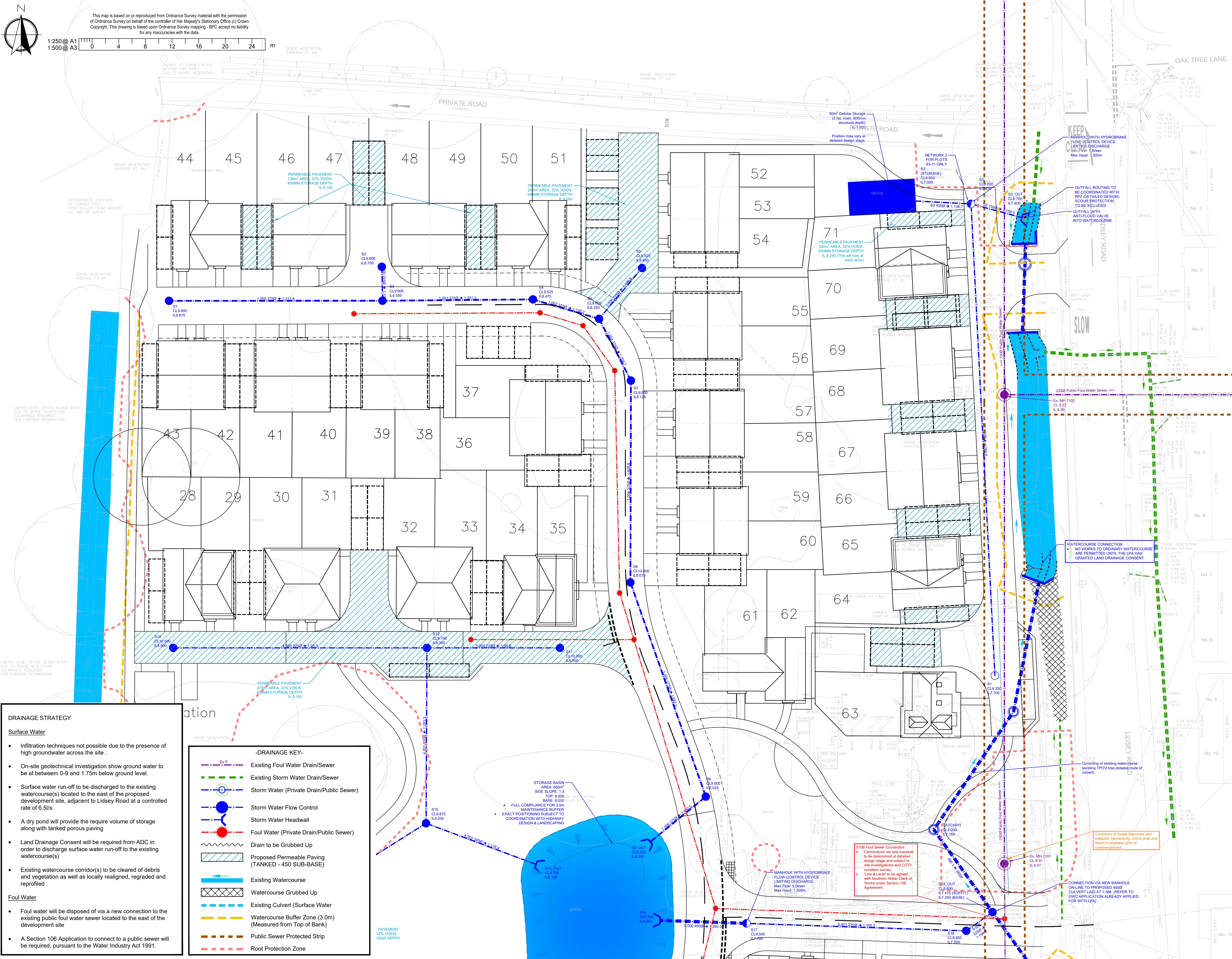
Drawing Status	PLANNING		
Client	Southern Housing Group Ltd		
Drawing Title	Proposed Impermeable Area		
Project	Land at Wings Nursery Lidsey Road		
Scale	1:1000	Date	Jan 2020
Drawn By	SPB	Checked By	MJA
Drawing No.	D1757-PL201		Rev.
		B	



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1:250 @ A1
1:500 @ A3

0 4 8 12 16 20 24 m



DRAINAGE STRATEGY

Surface Water

- Infiltration techniques not possible due to the presence of high groundwater across the site.
- On-site geotechnical investigation show ground water to be at between 0-9 and 1.75m below ground level.
- Surface water run-off to be discharged to the existing watercourse(s) located to the east of the proposed development site, adjacent to Lidsey Road at a controlled rate of 6.5l/s.
- A dry pond will provide the require volume of storage along with tanked porous paving
- Land Drainage Consent will be required from ADC in order to discharge surface water run-off to the existing watercourse(s)
- Existing watercourse corridor(s) to be cleared of debris and vegetation as well as locally realigned, reggraded and reprofiled

Foul Water

- Foul water will be disposed of via a new connection to the existing public foul water sewer located to the east of the development site
- A Section 106 Application to connect to a public sewer will be required, pursuant to the Water Industry Act 1991.

-DRAINAGE KEY-

- Ex F Existing Foul Water Drain/Sewer
- Existing Storm Water Drain/Sewer
- Storm Water (Private Drain/Public Sewer)
- Storm Water Flow Control
- Storm Water Headwall
- Foul Water (Private Drain/Public Sewer)
- Drain to be Grubbed Up
- Proposed Permeable Paving (TANKED - 450 SUB-BASE)
- Existing Watercourse
- Watercourse Grubbed Up
- Existing Culvert (Surface Water)
- Watercourse Buffer Zone (3.0m) (Measured from Top of Bank)
- Public Sewer Protected Strip
- Root Protection Zone

NOTES

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- Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

PRELIMINARY

SUBJECT TO:

- GEOTECHNICAL DATA
- SERVICES INVESTIGATION CONCLUSIONS
- CONSTRAINTS
- 3RD PARTY APPROVAL

ARCHITECT TO VERIFY SITE LAYOUT TO INFORM DESIGN

PRELIMINARY

"NOT FOR CONSTRUCTION"

B	Site layout updated.	12/05/2021
A	RPZ added. Plots 11-20 fence updated.	22/04/2021
	Original Issue	14/04/2021

Rev.	Amendments	Date

BRIGHT PLAN CIVILS

Transport Planning and Infrastructure Design Consultants

2 West Barn, Norton Lane, Chichester, West Sussex PO20 3AF
Tel: 01243 310418
www.bpcivils.co.uk

Drawing Status	PLANNING
Client	Thakeham Client Limited
Project	Land at Lidsey Road, Woodgate, West Sussex
Drawing Title	Preliminary Drainage Arrangement (1 of 2)
Scale	1:250
Date	Mar '2021
Drawn By	MJA
Checked By	MJA
Drawing No.	D1757-PL301
Rev.	B



LIMITED LEVEL DETAIL ALONG DITCH
DUE TO DENSE VEGETATION
CLEARANCE REQUIRED
FOR FURTHER INFORMATION

LIMITED LEVEL DETAIL ALONG DITCH
DUE TO DENSE VEGETATION
CLEARANCE REQUIRED
FOR FURTHER INFORMATION

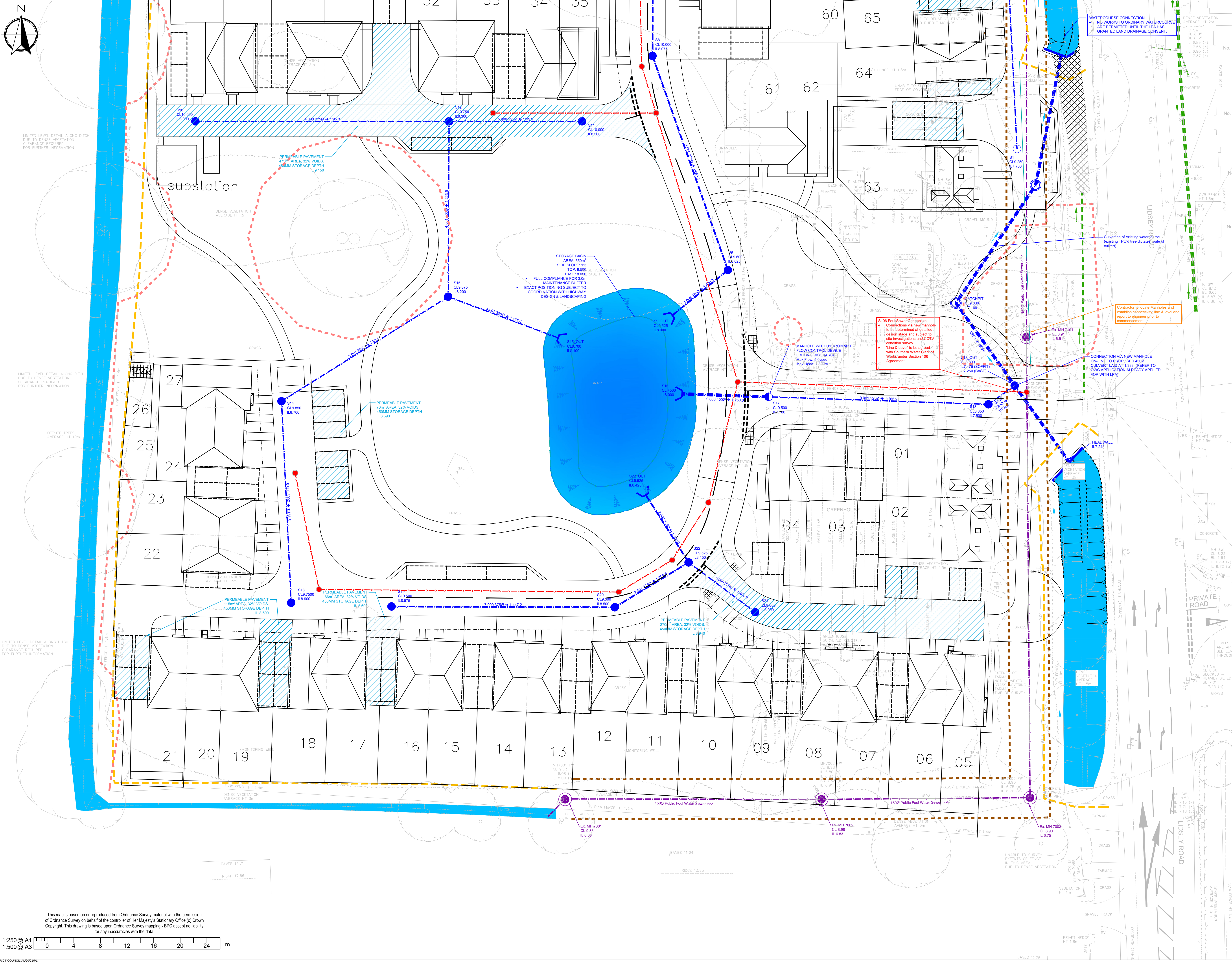
OFFSITE TREES
AVERAGE HT 10m

LIMITED LEVEL DETAIL ALONG DITCH
DUE TO DENSE VEGETATION
CLEARANCE REQUIRED
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1:250 @ A1
1:500 @ A3
0 4 8 12 16 20 24 m

ARUN DISTRICT COUNCIL 14/02/2021



NOTES

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WATERCOURSE CONNECTION
NO WORKS TO ORDINARY WATERCOURSE
ARE PERMITTED UNTIL THE LPA HAS
GRANTED LAND DRAINAGE CONSENT.

Contractor to locate Manholes and
establish connectivity, line & level and
report to engineer prior to
commencement.

S108 Foul Sewer Connection
Connections via new manhole
to be determined at detailed
design stage and subject to
site investigations and CCTV
condition survey.
Line & Level to be agreed
with Southern Water Clerk of
Works under Section 106
Agreement.

MANHOLE WITH HYDROBRAKE
FLOW CONTROL DEVICE
LIMITING DISCHARGE
Max Flow 5.0l/sec
Max Head 1.300m

CONNECTION VIA NEW MANHOLE
ONLINE TO PROPOSED 4500
CULVERT LAY AT 1.388 (REFER TO
OWC APPLICATION ALREADY APPLIED
FOR WITH LPA)

PRELIMINARY

SUBJECT TO:

- GEOTECHNICAL DATA
- SERVICES INVESTIGATION
CONCLUSIONS
- CONSTRAINTS
- 3RD PARTY APPROVAL

ARCHITECT TO VERIFY SITE
LAYOUT TO INFORM DESIGN

PRELIMINARY

"NOT FOR CONSTRUCTION"

B	Site layout updated.	12/05/2021
A	RFP added. Plots 11-20 fence updated.	22/04/2021
	Original Issue	14/04/2021

Rev.	Amendments	Date
------	------------	------



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Transport Planning and Infrastructure Design Consultants
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Tel: 01243 210418
www.bpcivils.co.uk

Drawing Status **PLANNING**

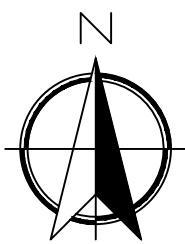
Client **Thakeham Client Limited**

Project **Land at Lidsey Road,
Woodgate, West Sussex**

Drawing Title **Preliminary Drainage
Arrangement (2 of 2)**

Scale	Date	Drawn By	Checked By
1:250	Mar '2021	MJA	MJA

Drawing No.	Rev.
D1757-PL302	B



NOTES

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PRELIMINARY

SUBJECT TO:

- GEOTECHNICAL DATA
- SERVICES INVESTIGATION CONCLUSIONS
- CONSTRAINTS
- 3RD PARTY APPROVAL

ARCHITECT TO VERIFY SITE LAYOUT TO INFORM DESIGN

PRELIMINARY

"NOT FOR CONSTRUCTION"

B	Site layout updated.	12/05/2021
A	RFP added. Plots 11-20 fence updated.	22/04/2021
	Original Issue	14/04/2021

Rev.	Amendments	Date
------	------------	------



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Drawing Status **PLANNING**

Client **Thakeham Client Limited**

Project **Land at Lidsey Road, Woodgate, West Sussex**

Drawing Title **Preliminary Floor Levels & Road Levels (1 of 2)**

Scale	Date	Drawn By	Checked By
1:250	Mar '2021	MJA	MJA

Drawing No. **D1757-PL303** Rev. **B**



LIMITED LEVEL DETAIL ALONG DITCH
DUE TO DENSE VEGETATION
CLEARANCE REQUIRED
FOR FURTHER INFORMATION

LIMITED LEVEL DETAIL ALONG DITCH
DUE TO DENSE VEGETATION
CLEARANCE REQUIRED
FOR FURTHER INFORMATION

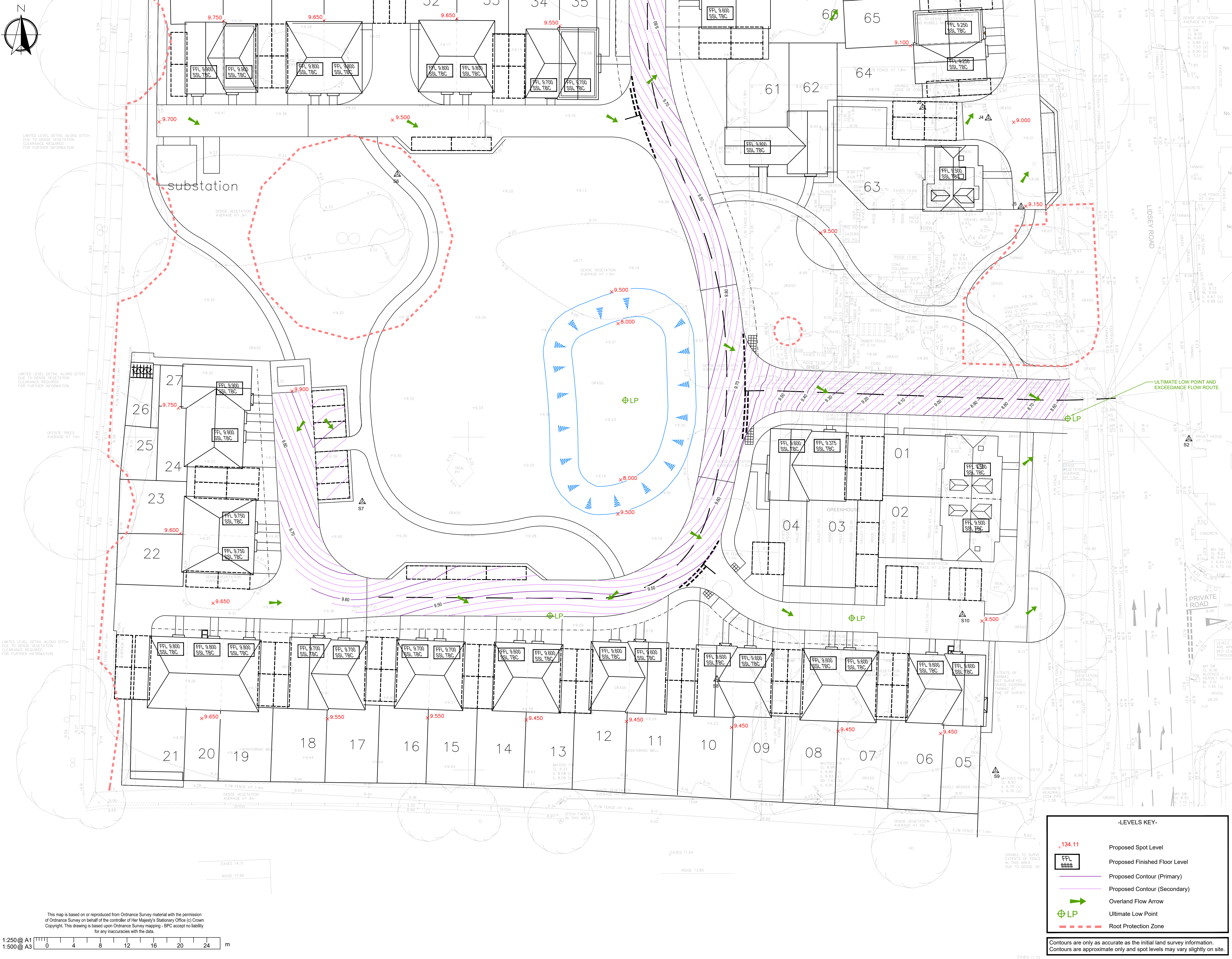
OFFSITE TREES
AVERAGE HT 10m

LIMITED LEVEL DETAIL ALONG DITCH
DUE TO DENSE VEGETATION
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1:250 @ A1
1:500 @ A3

ARUN DISTRICT COUNCIL 2022/PLC



NOTES

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PRELIMINARY

SUBJECT TO:

• GEOTECHNICAL DATA

• SERVICES INVESTIGATION

• CONCLUSIONS

• CONSTRAINTS

• 3RD PARTY APPROVAL

ARCHITECT TO VERIFY SITE LAYOUT TO INFORM DESIGN

PRELIMINARY

"NOT FOR CONSTRUCTION"

B Site layout updated.

A RFP added. Plots 11-20 fence updated.

Original Issue

12/05/2021

22/04/2021

14/04/2021

Rev.

Amendments

Date

BRIGHT PLAN CIVILS

Transport Planning and Infrastructure Design Consultants

2 West Barn, Norton Lane, Chichester, West Sussex PO20 3AF

tel: 01243 210418

www.bpcivils.co.uk

Drawing Status

PLANNING

Client

Thakeham Client Limited

Project

Land at Lidsey Road, Woodgate, West Sussex

Drawing Title

Preliminary Floor Levels & Road Levels (2 of 2)

Scale

1:250

Date

Mar '2021

Drawn By

MJA

Checked By

MJA

Drawing No.

D1757-PL304

Rev.

B

APPENDICES

Appendix A Architect's Development Proposals



Appendix B Geo-Environmental Ground Appraisal Report



Geo-Environmental

GROUND APPRAISAL REPORT

for the site at

LAND OFF LIDSEY ROAD, WOODGATE

WEST SUSSEX, PO20 3SU

on behalf of

THAKEHAM CLIENT LIMITED





Report:	GROUND APPRAISAL REPORT
Site:	LAND OFF LIDSEY ROAD, WOODGATE, WEST SUSSEX, PO20 3SU
Client:	THAKEHAM CLIENT LIMITED
Date:	10/10/2019
Reference:	GE18390-GAR-OCT-19
Version:	2.0
Prepared by:	 ANTHONY POTTER MSc, BSc (Hons), FGS SENIOR CONSULTING ENGINEER
Reviewed by:	 JONATHAN TINGLEY CEnv M.Sc. B.Eng. (Hons) F.G.S. MEnvSc. TECHNICAL DIRECTOR
Geo-Environmental Services Limited Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL +44(0)1273 832972 www.gesl.net	



EXECUTIVE SUMMARY		
	Site Address	Land At Lidsey Road, Woodgate, West Sussex, PO20 3SU
	Form of Development	Construction of residential properties with gardens, car parking, access road and associated infrastructure.
Encountered Conditions	Scope of works	An intrusive investigation to confirm the ground and groundwater conditions and support the development of geotechnical and geo-environmental assessments of the site in relation to the proposed development.
	Ground Conditions	The ground conditions comprised a limited thickness of Topsoil and Made Ground overlying River Terrace Deposits and the London Clay Formation.
	Groundwater	Groundwater was encountered at depths of between 1.85m and 3.00m bgl, during the fieldworks, with water standing at depths of between 1.20m and 2.50m bgl after twenty minutes. Groundwater monitoring wells were installed within WS1, WS2, WS3 and WS6 to depths of between 2.50m and 3.70m bgl. Two return monitoring visits have been made to date, with further visits to be undertaken throughout the winter period. To date, groundwater has been recorded at depths of between 0.91m and 1.75m bgl.
Geotechnical Considerations	Foundations	Based on the ground and groundwater conditions encountered in the boreholes conventional foundations are considered suitable for the proposed low rise development. Foundations should be taken below any Made Ground, soft, desiccated or disturbed ground and bear onto the firm to very stiff sandy silty gravelly clays or silty sands of the River Terrace Deposits. Based on the laboratory results, the more clayey parts of the River Terrace Deposits <i>en masse</i> should be considered Medium Volume Change Potential in accordance with the NHBC Standards, Chapter 4.2. A minimum founding depth within the River Terrace Deposits of 0.90m is therefore applicable remote from trees. Foundations should not be less than 450mm in width. Within the zone of moisture demand of any existing, proposed or recently felled trees it is recommended that foundation depths be calculated in accordance with the NHBC Standards, Chapter 4.2. Foundations should also be taken through any major root zone and desiccated clay soils should this be found at greater depth. Design measures will be required to prevent heave forces from developing on the faces of the foundations where footing depths are in excess of 1.5m on account of trees. It should be noted that the NHBC stipulate that foundations cast at depths greater than 2.5m should be “engineer designed”. Based on the typical settlement parameters for the types of soil encountered, a maximum net allowable bearing capacity of 125kPa is applicable for trench, strip or isolated pad foundations taken through any Made Ground, soft or loose zones, desiccated or disturbed soils and placed wholly into or onto the firm to very stiff sandy silty gravelly clays of the River Terrace Deposits. Under the above loading the settlements should remain within tolerable limits for the proposed scheme. It would be prudent to further consider the depth to the groundwater during the winter months as this could cause construction difficulties



		where intercepted within foundation or service trenches. The risk of intercepting the groundwater would be higher where foundations are required to be deepened on account of the presence of trees and careful design is required in this respect.
	Floor Slabs	Based on the laboratory testing results and the presence of trees and shrinkable soils, it is recommended that suspended ground floor slabs be adopted.
	Excavations	Shallow excavations within the Made Ground should remain relatively stable in the short term. Long deep excavations within the Made Ground are likely to be prone to instability, particularly where left open for prolonged periods, and should be battered back to a safe angle, or suitable shoring techniques should be adopted to provide stability. Shallow excavations within the River Terrace Deposits should remain relatively stable in the short term. Long, deep excavations within the River Terrace Deposits are likely to be prone to instability, particularly where left open for prolonged periods, or open to wet weather conditions and should be battered back to a safe angle, or suitable shoring techniques should be adopted to provide stability. Any excavations taken below the groundwater table is likely to be prone to collapse and running sand.
	Pavements	Where encountered. the Made Ground was noted to be of mixed composition and of limited thickness. The engineering characteristics of such soils are variable and unpredictable and the CBR value of Made Ground does not predict the overall settlements that may occur in such materials. Due to the heterogeneity of the variable amounts of Made Ground it would be prudent to assume the material to be deemed non-frost susceptible throughout. As part of the investigation, three bulk samples of the underlying River Terrace Deposits were taken from hand pits referenced TP DCP1, TP DCP4 and TP DCP6, with samples taken from depths of 0.50m bgl. The results of the laboratory remoulded (2.5kg rammer method) soaked CBR tests from gave results in the range of 1% and 9.5%. In addition, six dynamic cone penetrometer tests were undertaken across the site. The results between the depth of 300mm and 600mm bgl ranged between 5% and 22%. The Transport and Road Research Laboratory Report (LR1132) entitled '<i>The Structural Design of Bituminous Roads</i>' (1984) cites an estimated equilibrium suction index of 5% for the sandy silty gravelly clays such as those of the near surface River Terrace Deposits, under average construction conditions and a high groundwater level. An overall CBR value of 5% is recommended. Furthermore, based on the geotechnical results, the near surface River Terrace Deposits should be considered as being frost susceptible for pavement design purposes with abundant gravel noted within the sandy silty clays within the upper metre.



		It is recommended that the sub-grade be proof rolled and any soft spots removed and replaced with a suitable compacted granular fill.
	Drainage	The results indicate a relatively poor infiltration rate within the River Terrace Deposits, whilst groundwater was also noted to be shallow. Based on these findings, the design and construction of conventional soakaways may be viable, though the storage capacity will be severely restricted by the presence of the groundwater table.
	Buried Concrete	Seven pH and Sulphate tests were undertaken on the River Terrace Deposits. The results for the River Terrace Deposits corresponded to design class DS-1 as defined within the BRE Special Digest 1 (2005). The pH analyses indicate the ACEC class to be AC-1. It is recommended that a design class of DS-1 and an ACEC class of AC-1 be applied to all sub-surface concrete within this stratum.
Considerations	Human Health	All of the results indicated concentrations less than the Atkins ATRISK/C4SI screening values with the exception of Benzo(a)pyrene (TP1 0.10m 120mg/kg, TP2 0.10m 64mg/kg), Barium (TP2 0.10m 290mg/kg, WS7 0.20m 130mg/kg) and Beryllium (TP2 0.10m 2.40mg/kg). The Atkins ATRISK values for Benzo(a)pyrene are 4.95mg/kg, Barium 110mg/kg and 1.71mg/kg for Beryllium. The locations of TP1 and TP2 were within the area of the glasshouse, formerly used as a nursery. The location of WS7 was within the grounds of the residential property. Based on these initial findings, a cover system will be required within these areas. However, based on the limited sampling within these locations, it is recommended that further investigation in and around the garden nursery and residential property be undertaken. Those findings, along with these findings should be used to finalise a cover system for affected plots within those areas. As a preliminary guide it is likely that recommendations will be to strip the existing Made Ground from the proposed gardens and soft landscaping areas for the units located within the grounds of the house and glasshouse.
	Ground gas	Two ground gas monitoring visits have been undertaken to date to provide an initial assessment. No significant ground gas concentrations were noted and therefore no remedial works are required in this respect. A final assessment will be made upon completion of all monitoring visits.
	Built Environment	The current guidance on selection of materials for water supply pipes to be laid in contaminated land is contained in UK Water Industry Research's (UKWIR) report reference 10/WM/03/21 (re-issued 2010). However, the guidance is not mandatory and there have been concerns raised by various industry technical associations regarding the document and the methodologies proposed. Although there are concerns regarding the document, in lieu of any further guidance in the first instance the results of this investigation have been compared with the proposed thresholds published in UKWIR Table 3.1. The results of the relevant chemical analyses indicated elevated concentrations of SVOCs and TPH, barrier pipe is likely to be required on the area of the site currently occupied by the house and glasshouse, unless they are wholly placed in natural soils. It is recommended that the results of this investigation be presented to the water utility company as soon as reasonably practicable in order to

		confirm the pipe material.
	Waste Disposal	Initially, the results of the laboratory testing were submitted for Catwaste classification, the results Confirmed that the near surface soils did not have any properties that would deem the material hazardous waste for all but two samples. Samples TP1 0.10m and TP2 0.10m had hydrocarbon/oil with benzo(a)pyrene marker. Waste soils within this area require further analysis in the form of Waste Characterisation testing and Waste Acceptance Criteria testing to determine classification for off-site disposal.
Further Action: • A discovery strategy should be maintained during development such that any abnormal conditions (geotechnical or potential contamination) are identified and their potential impact on the proposed development assessed prior to determining any potential mitigation measures. • The results of this investigation be presented to the water utility company as soon as reasonably practicable in order to confirm the pipe material • Further investigation within the locations of the former garden nursery and residential property. • Further waste disposal classification comprising Waste Characterisation tests and Waste Acceptance Criteria testing.		

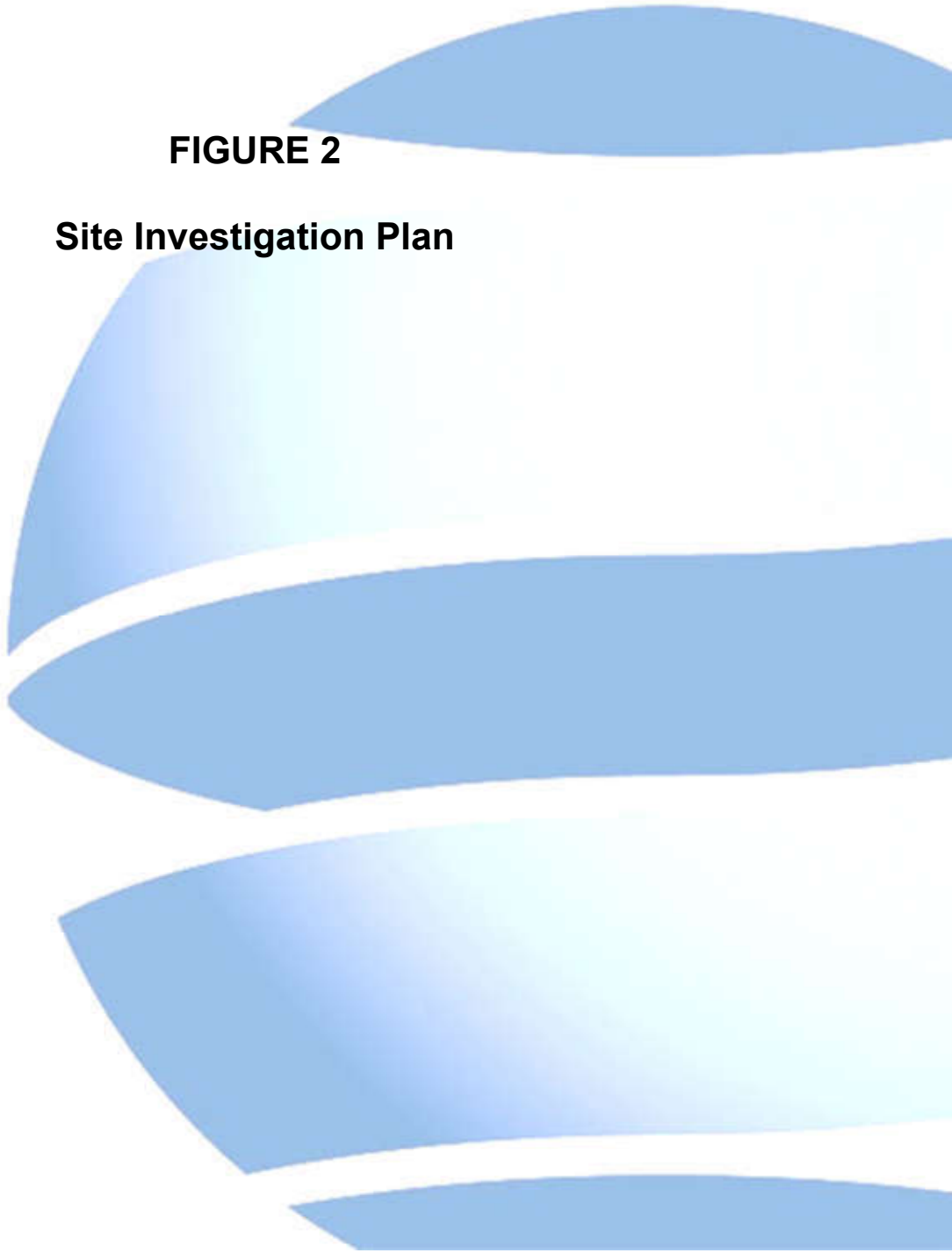
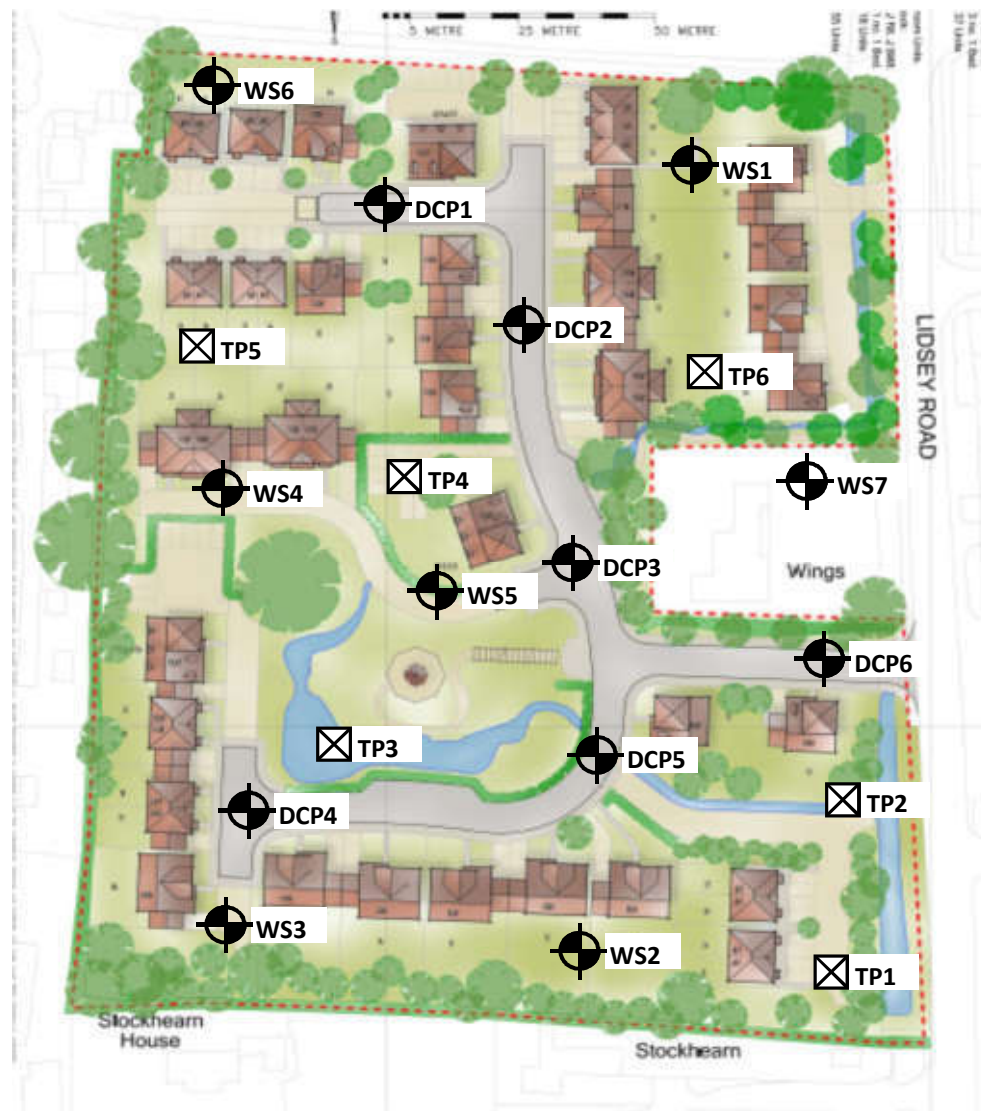


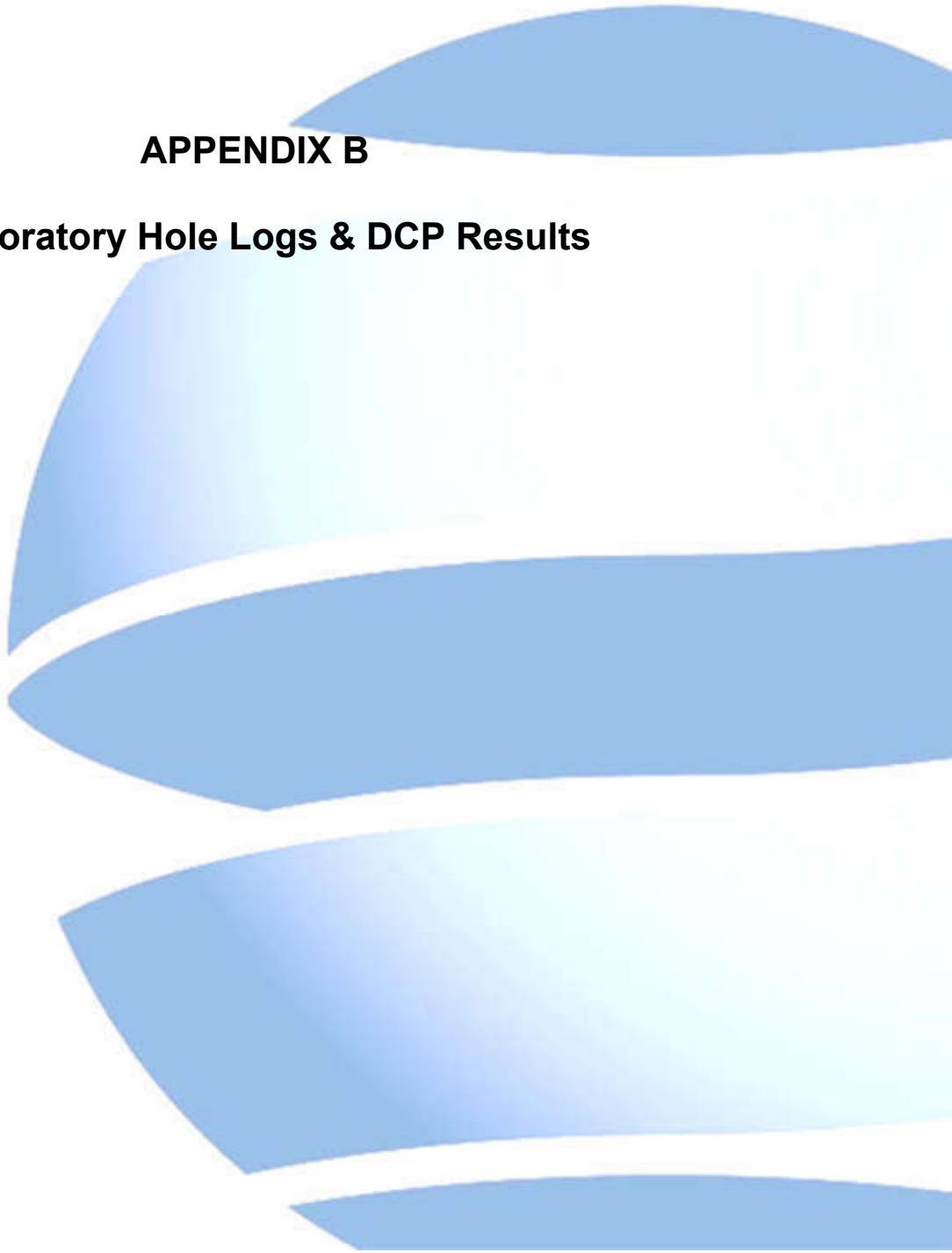
FIGURE 2

Site Investigation Plan



Project:	Land Off Lidsey Road, Woodgate			Title	Site Investigation Plan	
Client:	Thakeham Client Limited			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net	 Geo-Environmental	
Ref No:	GE18390	Revision:	v1			
Drawn:	AP	Date:	09/08/2019			
Figure:	2	Scale:	Not To Scale			





APPENDIX B

Exploratory Hole Logs & DCP Results

 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net				Trial Pit Log				TrialPit No TP1 Sheet 1 of 1	
Project Name: Land Off Lidsey Road, Woodgate				Project No. GE18390		Co-ords: 493775.63 - 104050.83 Level: 9.00		Date 19/08/2019	
Location: Woodgate, West Sussex						Dimensions (m):		Scale 1:25	
Client: Thakeham Client Limited						Depth 3.00		Logged GE	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	ES		0.25	8.75		Dark grey silty sand with ash, brick and concrete. MADE GROUND		
	0.50	D					Very stiff brown and orange brown mottled silty sandy CLAY. RIVER TERRACE DEPOSITS		
	0.50	PP	PP=4.5kg/cm2	0.60	8.40		Firm brown very sandy silty CLAY. RIVER TERRACE DEPOSITS		
	1.00	D					Orange brown and grey mottled very sandy silty CLAY. RIVER TERRACE DEPOSITS		
	1.00	PP	PP=2.5kg/cm2	1.30	7.70		Orange brown and grey mottled very sandy silty CLAY. RIVER TERRACE DEPOSITS		
	1.50	D					Orange brown silty fine to medium SAND. RIVER TERRACE DEPOSITS		
	1.50	PP	PP=2kg/cm2	1.80	7.20		Orange brown silty fine to medium SAND. RIVER TERRACE DEPOSITS		
	2.00	D					Orange brown silty fine to medium SAND. RIVER TERRACE DEPOSITS		
	2.50	D					Orange brown silty fine to medium SAND. RIVER TERRACE DEPOSITS		
	3.00			3.00	6.00		End of Pit at 3.00m		
Water Struck Depth Struck: 1.85 Rise to (m bgl): 0.00		Remarks: Groundwater encountered at 1.85m bgl, backfilled with arisings.							
		Stability							



 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net				Trial Pit Log				TrialPit No TP2 Sheet 1 of 1	
Project Name: Land Off Lidsey Road, Woodgate				Project No. GE18390		Co-ords: 493774.62 - 104078.16 Level: 8.99		Date 19/08/2019	
Location: Woodgate, West Sussex						Dimensions (m):		Scale 1:25	
Client: Thakeham Client Limited						Depth 2.00		Logged GE	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼	0.10	ES		0.25	8.74		Dark grey silty sand with ash, brick and concrete. MADE GROUND		
	0.50	D					Very stiff brown and orange brown mottled silty sandy CLAY. RIVER TERRACE DEPOSITS		
	0.50	PP	PP=5kg/cm2	0.60	8.39		Firm brown very sandy silty CLAY. RIVER TERRACE DEPOSITS		
	1.00	D					Orange brown and grey mottled very sandy silty CLAY with abundant fine chert gravel. RIVER TERRACE DEPOSITS		
	1.00	PP	PP=2kg/cm2	1.30	7.69		Orange brown silty fine to medium SAND. RIVER TERRACE DEPOSITS		
	1.50	D					Orange brown silty fine to medium SAND. RIVER TERRACE DEPOSITS		
	1.50	PP	PP=2.5kg/cm2	1.80	7.19				
	2.00	D		2.00	6.99		End of Pit at 2.00m		
Water Strains Depth Strike: 1.90 Rise to (m): 0.00		Remarks: Groundwater encountered at 1.90m bgl, backfilled with arisings.							
		Stability							



Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net				Trial Pit Log				TrialPit No TP3 Sheet 1 of 1	
Project Name: Land Off Lidsey Road, Woodgate				Project No. GE18390		Co-ords: 493698.54 - 104096.26 Level: 9.23		Date 19/08/2019	
Location: Woodgate, West Sussex						Dimensions (m):		Scale 1:25	
Client: Thakeham Client Limited						Depth 2.20		Logged GE	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	9.08		Grass overlying dark brown silty sand with rootlets. TOPSOIL	
	0.50 0.50	D PP	PP=5kg/cm2				Very stiff possibly desiccated very sandy silty CLAY. RIVER TERRACE DEPOSITS	
	1.00 1.00	D PP	PP=2.5kg/cm2	0.70	8.53		Firm to stiff orange brown and grey mottled sandy silty CLAY with occasional fine to coarse sub-angular chert gravel. RIVER TERRACE DEPOSITS	1
	1.50 1.50	D PP	PP=2.5kg/cm2					
	2.00	D		1.90	7.33		Orange brown silty fine to medium SAND. RIVER TERRACE DEPOSITS	2
				2.20	7.03		----- End of Pit at 2.20m	
								3
								4
								5

		Remarks Groundwater not encountered, backfilled with arisings. Stability
---	---	---



Geo-Environmental www.gesl.net

Trial Pit Log

TrialPit No
TP4
Sheet 1 of 1

Project Name: Land Off Lidsey Road, Woodgate

Project No.
GE18390

Co-ords: 493701.48 - 104146.65
Level: 9.21

Date
19/08/2019

Location: Woodgate, West Sussex

Dimensions

Scale
1:25

Client: Thakeham Client Limited

Depth
2.70

Logged
GE

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES	PP=2.5kg/cm2	0.15	9.06		Grass overlying dark brown silty sand with rootlets. TOPSOIL	1
	0.50	D					Firm to stiff orange brown very sandy CLAY with occasional fine to medium chert gravel. RIVER TERRACE DEPOSITS	
	1.00 1.00	D PP	PP=2kg/cm2	1.70	7.50		Orange brown silty fine to medium SAND. RIVER TERRACE DEPOSITS	2
	1.50 1.50	D PP						
	2.00	D	2.70	6.50		End of Pit at 2.70m	3	
	2.50	D						
4								
5								
Water Strikes								
Depth Strike	Water to (m bgl)	Remarks						
1.90	0.00	Groundwater encountered at 1.90m bgl, backfilled with arisings.						
		Stability						



Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net				Trial Pit Log				TrialPit No TP5 Sheet 1 of 1	
Project Name: Land Off Lidsey Road, Woodgate				Project No. GE18390		Co-ords: 493660.94 - 104174.25 Level: 9.09		Date 19/08/2019	
Location: Woodgate, West Sussex						Dimensions (m):		Scale 1:25	
Client: Thakeham Client Limited						Depth 2.00		Logged GE	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.20	8.89		Grass overlying dark brown silty sand with rootlets. TOPSOIL	1 2 3 4 5
	0.50 0.50	D PP	PP=5kg/cm2	0.70	8.39			
	1.00 1.00	D PP	PP=2.5kg/cm2	1.40	7.69	Firm to stiff orange brown and grey mottled slightly sandy silty CLAY. RIVER TERRACE DEPOSITS		
	1.50 1.50	D PP	PP=2.5kg/cm2	1.60	7.49	Firm orange brown and grey mottled CLAY with fine to medium sub-angular chert gravel. RIVER TERRACE DEPOSITS		
	2.00	D		2.00	7.09	Orange brown very silty damp fine to medium SAND. RIVER TERRACE DEPOSITS		
	End of Pit at 2.00m							

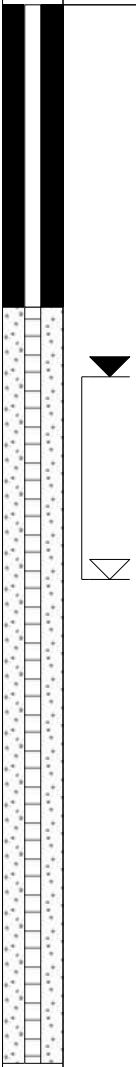
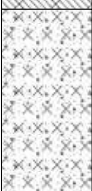
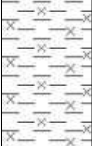
Water Strikes Depth Strike 1.90 Rise to (mbsgl) 1.95		Remarks Groundwater encountered at 1.90m bgl, standing at 1.95m bgl after sixty minutes. Backfilled with arisings.
		Stability

Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net				Trial Pit Log				TrialPit No TP6 Sheet 1 of 1	
Project Name: Land Off Lidsey Road, Woodgate				Project No. GE18390		Co-ords: 493749.45 - 104169.18 Level: 8.65		Date 19/08/2019	
Location: Woodgate, West Sussex						Dimensions (m):		Scale 1:25	
Client: Thakeham Client Limited						Depth 2.10		Logged GE	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.15	8.50		Grass overlying dark brown silty sand with rootlets and occasional chalk and shingle. TOPSOIL	1
	0.50	PP	PP=3.6kg/cm2				Firm to stiff orange brown silty sandy CLAY with abundant fine chert gravel, becoming fine to medium between 1.3m and 1.4m. RIVER TERRACE DEPOSITS	
	1.00	PP	PP=2.25kg/cm2				Orange brown silty fine to medium SAND. RIVER TERRACE DEPOSITS	2
				1.40	7.25			
				2.10	6.55	End of Pit at 2.10m		3
								4
								5

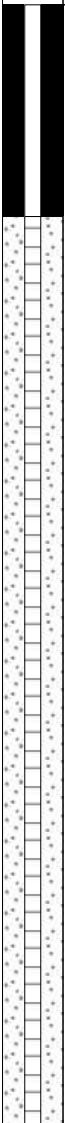
		Remarks: Groundwater encountered at 2.0m bgl, backfilled with arisings.
Depth Strike 2.00	Rose to (m bgl) 0.00	Stability

 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS1	
Project Name: Land Off Lidsey Road, Woodgate		Project No. GE18390		Co-ords: 493760E - 104218N		Sheet 1 of 1 Hole Type WLS	
Location: Woodgate, West Sussex				Level: 8.42		Scale 1:25	
Client: Thakeham Client Limited				Dates: 19/08/2019		Logged By AP	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.20	8.22		Grass overlying dark brown silty sand with rootlets TOPSOIL	
		0.50 0.50	D ES					Brown and grey mottled slightly sandy very clayey SILT with occasional rootlets and rare fine to coarse sub angular chert gravel RIVER TERRACE DEPOSITS	
		1.00 1.00	D PP	0.8kg/cm2	1.00	7.57 7.42		Soft orange brown and grey mottled silty CLAY with occasional fine to coarse sub angular chert gravel RIVER TERRACE DEPOSITS Orange brown mottled medium SAND RIVER TERRACE DEPOSITS	
		1.50	D						
		2.00	D						
		2.50	D		2.50	5.92			
		3.00	D						
		3.50 3.50	D PP	2.5kg/cm2	3.50	4.92		Stiff grey silty CLAY LONDON CLAY <i>...Collapsed to 3.5m on completion</i>	
		4.00 4.00	D PP	2.5kg/cm2	4.00	4.42		End of Borehole at 4.00m	

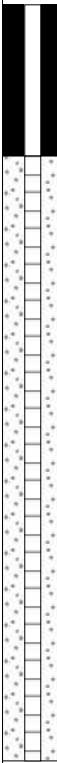
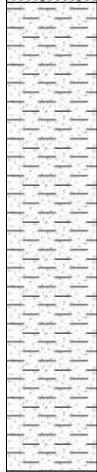
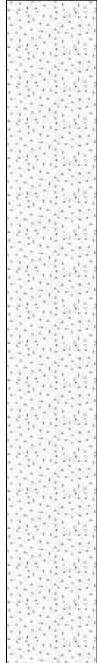
Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to		
		1.90	1.23			Groundwater encountered at 1.90m bgl, standing at 1.23m after twenty minutes. Standpipe installed to 3.50m bgl.	

 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS2	
Project Name: Land Off Lidsey Road, Woodgate		Project No. GE18390		Co-ords: 493724E - 104053N		Sheet 1 of 1 Hole Type WLS	
Location: Woodgate, West Sussex				Level: 9.25		Scale 1:25	
Client: Thakeham Client Limited				Dates: 19/08/2019		Logged By AP	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.30	8.95		Grass overlying brown silty sand with rootlets TOPSOIL	
		0.50	D		0.55	8.70		Light brown sandy SILT RIVER TERRACE DEPOSITS	
		0.50	ES						
		1.00	D						
		1.00	PP	2.0kg/cm2	1.30	7.95		Stiff orange brown and grey mottled sandy silty CLAY RIVER TERRACE DEPOSITS	
		1.50	D						
		1.50	PP	1.0kg/cm2					
		2.00	D		1.95	7.30		Firm brown sandy CLAY with abundant fine to coarse sub angular chert gravel RIVER TERRACE DEPOSITS	
		2.50	D						
		3.00	D						
	3.50	D							
	4.00	D		4.00	5.25			End of Borehole at 4.00m	

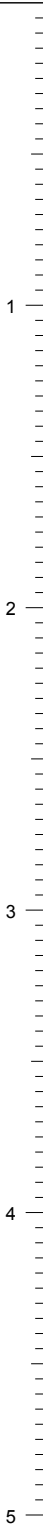
Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks Groundwater encountered at 3.00m bgl, standing at 1.20m bgl after twenty minutes. Standpipe installed to 3.70m bgl.	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to		
		3.00	1.20				

 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS3 Sheet 1 of 1	
Project Name: Land Off Lidsey Road, Woodgate		Project No. GE18390		Co-ords: 493666E - 104053N		Hole Type WLS	
Location: Woodgate, West Sussex				Level: 9.29		Scale 1:25	
Client: Thakeham Client Limited				Dates: 19/08/2019		Logged By AP	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.25	9.04		Grass overlying brown sandy silt TOPSOIL	
		0.50	D					Stiff orange brown and grey mottled sandy CLAY with rootlets RIVER TERRACE DEPOSITS	
		0.50	ES						
		0.50	PP	3.0kg/cm2					
		1.00	D					Brown SAND RIVER TERRACE DEPOSITS	
		1.00	PP	1.5kg/cm2					
		1.50	D						
		1.50	PP	2.0kg/cm2					
		2.00	D		1.80	7.49			
		2.50	D					...Collapsed to 2.5m on completion	
	3.00	D							
	3.50	D							
	4.00	D		4.00	5.29		End of Borehole at 4.00m	4	
								5	

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to		
		3.00	2.50			Groundwater encountered at 3.00m bgl, standing at 2.50m bgl after twenty minutes. Standpipe installed to 2.50m bgl.	

 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS4 Sheet 1 of 1	
Project Name: Land Off Lidsey Road, Woodgate		Project No. GE18390		Co-ords: 493661E - 104149N		Hole Type WLS	
Location: Woodgate, West Sussex				Level: 9.37		Scale 1:25	
Client: Thakeham Client Limited				Dates: 19/08/2019		Logged By AP	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.25	9.12		Grass overlying brown sandy silt with rootlets TOPSOIL	
		0.50 0.50	D ES		0.70	8.67		Brown clayey sandy silt with rootlets RIVER TERRACE DEPOSITS	
		1.00 1.00	D PP	4.5kg/cm2				Very stiff becoming stiff orange brown and grey mottled slightly sandy silty CLAY RIVER TERRACE DEPOSITS	
		1.50 1.50	D PP	2.7kg/cm2					
		2.00	D		1.80	7.57		Orange brown mottled SAND RIVER TERRACE DEPOSITS	
		2.50	D					...collapsed to 2.50m on completion	
		3.00	D						
		3.50	D						
		4.00	D		3.90 4.00	5.47 5.37		Orange brown sand with occasional fine to coarse chert gravel RIVER TERRACE DEPOSITS <i>End of Borehole at 4.00m</i>	4

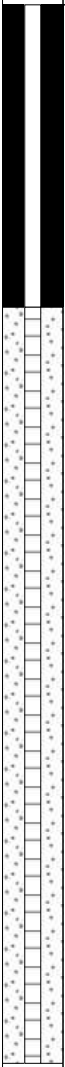
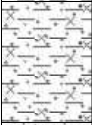
Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks Groundwater encountered at 3.00m bgl, standing at 2.50m bgl after twenty minutes. Backfilled with arisings.	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to		
		3.00	2.50				

 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS5	
Project Name: Land Off Lidsey Road, Woodgate		Project No. GE18390		Co-ords: 493711E - 104105N		Sheet 1 of 1 Hole Type WLS	
Location: Woodgate, West Sussex				Level: 9.17		Scale 1:25	
Client: Thakeham Client Limited				Dates: 19/08/2019		Logged By AP	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.20	ES		0.25	8.92		Brown sandy silt with rootlets TOPSOIL	1	
		0.50	D		0.50	8.67		Brown slightly clayey sandy SILT RIVER TERRACE DEPOSITS		
		0.50	ES					Very stiff orange brown mottled slightly silty sandy CLAY RIVER TERRACE DEPOSITS		
			1.00	D		1.20	7.97		Stiff brown sandy silty CLAY with rare chert gravel RIVER TERRACE DEPOSITS	2
		1.00	PP	3.0kg/cm2						
			1.50	D		1.70	7.47		Orange brown SAND RIVER TERRACE DEPOSITS	3
		1.50	PP	2.5kg/cm2						
			2.00	D						
			2.50	D						
			3.00	D						4
		3.50	D							
		4.00	D		4.00	5.17		End of Borehole at 4.00m	5	

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks Groundwater encountered at 3.00m bgl, standing at 2.30m bgl after twenty minutes. Backfilled with arisings.	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to		
		3.00	2.30				

 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS6 Sheet 1 of 1	
Project Name: Land Off Lidsey Road, Woodgate		Project No. GE18390		Co-ords: 493662E - 104219N		Hole Type WLS	
Location: Woodgate, West Sussex				Level: 9.16		Scale 1:25	
Client: Thakeham Client Limited				Dates: 19/08/2019		Logged By AP	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.20	ES	2.5kg/cm2	0.25	8.91		Grass overlying brown silty sand with rootlets and rare flint gravel TOPSOIL		
	0.50	D	1.0kg/cm2		1.10	8.06		Stiff becoming firm orange brown mottled silty sandy CLAY with rare rootlets RIVER TERRACE DEPOSITS		
	0.50	ES								
	0.50	PP								
			1.00	D	1.0kg/cm2	1.10	8.06			Firm brown silty CLAY with frequent to abundant fine to medium sub angular chert gravel RIVER TERRACE DEPOSITS
	1.00	PP								
			1.50	D	1.50	7.66		Brown medium SAND RIVER TERRACE DEPOSITS		
			2.00	D						
			2.50	D						
		3.00	D	3.00	7.66		Brown medium SAND RIVER TERRACE DEPOSITS			
		3.50	D							
		3.80	D							
		4.00	D	4.00	5.16		Brown SAND with frequent fine to coarse sub-angular chert gravel RIVER TERRACE DEPOSITS <i>End of Borehole at 4.00m</i>			

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to		
		2.00	1.70			Groundwater encountered at 2.00m bgl, standing at 1.70m bgl after twenty minutes. Standpipe installed to 3.50m bgl.	

 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. WS7 Sheet 1 of 1	
Project Name: Land Off Lidsey Road, Woodgate		Project No. GE18390		Co-ords: 493772E - 104149N		Hole Type WLS	
Location: Woodgate, West Sussex				Level: 8.86		Scale 1:25	
Client: Thakeham Client Limited				Dates: 19/08/2019		Logged By AP	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES				Dark brown reworked sandy silt MADE GROUND		
		0.50 0.50	D ES		0.40 0.45	8.46 8.41	Reworked chalk MADE GROUND		
		1.00 1.00	D PP	4.5kg/cm2			Very stiff becoming stiff brown possibly desiccated sandy CLAY with fine roots and rootlets RIVER TERRACE DEPOSITS	1	
		1.50 1.50	D PP	2.5kg/cm2	1.50	7.36	Brown SAND RIVER TERRACE DEPOSITS		
		2.00	D				...Collapsed to 2m on completion	2	
		2.50	D						
		3.00	D		2.92	5.94	Brown SAND with occasional fine to coarse sub angular chert gravel RIVER TERRACE DEPOSITS	3	
		3.50 3.50	D PP	1.8kg/cm2	3.50	5.36	Stiff grey silty CLAY LONDON CLAY		
		4.00 4.00	D PP	2.0kg/cm2	4.00	4.86	End of Borehole at 4.00m	4	
								5	

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to		
		2.00	2.00			Groundwater encountered at 2.00m bgl, standing at 2.00m bgl after twenty minutes. Backfilled with arisings.	

GE18390 Lidsey Road, Woodgate
Thakeham Client

Column1	Column2	Column3	Column4
Date	Position	Groundwater Depth (m)	Standpipe Depth (m)
29/08/2019	WS1	1.3	1.45
	WS2	DRY	2.21
	WS3	DRY	2.21
	WS6	DRY	1.72
01/10/2019	WS1	0.91	1.42
	WS2	1.75	2.21
	WS3	1.7	2.21
	WS6	1.22	1.7
14/10/2019	WS1	0.73	1.34
	WS2	1.52	2.21
	WS3	1.27	2.13
	WS6	0.9	1.7
28/10/2019	WS1	0.6	1.2
	WS2	1.24	2.15
	WS3	0.9	2.13
	WS6	0.85	1.7
20/11/2019	WS1	0.5	1.18
	WS2	1	2.1
	WS3	0.55	2.1
	WS6	0.71	1.7
25/11/2019	WS1	0.41	1.18
	WS2	0.91	2.07
	WS3	0.5	2.05
	WS6	0.54	1.66

Appendix C BGS Records

GEORGE STOW CO. LTD.

317

453

Waterworks Engineers

READING ROAD - HENLEY-on-THAMES, OXON.

RECORD OF WELL (SHAFT OR BOREHOLE)

Su 90/93

Borehole No. 9

DATE COMPLETED 1.5.78

All depths to be measured below Ground Level

Work carried out for Southern Water Authority, Sussex River & Water Division (Brighton)
 Locality (Exact Site) Woodgate, Nr. Chichester, Sussex - N.G.R. SU 40 SW (4283 0400)
 Level of Ground Surface above Sea Level (O.D.) 50 m.
 Depth of Shaft 156 (2' 10 1/2") m. Diameter 100 (3 1/2") mm.
 Depth of Bore 156 (2' 10 1/2") m. Diameter: At Top 100 mm. At Bottom 300 mm.

Details of Permanent Lining Tubes

Diameter	Length Inserted		Plain	Slotted	Top At	above Ground Level
	mm	m				
300	136.65	m	NIL		0.15	m
"	"	"	"	"	"	"
"	"	"	"	"	"	"
"	"	"	"	"	"	"
"	"	"	"	"	"	"
"	"	"	"	"	"	"

Water Struck at depth of (in m.) 5

Rest Level of Water below Ground Level 5.5 m.

Yield on 1 Hour test. Pumping litres per sec. Date

Pump Water level 1 m. below Ground Level.

Time of Recovery

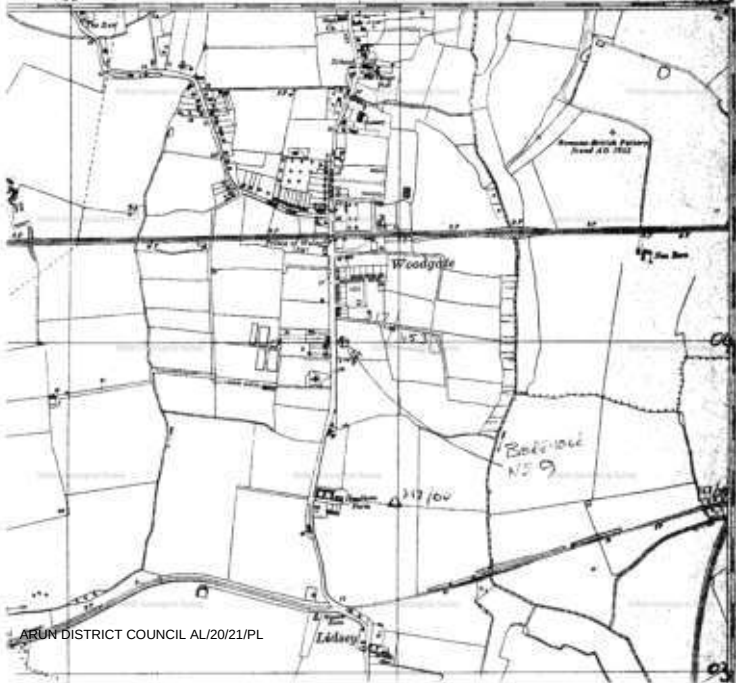
Remarks X Borehole drilled by mud flush Rotary therefore depth at which water struck not apparent. The borehole was developed by swabbing and jetting. No test pumping was carried out.

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA (and any additional remarks)	THICKNESS	DEPTH
		METRES	METRES
	Topsoil	0.50	0.50
DRIFT	Sandy brown clay	0.50	1.00
	C lay with stones	1.00	2.00
	Bed of gravel	1.00	3.00
	Sandy blue clay	9.00	12.00
LONDON CLAY	Blue clay with bands of hard stone	67.00	79.00
	Bed of blue coloured clay	5.00	84.00
	Very hard black stone with pyrites	0.50	84.50
	Blue clay with bands of stone	17.50	102.00
BEDDOCK BEDS	Sandy/green/brown clay	3.00	105.00
	Red mottled clay	9.00	114.00
	Dark blue mottled clay	2.00	116.00
	Red mottled clay	2.00	118.00
UPPER CHALK	Red clay with bands of blue/green shale	2.00	120.00
	Red/blue mottled clay	14.00	134.00
	Red clay mottled green and yellow	5.00	139.00
	Chalk and flints	20.00	159.00
END 9/18			(512 ft)

CHICHESTER CO CONST
ALDINGBOURNE FR

S4 90 SW.

S4 62 SW/E S490/93



Appendix D Southern Water Public Sewer Records

104429



SU9304SE

Title: 263390_Land at Wings Nursery,

N



Southern
Water

404400

Appendix E Arun District Council Correspondence

From: Paul Cann
Sent: 08 January 2020 15:24
To: Kevin Macknay; Stuart Burnett
Subject: RE: D1757 Lidsey Road, Woodgate PO20 3SU (Land at Wings Nursery)

Hi Stuart

Our records enclosed. It is very likely that improvements will be required to the adjacent ditches/culverts for which the landowner will have riparian responsibility.

Also enclosed is an historic map overlaying current OS. As a priority, the extent of existing ditches/culverts on and around the perimeter need to be fully identified – this includes checking the possibility of a culvert following the old boundary line that runs through the middle of the site. This could be critical to the development layout.

Infiltration will need to be fully investigated for surface water disposal.

The site is within the Lidsey sewerage treatment works catchment. See <https://www.arun.gov.uk/lidsey-foul-water> - a foul drainage statement will be required in terms of the intended scheme. Southern Water comments in this respect would also be advised.

Regards

Paul Cann
Principal Engineer (Drainage)

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

Arun is Working in Partnership with Chichester District Council

Visit Arun's web site at <http://www.arun.gov.uk/> and www.chichester.gov.uk

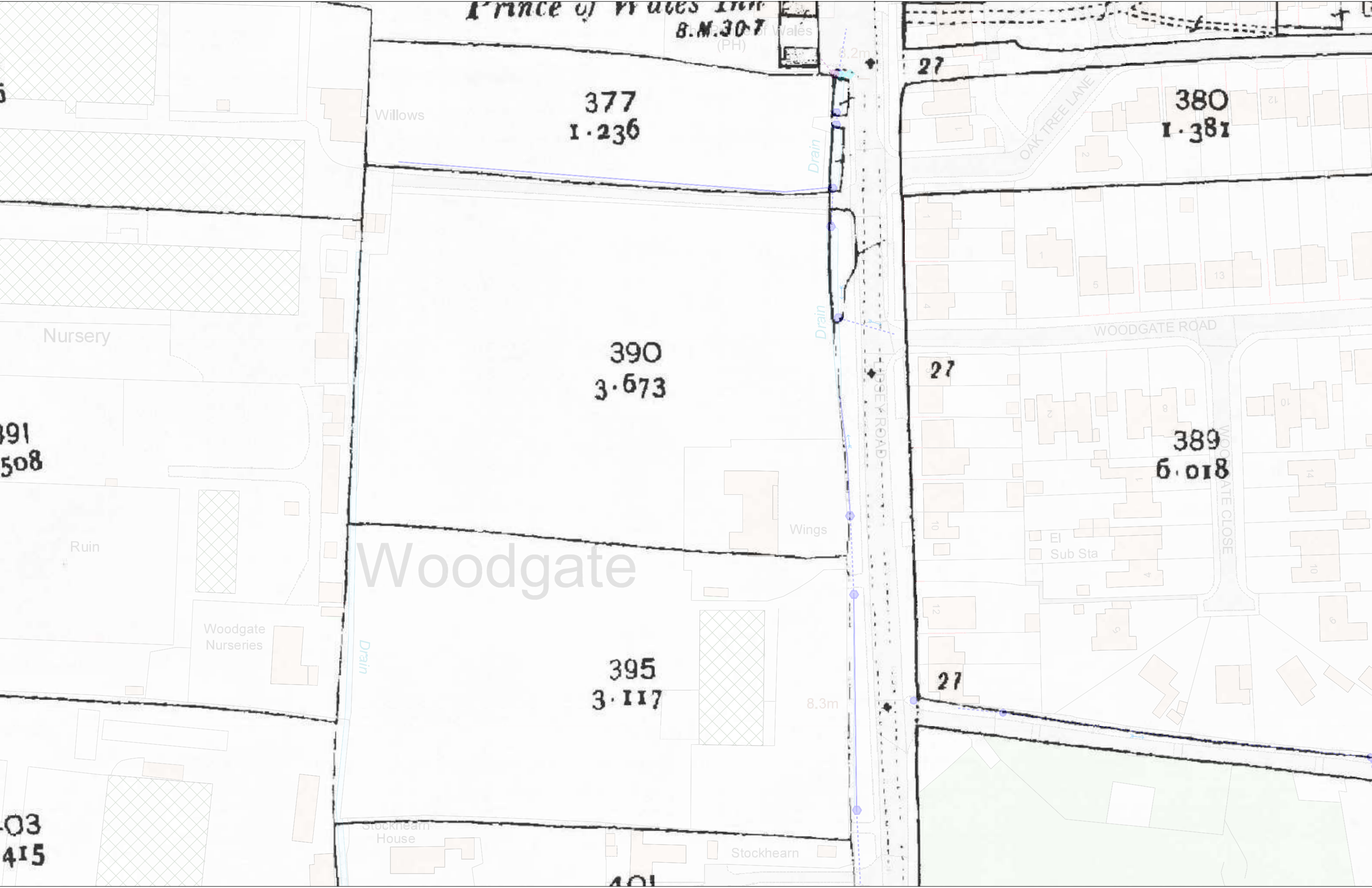


Save the environment - think before you print.

Arun District Council Maps



Arun District Council Maps



From: Kevin Macknay
Sent: 08 January 2020 13:07
To: Stuart Burnett
Cc: Paul Cann
Subject: RE: D1757 Lidsey Road, Woodgate PO20 3SU (Land at Wings Nursery)

Stuart,

Further to your recent enquiry. I could not find a copy of our response dating back to November 2017. So please see our response below.

Regards,

Kevin

Kevin Macknay
Flood Risk Management – Team Leader
Highways, Transport and Planning
Place Services
West Sussex County Council

 **CALL**  **IM**  **EMAIL**

Location: Western Area Office, Drayton Lane, Nr. Chichester, West Sussex. PO20 2AJ.

[Report a problem with a road or pavement](#) or [raise a highways related enquiry](#)

Follow us at  [@WSHighways](#)

From: Stuart Burnett
Sent: 08 January 2020 09:34
To: Paul Cann; Kevin Macknay
Subject: D1757 Lidsey Road, Woodgate PO20 3SU (Land at Wings Nursery)

Good morning Paul/Kevin,

Happy New Year to you both, I hope you both managed to catch a break over the festive period (where did that go!?)

Apologies for the email this morning, we have been appointed to prepare a FRA and Drainage Strategy in relation the above site (location plan attached).

We prepared a report for the same site back in November 2017, however the site has now been sold (I believe) and the proposals have been re-development. Previously, the proposals consisted of up to 55 No. residential units, where as the new scheme consists of up to 75 dwellings.

Please could you review our standard checklist, below, and provide me with any fresh information that you may have in relation to the site;

Flood Zones

- Please confirm the Flood Zones for this area.
The area is shown to be within Flood Zone 1 on the current EA Flood Zone mapping.
- Please confirm surface water, reservoir flooding, sewer flooding. Please provide plans and depth data from your GIS UFMSW for 30yr, 100yr & 1000yr as applicable (OS Datum).
The area of interest is shown to be at low risk of surface water flood, based on the current FMfSW. See attached plan.

- Please confirm mapping and records for any surface water assets owned or maintained.
See attached plans showing existing WSCC road gullies and highway manholes.
- Please confirm if there are any future drainage improvements proposed for this area.
None that we are aware of. However, the BEW (Barnham, Eastergate, Westergate) development to the east of Lidsey Road will affect the local drainage systems to the east.
- Please confirm details of existing or planned flood alleviation and defences in this area.
None that we are aware of. However, the BEW (Barnham, Eastergate, Westergate) development to the east of Lidsey Road will affect the local drainage systems to the east.
- Please confirm if you are aware of any historic flooding within the confines of the site.
None that we are aware of.
- Please confirm if you are aware of any historic flooding in close vicinity and/or on the public highway.
We are aware of historic flooding at the junction of Oak Tree Lane / Lidsey Road, affecting No. 1 and 2, Lidsey Road. This is due to surface water run-off from Lidsey Road not draining away once it flows on to the existing grass verge.

Groundwater

- Please confirm details of any groundwater flooding issues in the area, including flood levels, flood extents and any available anecdotal information.
The area is shown to be at 'moderate' risk of ground water flooding on the current JBA mapping i.e. groundwater levels can reach between 0.025m and 0.5m below the ground surface. We know that ground water flooding is an issue north of the railway, but we have no record of issues to the south.

Assets

- Please confirm mapping and records for any surface water assets owned or maintained.
See attached plans showing existing WSCC road gullies and highway manholes.
- Please confirm if there are any historic culverted watercourses within or in close vicinity to the site. Please provide map records where available.
The site has existing ditches along the east and west site boundaries. It is important that these ditches are retained during and after the construction. It would appear, based on historic OS mapping that many of the historic field boundaries were once ditches which drained to the west.
- Please can you provide any map records denoting the highway drainage network. Is this a piped system or soakaways?
See attached plans showing existing WSCC road gullies and highway manholes.

Policy/Future

- Please confirm the most recent Strategic Flood Risk Assessment (SFRA).
WSCC – June 2010.
- Please confirm if there are any future drainage improvements proposed for this area.
None that we are aware of. However, the BEW (Barnham, Eastergate, Westergate) development to the east of Lidsey Road will affect the local drainage systems to the east.
- Please confirm if any drainage studies and/or SWMP have/are being assess for this area.
The Lidsey SWMP covers your area of interest.
https://www.westsussex.gov.uk/media/4734/lidsey_swmp.pdf

Paul, from memory, I believe the site falls within the Lidsey Foul Water Treatment Catchment Area. Any specific information or requirements which may or may not have changed since our last report was produced would be gratefully received if you could point me in the right direction.

Thank you in advance to you both for your help with this matter, I look forward to hearing from you in due course. As always, should you have any questions at all, please feel free to let me know – happy to help where I can.

Kind regards

Stuart Burnett
Engineer



Bright Plan Civils, Transport Planning and Civil Engineering Consultants

Bright Plan Civils, 2 West Barn, Norton Lane, Chichester, PO20 3AF

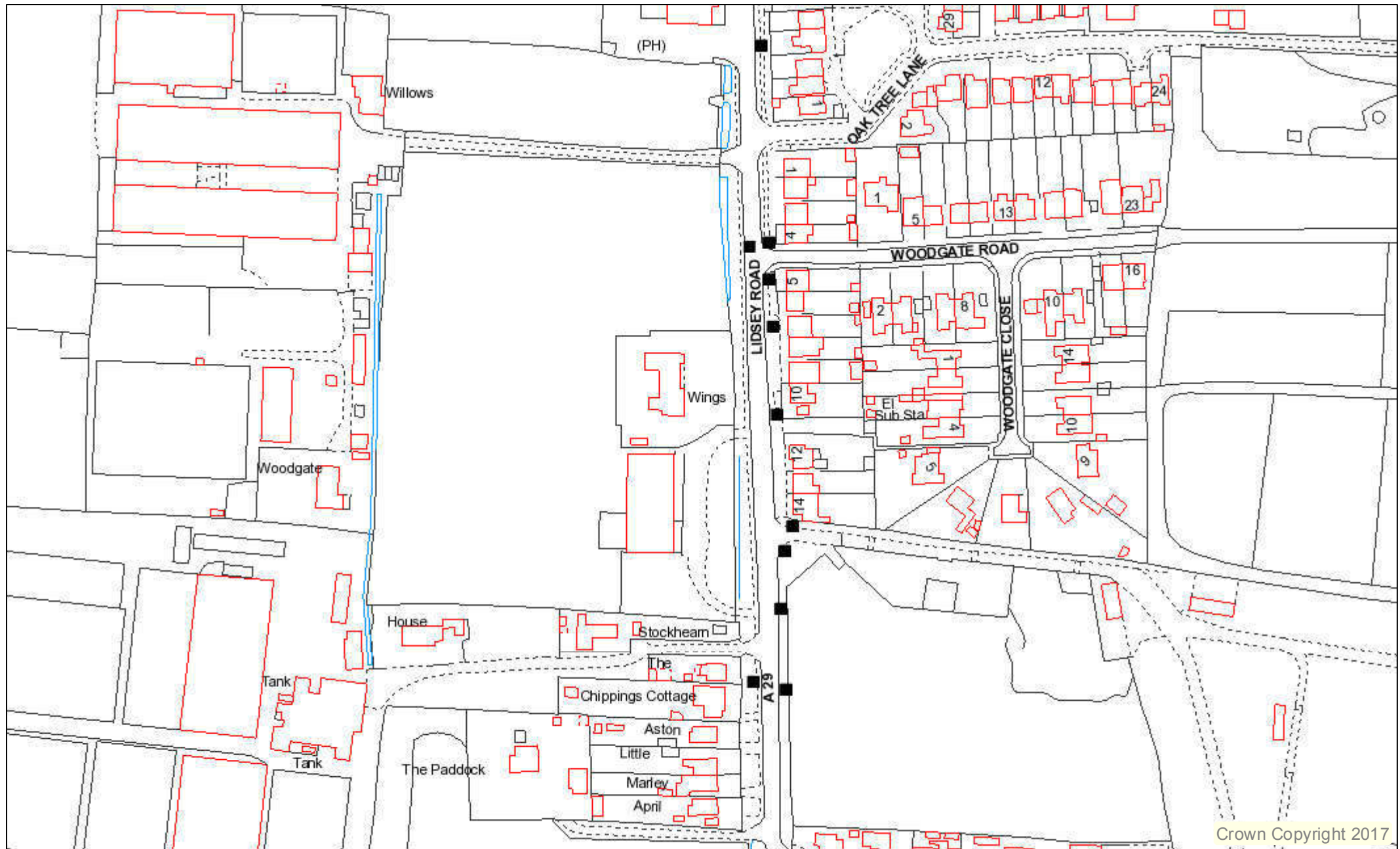
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Appendix F West Sussex County Council Correspondence

A29 Lidsey Road, Woodgate - Existing Highway Manholes



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Date: January 2020

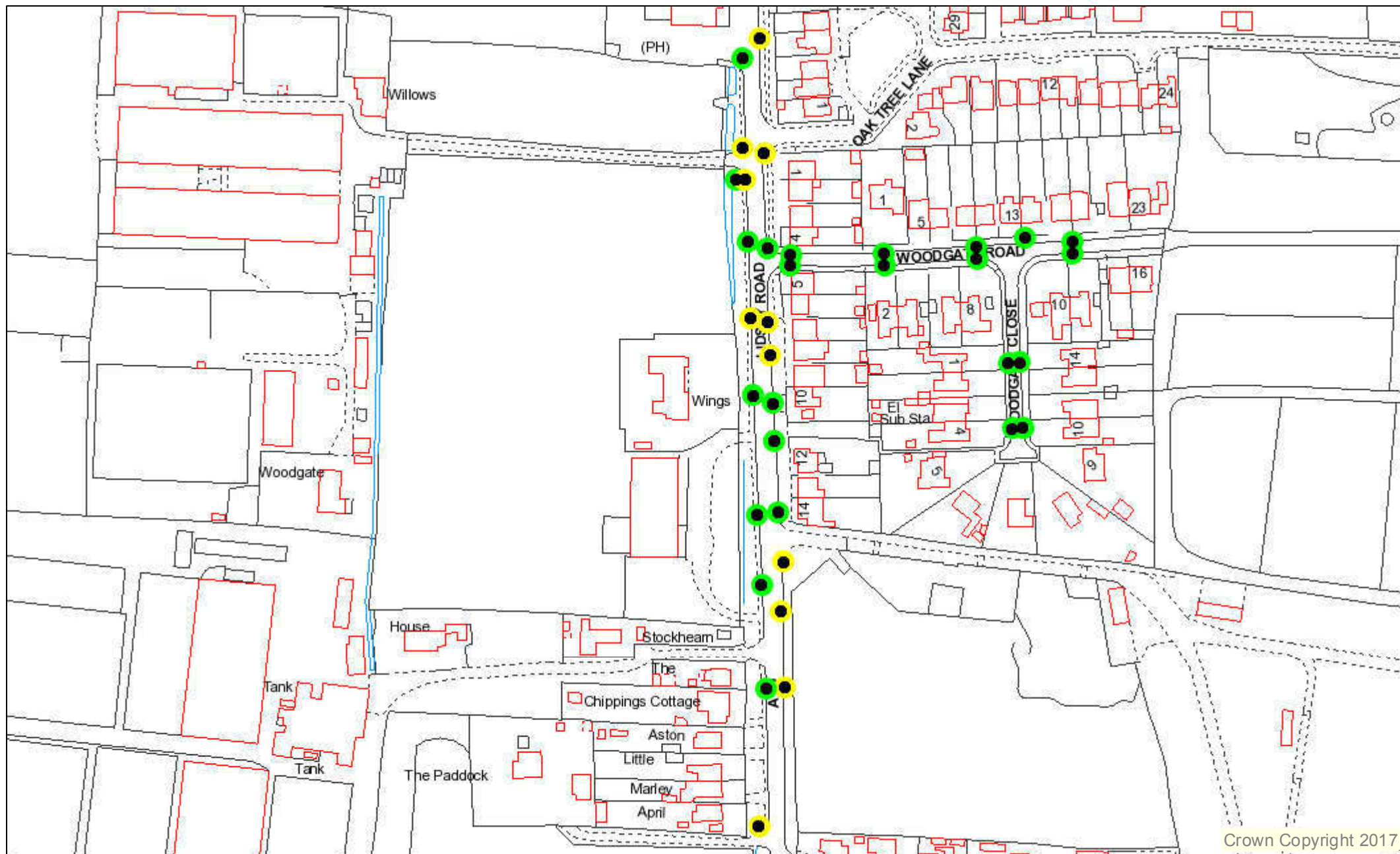
Author: K Macknay

Scale 1:2,000

Map Notes:

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West Sussex County Council
100023447 (2017)

A29 Lidsey Road, Woodgate - Existing Highway Gullies



Date: January 2020

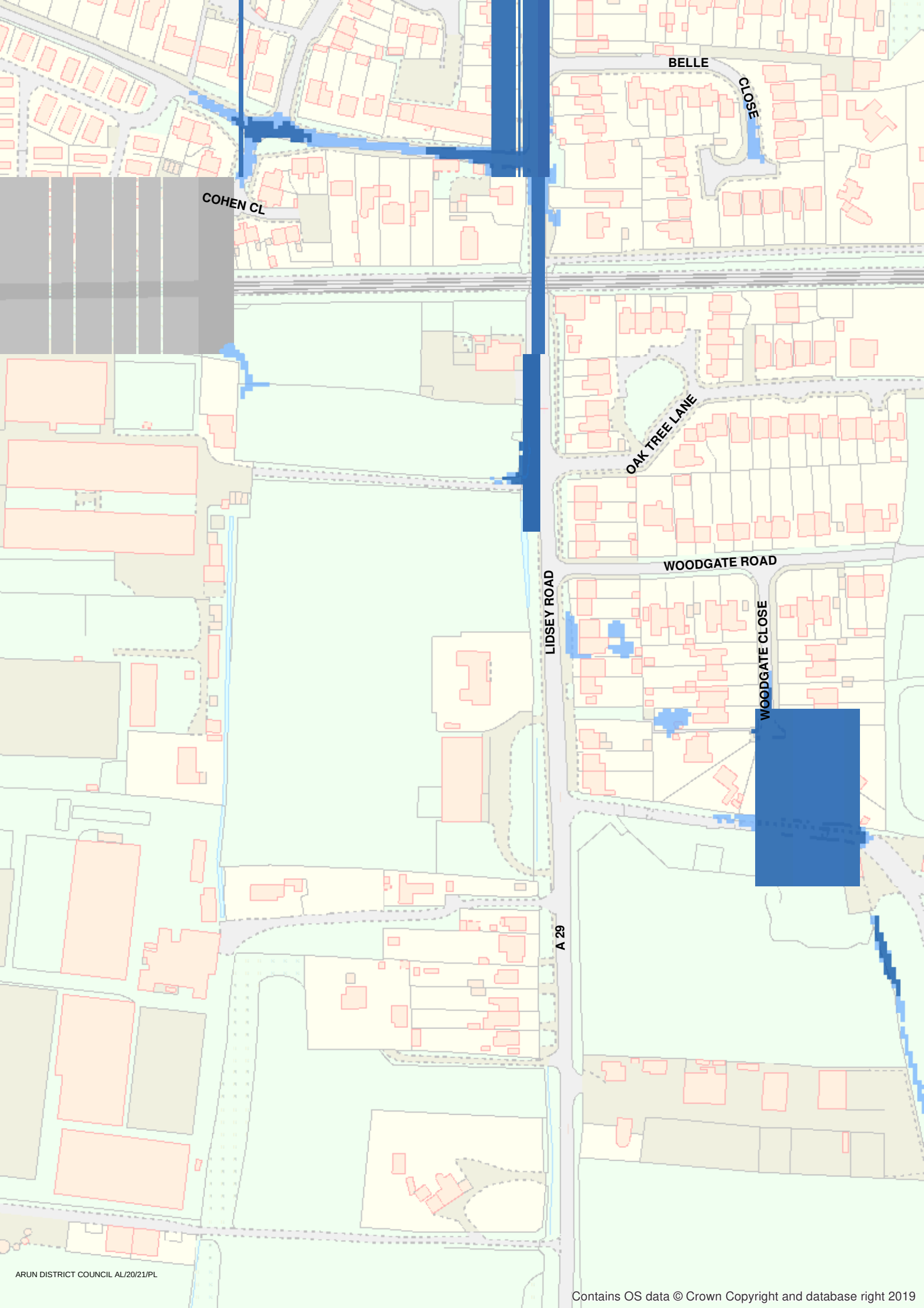
Author: K Macknay

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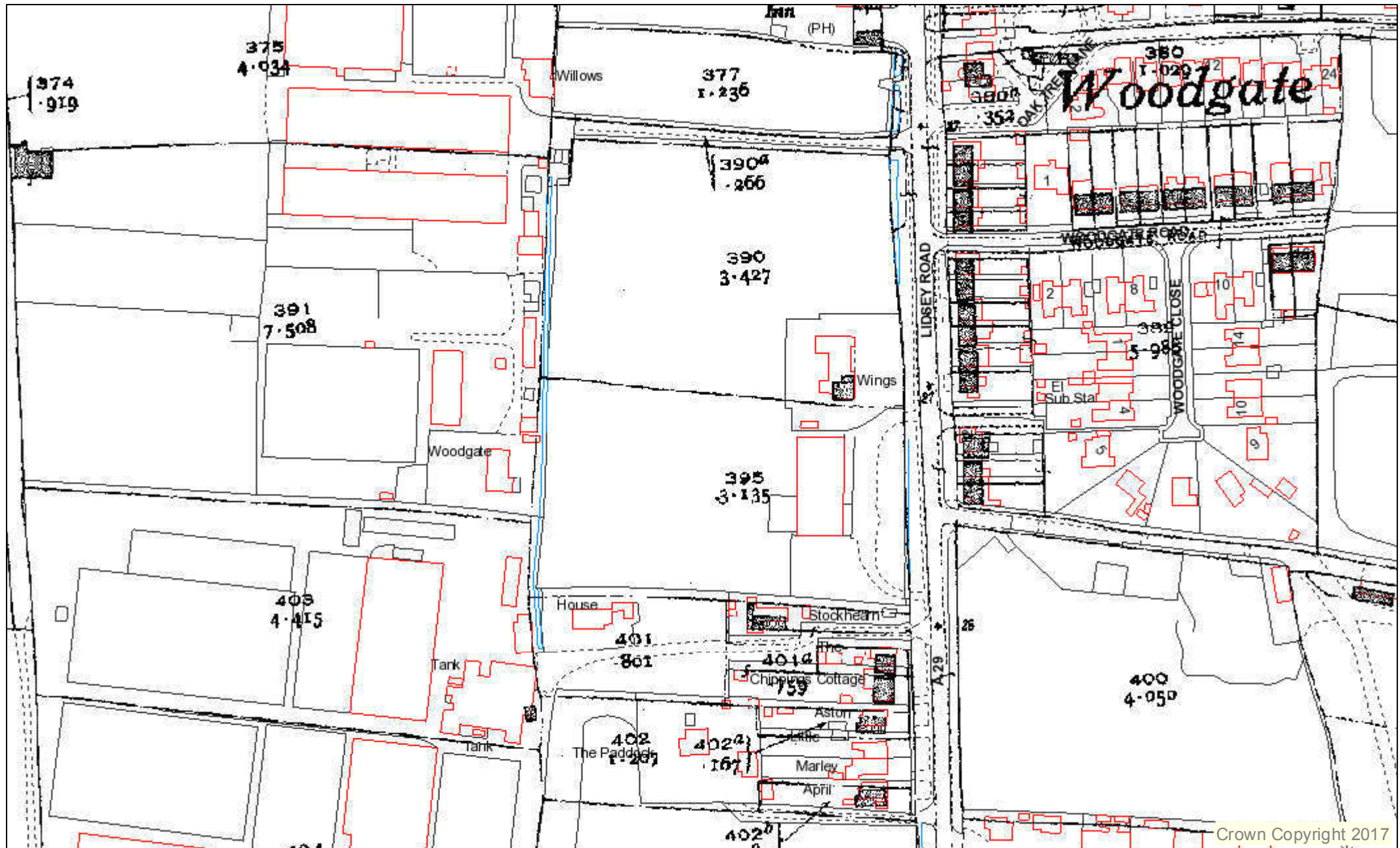
Map Notes:

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West Sussex County Council
100023447 (2017)



A29 Lidsey Road, Woodgate - Historic OS Mapping 1930's



Date: January 2020

Author: K Macknay

Scale 1:2,000

Map Notes:

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West Sussex County Council
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Appendix G Lidsey Surface Water Management Plan

Lidsey Surface Water Management Plan

West Sussex County Council

ATKINS

A Partnership between:

- West Sussex County Council
- Southern Water
- Arun District Council
- Environment Agency



Summary

Opportunity Area Reference	Lidsey Road & Oak Tree Lane
Local Flood Risk Zone	LFRZ_018
Properties at Risk (1 in 100 Year)	10
Average Annual Damages	£6,861
Preferred Intervention	Asset Management. Reduce surface water and infiltration entering public foul sewers. Improve surface water conveyance.
Present Value Damage Avoided (Assuming a 1 in 30 year level of protection scheme is identified and implemented)	£2,406
Key Stakeholders	WSCC, ADC, SWS

Flood History	Pluvial flooding experienced during the summer 2012 storm along Lidsey Road - otherwise flooding has not occurred here in recent history. Hydraulic overload of sewers reported in Oak Tree Lane on 02/01/2013 and on Westergate Street on 29/01/2013 and 09/11/2010.
Constraints	Limited detail on surface water drainage records in this area.
Receptors	Property and Highway
Opportunities	Asset Management. Reduce surface water and infiltration entering public foul sewers. Improve surface water conveyance.

Overview of Key Flood Risk Sources, Mechanisms, and Pathways

Property flooding caused by pluvial runoff from highway. Flooding from foul manholes in highway due to hydraulic overload.

Flood Risk Damage Estimates

Rainfall Return Period	Number of Properties at Risk		Average Annual Damages
	Residential	Commercial	
1 in 30 Year	8	0	£6,861
1 in 100 Year	10	0	
1 in 100 Year + CC (2080's)	16	1	

Shortlisting of Interventions

					Scoring (-2 to +2)						
					Options Assessment						
Option Ref.	Option Category (Source / Pathway / Receptor / Other)	Option	Potential	Considered	Economic	Environmental	Objectiveness	Social	Technical	Total Score	
1	Do Nothing	Do Nothing	No	No	0	0	0	0	0	0	
2	Do minimum	Do minimum - continue current maintenance	Yes	Yes	2	2	0	2	1	7	
3	Source	Green Roof	No	No	0	0	0	0	0	0	
4	Source	Detention Basins (Attenuation / Retention)	No	No	0	0	0	0	0	0	
5	Source	Permeable Paving	No	No	0	0	0	0	0	0	
6	Source	Ponds and Wetlands	No	No	0	0	0	0	0	0	
7	Source	Rainwater Harvesting	Yes	Yes	2	2	1	2	2	9	Installation of water butts in upstream catchment.
8	Source	Soakaways	No	No	0	0	0	0	0	0	
9	Source	Swales	No	No	0	0	0	0	0	0	
10	Source	Bioretention Basins	No	No	0	0	0	0	0	0	
11	Source	Bioretention Street Planting	No	No	0	0	0	0	0	0	
12	Source	Sealing of manhole covers and protecting gullies	Yes	Yes	1	2	2	2	1	8	Reduce surface water inflow.
13	Source	Sealing Sewers (Reduce ground water / rainfall induced infiltration)	Yes	Yes	1	2	2	2	0	7	Reduce ground water inflows.
14	Source	Other Source Measures	No	No	0	0	0	0	0	0	
15	Pathway	Increasing Capacity in Drainage System (Storage,Upsize)	Yes	Yes	0	0	2	0	2	4	Investigate conveying surface water away from properties. This should be completed after survey of existing drainage assets.
16	Pathway	Deculverting Watercourse(s)	No	No	0	0	0	0	0	0	
17	Pathway	Improved maintenance regimes	Yes	Yes	-2	0	2	0	2	2	optimisation of existing assets. WSCC and ADC are planning to clear the ditch on the west side of Lidsey Road
18	Pathway	Increase Gully Assets	Yes	Yes	0	0	2	1	2	5	This should be investigated to remove highway flooding.
19	Pathway	Land management practices	No	No	0	0	0	0	0	0	
20	Pathway	Managing overland flows (above ground storage)	Yes	No	0	0	0	0	0	0	
21	Pathway	Managing overland flows (preferential flow paths during exceedance)	Yes	No	0	0	0	0	0	0	
22	Pathway	Seperation of foul and surfacewater	Yes	Yes	0	2	2	0	0	4	Control at source see activities 12 & 13
23	Receptor	Improve Weather Warning	No	No	0	0	0	0	0	0	
24	Receptor	Improve resilience to flooding	Yes	Yes	2	2	2	2	1	9	To be considered in a hydraulic investigation
25	Receptor	Social change, education and awareness	No	No	0	0	0	0	0	0	
26	Receptor	Raising doorway / access threshold	Yes	Yes	2	2	2	2	1	9	To be considered in a hydraulic investigation
27	Receptor	Planning policies to influence development (Development Control, SUDS Strategy, Blue Development Corridors, New Development).	Yes	No	0	0	0	0	0	0	
28	Receptor	Temporary demountable flood defences	Yes	Yes	1	0	2	0	2	5	Potentially applicable.
29	Strategy	Further Study / Investigations	Yes	Yes	1	1	1	1	1	5	Detailed hydraulic investigation is required. As detaile din Option 15.
30	Strategy	Survey, Advise & Monitoring	No	No	0	0	0	0	0	0	
31	Strategy	Community Awareness	No	No	0	0	0	0	0	0	

Key Stakeholders

Provisionally Identified
ADC / WSCC (Action 1) SWS (Action 2), ADC (Action 3), SWS WSCC (Action 4)

Actions

As Agreed by Partner Organisations	
1	Survey private road existing highway drainage and confirm condition and arrangements. Implement clearance of the ditch on the west side of Lidsey Road and investigate capacity downstream of the highway ditch
2	Area to be considered as part of the DSF study.
3	Consider use of flood mitigation to protect properties from pluvial flooding from highway based on outputs from the DSF study
4	Investigate and prioritise interventions to reduce clear water inflow and Infiltration of public foul sewers. Work with Local Authority to target resilience improvements.
5	

LFRZ_0018 - Oak Tree Lane, Woodgate

Figure 7.37 - Flood Risk LFRZ_018 (1 in 100 year storm event)



Figure 7.38 - Flood Hazard LFRZ_018 (1 in 100 year storm event)



Table 7-36 - Predicted Residential and Commercial Property Flood Impact LFRZ_018

Rainfall Return Period	Predicted number of properties at risk of flooding	
	Residential	Commercial
1 in 30 Year	8	0
1 in 100 Year	10	0
1 in 100 Year + (Climate Change (2080's))	16	1

Table 7-37 - Summary of local flood risk within the LFRZ_018

Flood Risk Source			
Pluvial Flood Risk	Fluvial Flood Risk	Ground Water Flood Risk	Public Sewer Flood Risk
Medium	Low	Low	High
Flood Mechanism			
Property flooding caused by pluvial runoff from highway. Flooding from foul manholes in highway due to hydraulic overload.			
Flood Risk Receptors			
Residential, commercial properties and highway.			
Flood Hazard			
A 'low' flood hazard is predicted for 1% annual chance storm event (1 in 100 year return period) of Burndell Road			
Validation			
Pluvial flooding experienced during the summer 2012 storm along Lidsey Road - otherwise flooding has not occurred here in recent history. Hydraulic overload of sewers reported in Oak Tree Lane on 02/01/2013 and on Westergate Street on 29/01/2013 and 09/11/2010.			

Table 0-1 - LFRZ Average Annual Damages

Local Flood Risk Zone	Location Name	Average Annual Damages (£)	Assuming a flood relief scheme was implemented providing 1 in 30 year level of flood protection	
			Predicted Residual Annual Average Damages (£)	Annual Average Damages Avoided (£)
LFRZ_006	Lake Lane, Barnham	£277,702	£76,471	£201,231
LFRZ_017	Felpham Road, Felpham	£74,582	£22,367	£52,215
LFRZ_013	Elmer Sands, Middleton on Sea	£70,270	£18,790	£51,481
LFRZ_019	Wandleys Lane, Eastergate	£42,018	£10,454	£31,564
LFRZ_023	Rudwicks Close, Broomcroft Road, The Loop, Jacken Close, Bramfield Road, Leverton Avenue, Limmer Lane (east end), Burley Road and Dryad Way in Felpham	£40,048	£17,538	£22,510
LFRZ_025	Limmer Lane, Felpham	£39,629	£13,084	£26,545
LFRZ_003	Walberton Village (Barnham Lane (A))	£36,918	£10,881	£26,037
LFRZ_002	Elm Grove, Barnham	£31,363	£11,984	£19,379
LFRZ_026	Eastergate Lane, Eastergate	£27,116	£15,545	£11,572
LFRZ_024	West Close, Middleton on Sea	£24,643	£5,608	£19,035
LFRZ_014	Lodge Close & Willow Brook, Middleton on Sea	£22,553	£9,285	£13,268
LFRZ_015	Sea Way, Middleton on Sea	£14,495	£2,965	£11,530
LFRZ_004	Maple Road, Walberton	£13,692	£3,298	£10,394
LFRZ_021	Marshalls Close / Church Lane, Barnham	£13,006	£3,839	£9,167
LFRZ_022	Southdean Close, Middleton on Sea	£9,816	£4,502	£5,313
LFRZ_018	Oak Tree Lane, Woodgate	£6,861	£2,406	£4,454
LFRZ_020	Highground Lane, Barnham	£5,916	£1,885	£4,030
LFRZ_012	Yapton Road, Middleton on Sea	£4,439	£2,197	£2,242
LFRZ_010	Burdell Road, Yapton	£4,065	£1,722	£2,343
LFRZ_027	Downsview Road, Barnham	£3,794	£825	£2,970
LFRZ_001	West Walberton Lane, Walberton	£3,693	£723	£2,970
LFRZ_016	Golf Links Road, Felpham	£524	£330	£194
LFRZ_009	Yapton Road, Yapton	£429	£429	£-
LFRZ_008	Barnham Lane, Barnham (C)	£362	£362	£-
LFRZ_005	Barnham Lane, Barnham (B)	£68	£68	£-
LFRZ_007	Park Road, Barnham	£-	£-	£-
LFRZ_011	West View Drive, Yapton	£-	£-	£-
Total		£768,001	£237,559	£530,442

Analysis from the integrated modelling predicts that there are 592 residential properties and 215 non-residential properties at risk across the catchment for a 3.33 probability storm event. This totals £2.7 million estimated Average Annual Damages (AAD), of which £0.77 million is within 27 LFRZs. As such, the LFRZs account for 28% of the Lidsey SWMP study areas AADs predicted to be incurred. If schemes were implemented in all of the LFRZs and continued for 100 years, then the Present Value benefits would be in the order of £15.8M based on the current Treasury variable discount rate which starts at 3.5%.

7.6 LFRZ Prioritisation

To assist with prioritising future works on all LFRZs a prioritisation methodology was applied. It is considered important to use a simple approach to ensure clear interpretation of the prioritisation process between one LFRZ over another. Given the economic AADs for the LFRZ incorporates the predicted number of properties flooded and accounts for apportioned damages to commercial properties it is considered appropriate that the following priority is given to each of the LFRZs as shown in Table 7.57.

Table 0-2 - LFRZ Prioritisation

Local Flood Risk Zone	Location Name	Priority
LFRZ_006	Lake Lane, Barnham	High
LFRZ_017	Felpham Road, Felpham	High
LFRZ_013	Elmer Sands, Middleton on Sea	High
LFRZ_019	Wandleys Lane, Eastergate	High
LFRZ_023	Rudwicks Close, Broomcroft Road, The Loop, Jacken Close, Bramfield Road, Leverton Avenue, Limmer Lane (East), Burley Road and Dryad Way in Felpham	High
LFRZ_025	Limmer Lane, Felpham	High
LFRZ_003	Walberton Village (Barnham Lane (A))	High
LFRZ_002	Elm Grove, Barnham	Medium
LFRZ_026	Eastergate Lane, Eastergate	Medium
LFRZ_024	West Close, Middleton on Sea	Medium
LFRZ_014	Lodge Close & Willow Brook, Middleton on Sea	Medium
LFRZ_015	Sea Way, Middleton on Sea	Medium
LFRZ_004	Maple Road, Walberton	Medium
LFRZ_021	Marshalls Close / Church Lane, Barnham	Medium
LFRZ_022	Southdean Close, Middleton on Sea	Medium
LFRZ_018	Oak Tree Lane, Woodgate	Medium
LFRZ_020	Highground Lane, Barnham	Medium
LFRZ_012	Yapton Road, Middleton on Sea	Medium
LFRZ_010	Burdell Road, Yapton	Medium
LFRZ_027	Downsview Road, Barnham	Medium
LFRZ_001	West Walberton Lane, Walberton	Medium
LFRZ_016	Golf Links Road, Felpham	Low
LFRZ_009	Yapton Road, Yapton	Low
LFRZ_008	Barnham Lane, Barnham (C)	Low
LFRZ_005	Barnham Lane, Barnham (B)	Low
LFRZ_007	Park Road, Barnham	Low
LFRZ_011	West View Drive, Yapton	Low

LFRZ_018 – Oak Tree Lane, Woodgate

Preferred Interventions: Asset Management. Reduce surface water and infiltration entering public foul sewers. Improve surface water conveyance.

Table 10-19 - LFRZ_018 Options

Option Ref.	Option Category (Source / Pathway / Receptor / Other)	Option	Potential	Considered	Economic	Environmental	Objectiveness	Social	Technical	Total Score	Summary of scheme / General discussion
2	Do minimum	Do minimum - continue current maintenance	Yes	Yes	2	2	0	2	1	7	
7	Source	Rainwater Harvesting	Yes	Yes	2	2	1	2	2	9	Installation of water butts in upstream catchment.
12	Source	Sealing of manhole covers and protecting gullies	Yes	Yes	1	2	2	2	1	8	Reduce surface water inflow.
13	Source	Sealing Sewers (Reduce ground water / rainfall induced infiltration)	Yes	Yes	1	2	2	2	0	7	Reduce ground water inflows.
15	Pathway	Increasing Capacity in Drainage System (Storage, Upsize)	Yes	Yes	0	0	2	0	2	4	Investigate conveying surface water away from properties. This should be completed after survey of existing drainage assets. See figure 9.9.
17	Pathway	Improved maintenance regimes	Yes	Yes	-2	0	2	0	2	2	Optimisation of existing assets. WSCC and ADC are planning to clear the ditch on the west side of Lidsey Road
18	Pathway	Increase Gully Assets	Yes	Yes	0	0	2	1	2	5	This should be investigated to remove highway flooding.
22	Pathway	Separation of foul and surface water	Yes	Yes	0	2	2	0	0	4	Control at source see activities 12 & 13
24	Receptor	Improve resilience to flooding	Yes	Yes	2	2	2	2	1	9	To be considered in a hydraulic investigation.
26	Receptor	Raising doorway / access threshold	Yes	Yes	2	2	2	2	1	9	To be considered in a hydraulic investigation.
28	Receptor	Temporary demountable flood defences	Yes	Yes	1	0	2	0	2	5	Potentially applicable.
29	Strategy	Further Study / Investigations	Yes	Yes	1	1	1	1	1	5	Detailed hydraulic investigation is required. As detailed in Option 15.

LFRZ_018 – Oak Tree Lane, Woodgate (Cont.)

Increased Surface Water Conveyance

A: Improve / maintain existing ditch. The conveyance system upgrade may also need to extend further north to the level crossing as the hydraulic model indicates that surface water runoff is predicted to occur north of the railway line. Conveying surface water from Lidsey Road (north of railway crossing) to the south would require construction of a culvert. If practical this would be costly element of works.

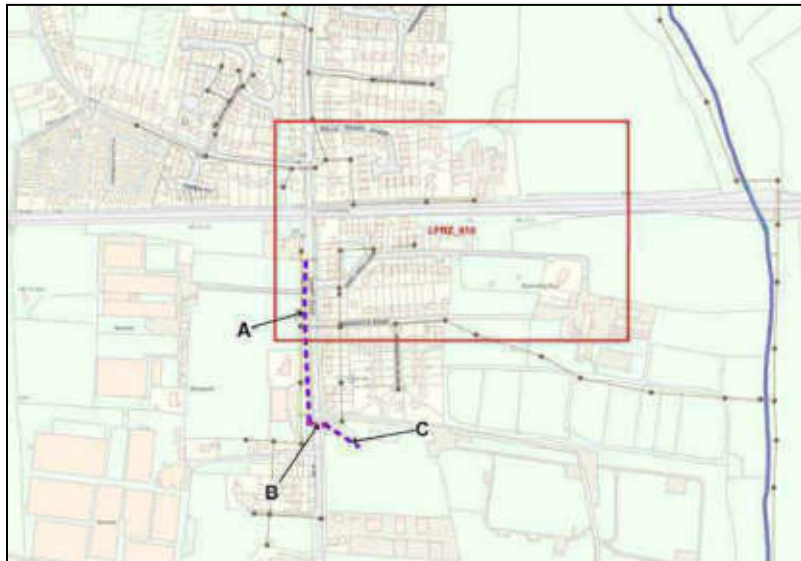
B: New Culvert

C: Install new ditch to convey water to open green space

Note: This option has not been hydraulically modelled.

WSCC and ADC are planning to clear the ditch on the west side of Lidsey Road and are investigating liaising with land owners to ensure capacity is available downstream of the highway ditch.

Figure 10.9 - Oak Tree Lane, Woodgate



13	LFRZ_004 Maple Road, Walberton	 Carry out a detailed investigation of flooding issue and where required develop hydraulic solution.	 Investigate fat, oil, grease problems reported by residents.	  Investigate and prioritise interventions to reduce clear water inflow and Infiltration of public foul sewers. Work with Local Authority to target resilience improvements.	 Continue proactive maintenance of highway gullies and jetting of sewers to optimise existing drainage assets.	
14	LFRZ_021 Marshalls Close / Church Lane, Barnham	 Investigate the Operation of Marshalls Close CSO	 Investigate options to reduce flood risk as part of the EA 2014 ARIFRM project.	 Investigate additional flood protection measures for two properties in Marshalls Close i.e. sealing floors and walls.		
15	LFRZ_022 Southdean Close, Middleton on Sea	   Confirm surface water drainage arrangements and condition in Southdean Close.	   Consider connecting existing or new highway drainage system into the Rose Avenue public storm water system. The storm system may require upgrade to accommodate increased inflows.	 Consider use of ATAC (Temporary Treatment Plant)		
16	LFRZ_018 Oak Tree Lane, Woodgate	  Survey private road existing highway drainage and confirm condition and arrangements. Implement clearance of the ditch on the west side of Lidsey Road and investigate capacity downstream of the highway ditch	 Area to be considered as part of the DSF study.	  Consider use of flood mitigation to protect properties from pluvial flooding from highway based on outputs from the DSF study	  Investigate and prioritise interventions to reduce clear water inflow and Infiltration of public foul sewers. Work with Local Authority to target resilience improvements.	
17	LFRZ_020 Highground Lane	  Investigate and prioritise interventions to reduce clear water inflow and Infiltration of public foul sewers. Work with Local Authority to target resilience improvements.				
18	LFRZ_012 Yapton Road, Middleton on Sea	 Optimise existing drainage assets. Continue maintenance of ditch system.	 Monitor flooding to evaluate improvements in the ditch system.	 Consider increased conveyance and provide attenuation for surface water flows into the fields to the north or east.	 Consider more gullies along Yapton Lane to intercept highway runoff from Norton Road and Yapton Road.	 Investigate flood mitigations.

Appendix H Environment Agency Correspondence

From: SSD Enquiries <SSDEnquiries@environment-agency.gov.uk>
Sent: 31 January 2020 11:22
To: Stuart Burnett
Subject: 200131 SSD156540: D1757 Lidsey Road, Woodgate PO20 3SU (Land at Wings Nursery)

Dear Stuart,

Thank you for your enquiry dated 8 January. This was passed to our technical teams, who have provided the following responses:

GROUNDWATER

- Please confirm details of any groundwater flooding issues in the area, including flood levels, flood extents and any available anecdotal information.
 - We have no recorded evidence, anecdotal or otherwise, of groundwater flooding in this area.
 - The London clay is approximately 120m deep at the area of interest, which would prevent any flooding from the primary aquifer.
 - Over the clay, there is a thinner layer of Fluvial (river) deposits which likely consist of sands, gravels and/or clay. It is possible there may be very localised groundwater activity in these surface deposits.
 - The GW vulnerability layer in Magic Map takes into account these superficial river deposits in the assessment of GW flood risk – <https://magic.defra.gov.uk/>
- Please confirm details of any recorded groundwater levels in the area, and groundwater vulnerability of the area.
 - Please find attached the Groundwater level record for the nearest borehole on the same geology as the site.
 - Please note that the aquifer here is confined below a layer of London clay so the levels attached represent the piezometric surface of the groundwater in the underlying chalk aquifer – not the actual, natural, groundwater level if someone hadn't drilled a hole into it.
 - The piezometric surface is the level at which the groundwater would rise to under hydrostatic pressure if it were not confined beneath the waterproof layer of the clay.

FLOOD ZONES

- Please confirm any gauged flow records for river networks in close proximity to the site
 - Please use the following link to download 15 minute logged flow data for Barnham Rife GS: <https://ea.sharefile.com/d-sc3731b2131f48778>
Please note, the above web link will expire on **28 February 2020** so please ensure all data has been downloaded and saved locally by this date.
 - The data ranges from 2002 until March 2019 as it is now only a flow site.
 - There are no other gauges within close proximity to the site
- Please confirm the Flood Zones for this area.
 - We can confirm that the above property/site is located in Flood Zone 1 - an area where the chance of flooding from both rivers and the sea has been assessed as less than 0.1% in any year (1 chance in 1,000 in any year). Please see the attached letter for more information.
 - The Environment Agency has no record of flooding to this property/area, however please note our records are not comprehensive and may not include all events. We recommend

contacting the Lead Local Flooding Authority or the Local Authority for a more comprehensive flood history check.

- Please confirm surface water, reservoir flooding, sewer flooding. Please provide plans and depth data from your GIS UFMSW for 30yr, 100yr & 1000yr as applicable (OS Datum).
 - The site is primarily unaffected by surface water flooding.
 - Please see the attached surface water flood map for more information.

This information is supplied subject to the notice which can be viewed via the following link:
<http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Please get in touch if you would like additional data or contact us within two months if you would like us to review the information we have sent.

Kind Regards,

Amrit

Customers & Engagement Team | Environmental Planning and Engagement | Solent and South Downs Area |
Environment Agency | Romsey District Office, Canal Walk, Romsey, SO51 7LP

SSEnquiries@environment-agency.gov.uk
National Contact Call Centre 03708 506506



From: Stuart Burnett

Sent: 08 January 2020 09:38

To: Enquiries, Unit <enquiries@environment-agency.gov.uk>

Subject: D1757 Lidsey Road, Woodgate PO20 3SU (Land at Wings Nursery)

Dear Sirs,

We are preparing a drainage strategy for the above site and would be grateful if you could provide us with any relevant information you have (via a 'Product 4' for EA only) as per our drainage checklist below:

Flood Zones

- Please confirm the Flood Zones for this area.
- Please confirm surface water, reservoir flooding, sewer flooding. Please provide plans and depth data from your GIS UFMSW for 30yr, 100yr & 1000yr as applicable (OS Datum).
- Please confirm mapping and records for any surface water assets owned or maintained.
- Please confirm if there are any future drainage improvements proposed for this area.
- Please confirm details of existing or planned flood alleviation and defences in this area.
- Please confirm any existing river and/or tidal levels, for the 100yr, 100yr with climate change, 200yr, 200yr with climate change, 1000yr, and 1000yr with climate change flood events.
- Please confirm any gauged flow records for river networks in close proximity to the site, with associated estimated return periods.
- Please confirm if you are aware of any historic flooding within the confines of the site.
- Please confirm if you are aware of any historic flooding in close vicinity and/or on the public highway.

Groundwater

- Please confirm details of any groundwater flooding issues in the area, including flood levels, flood extents and any available anecdotal information.
- Please confirm details of aquifer designation, soil classification, and Source Protection Zones in this area.
- Please confirm details of any surface and groundwater discharges, abstractions including private licences and pollution incidents.
- Please confirm details of any recorded groundwater levels in the area, and groundwater vulnerability of the area.

Policy/Future

- Please confirm any Flood Modelling data undertaken within a 1 km radius of the site.
- Please confirm details of future defence upgrades and/or shoreline management plans/policies.

We look forward to hearing from you in due course.

Kind regards

Stuart Burnett
Engineer



Bright Plan Civils, Transport Planning and Civil Engineering Consultants

Bright Plan Civils, 2 West Barn, Norton Lane, Chichester, PO20 3AF

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Our reference: SSD158540

SENT BY EMAIL ONLY: s.burnett@bpcivils.co.uk

31 January 2020

Dear Stuart,

Thank you for your request of 8 January to use Environment Agency Product 4 data, for the site at Wings Nursery, Lidsey Road, Woodgate PO20 3SU.

Response to your request

The Environment Agency's records indicate that the above site is located in Flood Zone 1 (land assessed as having less than 0.1% (1 in 1,000) chance of flooding in any given year from **rivers or the sea**). Therefore, the likelihood of flooding from rivers and sea in this area is estimated as 'very low'.

Proximity to Flood Zones 2 or 3

The above site is approximately 340 metres away from Flood Zone 2. We are therefore unable to provide data from our detailed fluvial or tidal models which is relevant to your site.

More information on Flood Zones can be found on the GOV.UK website:

<http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-1-flood-zones/>

Surface water flooding

Our mapping indicates that this site is at risk of surface water flooding.

For information on flooding from all other sources, such as surface water, please contact the Lead Local Flood Authority, which in this case is West Sussex County Council. A link to their information available online is shown below:

<https://www.westsussex.gov.uk/fire-emergencies-and-crime/dealing-with-extreme-weather/dealing-with-flooding/flood-risk-management/local-flood-risk-management-strategy/>

Please note that the above is a link to an external website which the Environment Agency does not control or maintain. Therefore, the link may not be the most up-to-date at the date of this letter. If the link does not work, and you are unable to find the information about surface water flooding on the relevant website, please contact the authority named above directly.

Where you can find further information

- Detailed long-term flood information and maps can be found on the GOV.UK website:
<https://flood-warning-information.service.gov.uk/long-term-flood-risk/>
- Flood maps for planning can be found on the GOV.UK website:
<https://flood-map-for-planning.service.gov.uk/>
- Please be aware that in February 2016 the Environment Agency updated its guidance on climate change allowances. The standard allowance of adding 20% to peak flows – as per previous guidance in the National Planning Policy Framework, may not be applicable for the purposes of informing development proposals. It is possible that our current modelling has under estimated flood risk when taking climate change into consideration. This does not however have an effect on Flood Zones 2 or 3. For further information please visit:
<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>
- Further details about the Environment Agency information supplied can be found on the GOV.UK website:
<https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>
- If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency information for Flood Risk Assessments:
<https://www.gov.uk/planning-applications-assessing-flood-risk>
<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

If you have any queries or would like to discuss the content of this letter further please call us on 03708 506 506, or reply to the email sent to you with this letter attached.

Please get in touch if you have any further queries or contact us within two (2) months if you would like us to review the information we have sent.

For information on what you can expect from us and our full service commitment to you, please click on this link:

<https://www.gov.uk/government/publications/environment-agency-customer-service-commitment--2/environment-agency-customer-service-commitment>

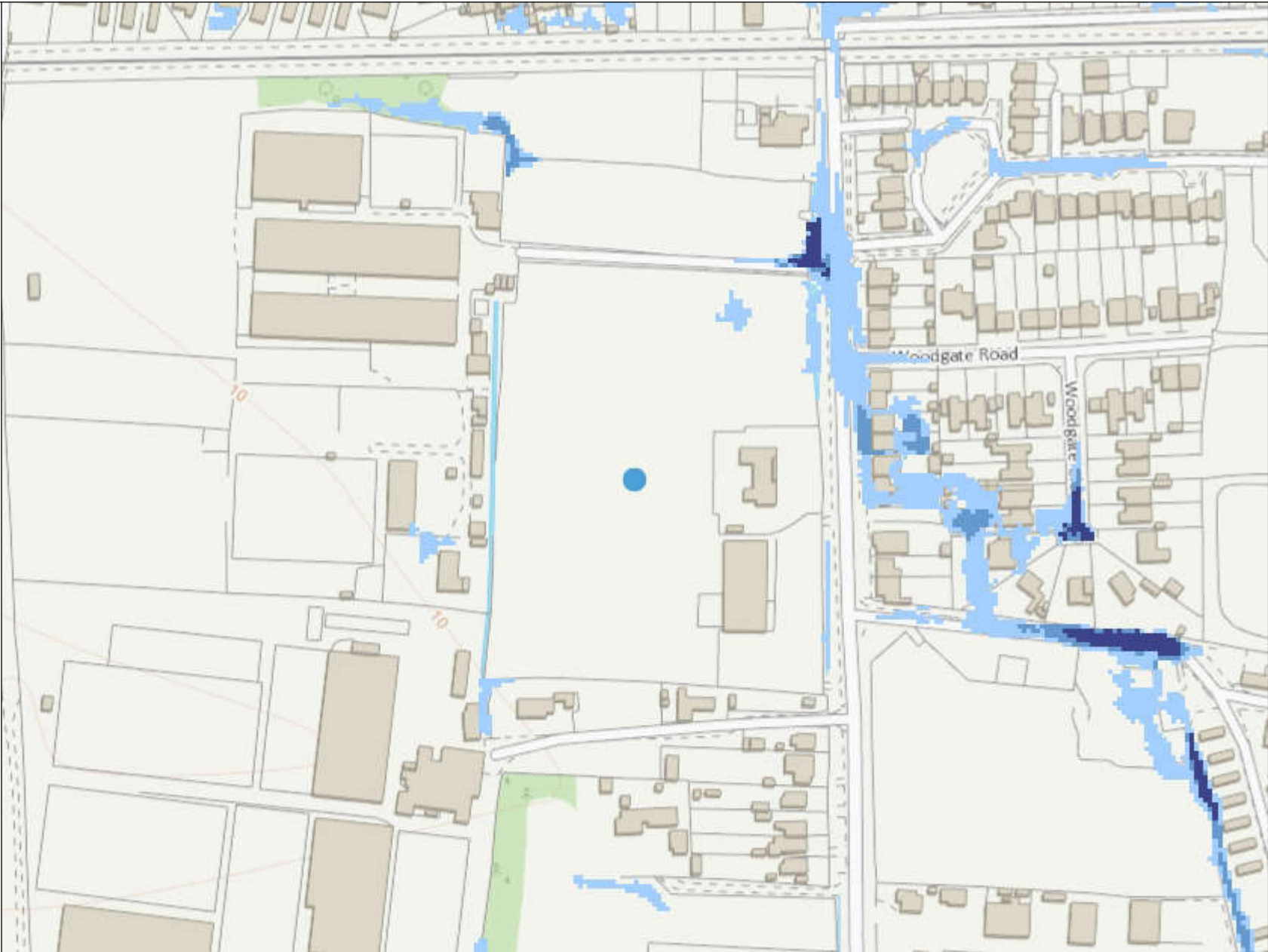
Yours sincerely,

Customers and Engagement Team
Environment Agency

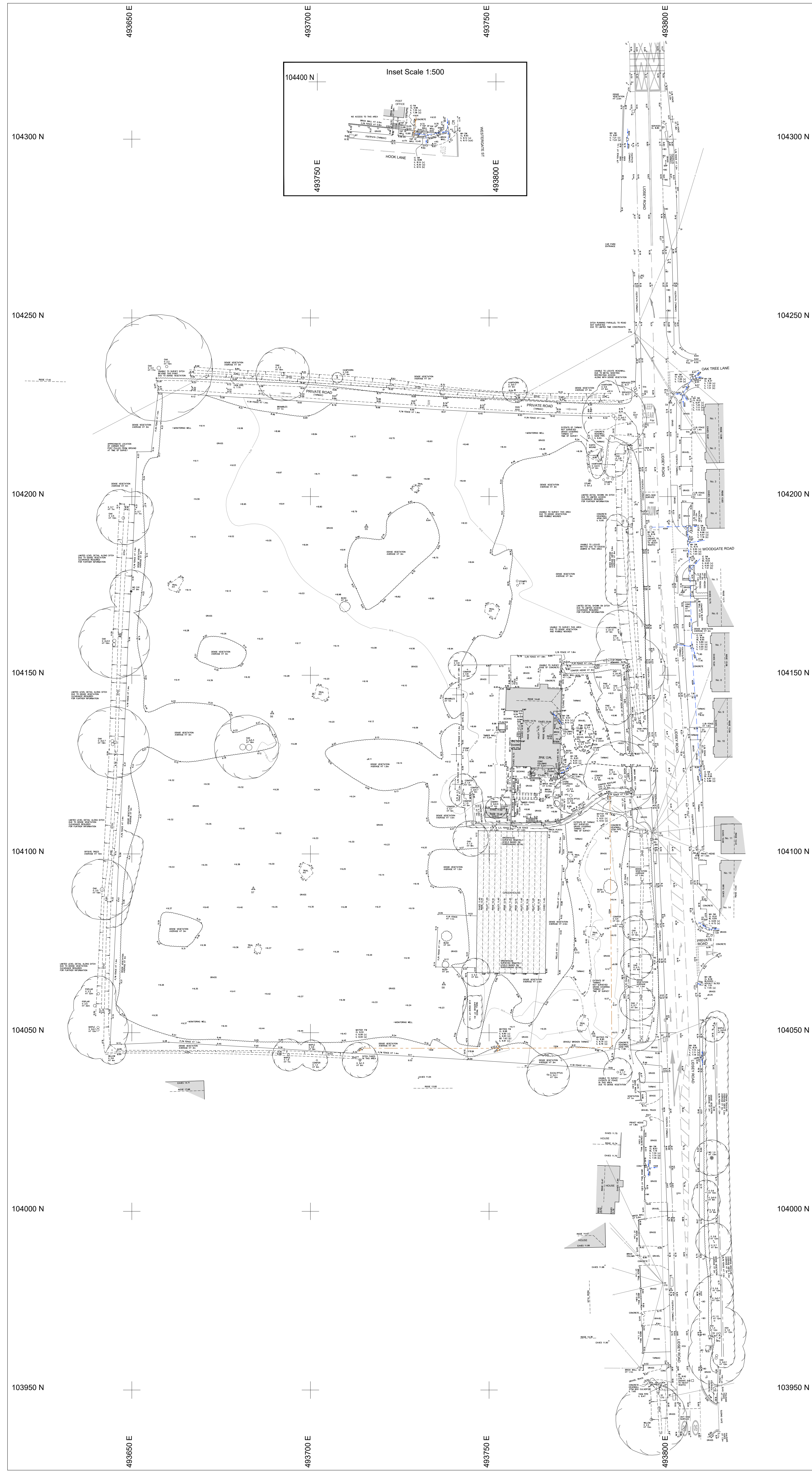
Surface Water Flooding - Map



- Legend
- High ($\geq 3.3\%$)
 - Medium (3.3% - 1%)
 - Low (1% - 0.1%)



Appendix I MK Surveys Topographical Survey



- Notes:
- GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL GNSS NETWORK. LOCAL SCALE FACTOR (0.99971) APPLIED.
 - DRAINAGE INFORMATION HAS BEEN DETERMINED WITHOUT MAN ENTRY INTO CHAMBERS AND WHILST EVERY EFFORT HAS BEEN MADE TO CORRECTLY IDENTIFY THIS INFORMATION, IT SHOULD ALWAYS BE CHECKED IN AREAS THAT ARE CRITICAL TO THE FUTURE PROPOSAL.
 - ALL SEWERS ARE PRESUMED TO BE STRAIGHT BETWEEN CHAMBERS, WITH ROUTES /CONNECTIVITY OBTAINED USING ACOUSTIC METHODS ONLY. THESE ARE TO BE CONSIDERED ASSUMED AND SHOULD BE INVESTIGATED FURTHER IN CRITICAL AREAS.
 - TREE AND HEDGE SPECIES HAVE BEEN IDENTIFIED AS ACCURATELY AS POSSIBLE BUT SHOULD BE CROSS CHECKED IN CRITICAL AREAS.

Coordinate Table				
Station	Description	Easting	Northing	Level
J3	ROAD NAIL	493768.236	104149.535	8.860
J4	ROAD NAIL	493778.099	104147.921	8.899
J5	ROAD NAIL	493783.019	104134.628	8.805
S1	ROAD NAIL	493800.903	103978.083	8.838
S2	ROAD NAIL	493808.226	104099.716	8.405
S3	ROAD NAIL	493804.154	104173.396	8.130
S4	ROAD NAIL	493800.726	104226.417	8.227
S5	PEG	493715.660	104191.694	8.613
S6	PEG	493689.293	104139.466	9.275
S7	PEG	493684.033	104090.276	9.374
S8	PEG	493737.321	104063.621	9.196
S9	ROAD NAIL	493779.184	104049.861	8.963
S10	ROAD NAIL	493774.205	104073.335	9.015

TOPOGRAPHICAL KEY

SURVEY STATION

BANKING

HEDGE SPREADS

WOODLAND CANOPY

ARROW ON STEPS / RAMP INDICATES DIRECTION UPWARDS

TREES

GATE

KERB CHANNEL

ROAD UNKERRIED

FOOTPATH

CHANGE IN SURFACE

FENCE

WALL

OVERHEAD ELECTRIC

OVERHEAD TELECOM

FOUL SEWER

SURFACE SEWER

P-TRAP

BACK DROP (EXTERNAL)

BACK DROP (INTERNAL)

BUILDING

OPEN SIDED BUILDING

OVERHANG / CANOPY

GLASSHOUSE

CONTOUR

SPOT LEVEL

SONAR LEVEL

BORE HOLE

TRIAL HOLE

BARBED WIRE FENCE

CLOSE BOARDED FENCE

CONCRETE PANEL FENCE

CORRUGATED IRON FENCE

CHAIN LINK FENCE

CHESTNUT PALING

5

TOP

BOTTOM

SPREAD & GIRTH SHOWN TO SCALE

25.50

+ 127.13

127.13

BH

TH

FENCE ABBREVIATIONS

IRON RAILINGS

LARCH LAP FENCE

POST AND RAIL FENCE

POST AND WIRE FENCE

WIRE MESH FENCE

CMP

AIR CONDITIONING UNIT

AIR VALVE

AVERAGE

BACK DROP

BASE LEVEL

BELUSHA BEACON

BOLLARD

BOLLARD LIGHT

BRICK

BUS STOP

CABLE RISER

CABLE TV COVER

CABLES TO GROUND

CATCH PIT

CONTROL BOX

COVER LEVEL

CROSSING CONTROL BUTTON

DAMP PROOF COURSE

DRAINAGE CHANNEL

DROP KERB

ELECTRICITY POLE

EARTH ROD

FIRE HYDRANT

FL

FOOTPATH

FOUL WATER

GAS RISER

GAS VALVE

GULLY

HARD BED

INSPECTION COVER

INVERT LEVEL

KERB OUTLET

LAMP POST

MANHOLE

MARKER POST

METER

NO PIPES VISIBLE

ORDNANCE SURVEY BENCH MARK

P-TRAP

POST

POST BOX

RODDING EYE

ROAD SIGN

RAIN WATER PIPE

RETAINING WALL

SOFT BED

STOP COCK

STREET NAME PLATE

STOP VALVE

SOIL PIPE

SOIL VENT PIPE

SURFACE WATER

TACTILE PAVING

TELECOM POLE

TELECOM INSPECTION COVER

TELEPHONE CALL BOX

TICKET MACHINE

TOP OF WALL

TRAFFIC LIGHT

TRAFFIC LIGHT COVER

THRESHOLD LEVEL

UNABLE TO LOCATE

UNABLE TO RAISE

UNABLE TO SURVEY

VENT PIPE

WATER LEVEL

WATER METER

WASH OUT

WATER RISER

WATER TAP

104150 N

104100 N

104050 N

104000 N

103950 N

1

Manholes 7001, 7002, 7003, 7101 surveyed and 2 no. tree girths checked within property boundary.

MK CP NS 16/01/2020

Revision Description Surv. by Check. by Appr. by Date

0m 5 10 15 20 25 30 35 40 45 50 55

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THAKEHAM

**Lidsey Road
Woodgate
West Sussex**

Topographical Survey

Scale: 1:500 Sheet Size: A1 Sheet Number: 1 Date: August 2019

Project Number: 27568 Rev: 1 Surveyed by: RG / JM Checked by: AJ Approved by: CP

Appendix J Calculations

RGP Design Limited		Page 1
2 West Barn Norton Lane Chichester PO20 3AF	Land at Lidsey Road, Woodgate Greenfield Run-Off	
Date 28/01/2020 File	Designed by SPB Checked by MJA	
Innovyze Source Control 2018.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	2.530	Urban	0.000
SAAR (mm)	764	Region Number	Region 7

Results l/s

QBAR Rural	9.5
QBAR Urban	9.5
Q100 years	30.4
Q1 year	8.1
Q30 years	21.6
Q100 years	30.4

©1982-2018 Innovyze

RGP Design Limited		Page 1
2 West Barn Norton Lane Chichester PO20 3AF	Land at Lidsey Road, Woodgate Greenfield Volume	
Date 28/01/2020 File	Designed by SPB Checked by MJA	
Innovyze Source Control 2018.1		

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	19.400
Ratio R	0.337
Areal Reduction Factor	1.00
Area (ha)	2.530
SAAR (mm)	764
CWI	113.258
Urban	0.000
SPR	37.000

Results

Percentage Runoff (%)	38.36
Greenfield Runoff Volume (m³)	631.983

©1982-2018 Innovyze



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.400	Minimum Backdrop Height (m)	0.500
Ratio-R	0.333	Preferred Cover Depth (m)	0.800
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.068	5.00	9.250	1350	493782.406	104143.299	1.550
2	0.070	5.00	8.800		493771.993	104214.526	1.300
3			8.800	1350	493778.821	104214.168	1.350
3_OUT			8.700		493786.449	104212.110	1.300

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	3	70.960	0.600	7.700	7.450	0.250	283.8	450	5.98	50.0
2.000	2	3	6.837	0.600	7.500	7.450	0.050	136.7	450	5.07	50.0
1.001	3	3_OUT	7.901	0.600	7.450	7.400	0.050	158.0	150	6.15	50.0

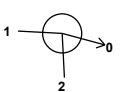
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.201	191.1	9.2	1.100	0.900	0.068	0.0
2.000	1.736	276.2	9.5	0.850	0.900	0.070	0.0
1.001	0.797	14.1	18.7	1.200	1.150	0.138	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	70.960	283.8	450	Circular	9.250	7.700	1.100	8.800	7.450	0.900
2.000	6.837	136.7	450	Circular	8.800	7.500	0.850	8.800	7.450	0.900
1.001	7.901	158.0	150	Circular	8.800	7.450	1.200	8.700	7.400	1.150

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1350	Manhole	Adoptable	3	1350	Manhole	Adoptable
2.000	2		Junction		3	1350	Manhole	Adoptable
1.001	3	1350	Manhole	Adoptable	3_OUT		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	493782.406	104143.299	9.250	1.550	1350		0	1.000	7.700 450
2	493771.993	104214.526	8.800	1.300			0	2.000	7.500 450
3	493778.821	104214.168	8.800	1.350	1350		1 2	2.000 1.000	7.450 450 7.450 450
3_OUT	493786.449	104212.110	8.700	1.300			0 1	1.001 1.001	7.450 150 7.400 150

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	19.400	Additional Storage (m³/ha)	20.0
Ratio-R	0.333	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x
Analysis Speed	Detailed		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	40	10	0

Node 3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	7.450	Product Number	CTL-SHE-0058-1500-1000-1500
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.5	Min Node Diameter (mm)	1200

Node 2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	8.140	Slope (1:X)	1500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.450
Safety Factor	1.0	Width (m)	50.000	Inf Depth (m)	
Porosity	0.35	Length (m)	7.000		



Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	7.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	50.0	0.0	0.400	50.0	0.0	0.800	50.0	0.0	0.801	0.0	0.0



Results for 2 year Critical Storm Duration. Lowest mass balance: 98.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	7.778	0.078	13.5	0.1800	0.0000	OK
180 minute winter	2	156	7.777	0.277	4.4	13.4679	0.0000	OK
180 minute winter	3	156	7.777	0.327	4.0	0.4684	0.0000	SURCHARGED
15 minute winter	3_OUT	1	7.400	0.000	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	3	12.9	0.515	0.068	2.8608	
180 minute winter	2	2.000	3	4.0	0.282	0.014	0.7726	
180 minute winter	3	Hydro-Brake®	3_OUT	1.4				30.3



Results for 30 year Critical Storm Duration. Lowest mass balance: 98.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	1	228	8.145	0.445	5.4	1.0279	0.0000	OK
240 minute winter	2	232	8.144	0.644	6.5	31.4630	0.0000	SURCHARGED
240 minute winter	3	232	8.144	0.694	4.8	0.9929	0.0000	SURCHARGED
15 minute winter	3_OUT	1	7.400	0.000	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	1	1.000	3	4.8	0.277	0.025	11.2340	
240 minute winter	2	2.000	3	-1.7	0.103	-0.006	1.0833	
240 minute winter	3	Hydro-Brake®	3_OUT	1.4				33.3



Results for 100 year Critical Storm Duration. Lowest mass balance: 98.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	1	344	8.249	0.549	5.2	1.2672	0.0000	SURCHARGED
360 minute winter	2	344	8.249	0.749	7.3	49.3466	0.0000	SURCHARGED
360 minute winter	3	344	8.249	0.799	4.1	1.1427	0.0000	SURCHARGED
15 minute winter	3_OUT	1	7.400	0.000	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	1	1.000	3	4.1	0.263	0.021	11.2431	
360 minute winter	2	2.000	3	-2.8	0.108	-0.010	1.0833	
360 minute winter	3	Hydro-Brake®	3_OUT	1.4				44.5



Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 98.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	1	464	8.696	0.996	6.4	2.3883	0.0000	SURCHARGED
480 minute winter	2	464	8.698	1.198	11.3	94.3232	0.0000	FLOOD RISK
480 minute winter	3	464	8.698	1.248	6.1	1.7852	0.0000	FLOOD RISK
15 minute winter	3_OUT	1	7.400	0.000	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	1	1.000	3	6.1	0.264	0.032	11.2431	
480 minute winter	2	2.000	3	-4.7	0.084	-0.017	1.0833	
480 minute winter	3	Hydro-Brake®	3_OUT	1.7				60.4



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	0.75
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.400	Minimum Backdrop Height (m)	0.500
Ratio-R	0.333	Preferred Cover Depth (m)	0.800
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.076	5.00	9.800	1350	493658.343	104199.609	0.925
2	0.019	5.00	9.600	1200	493690.301	104204.721	0.850
3	0.063	5.00	9.600	1350	493690.412	104199.617	1.050
4	0.026	5.00	9.525	1350	493713.002	104199.819	1.050
5	0.074	5.00	9.525	1200	493729.387	104204.530	1.075
6	0.026	5.00	9.600	1350	493722.945	104196.895	1.350
7	0.026	5.00	9.800	1350	493727.725	104187.618	1.675
8	0.111	5.00	10.000	1350	493727.646	104157.287	1.925
9			9.600	1350	493738.972	104125.109	1.575
9_OUT			9.525	1350	493730.627	104118.311	1.525
10	0.040	5.00	10.000	1200	493658.975	104147.455	1.100
11	0.040	5.00	10.000	1200	493717.063	104147.455	1.500
12	0.040	5.00	9.750	1200	493697.079	104147.455	1.450
13	0.040	5.00	9.750	1200	493673.362	104075.128	0.850
14	0.040	5.00	9.850	1200	493671.906	104105.399	1.150
15			9.875	1200	493696.950	104121.110	1.675
15_OUT			9.700	1200	493713.471	104114.923	1.662
20		5.00	9.500	1200	493732.097	104106.511	1.500
21			9.500	1200	493745.090	104106.067	1.800
22			9.000	1200	493778.105	104104.940	1.500
22_OUT			9.000	1200	493782.059	104107.757	1.525
16	0.080	5.00	9.550	1200	493688.435	104074.568	0.975
17	0.080	5.00	9.500	1200	493721.976	104074.449	1.000
18	0.070	5.00	9.600	1200	493745.703	104073.097	0.700
19	0.038	5.00	9.525	1200	493733.072	104081.187	1.075
19_OUT			9.525	1200	493726.624	104091.333	1.487



Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	3	32.069	0.600	8.875	8.725	0.150	213.8	375	5.43	50.0
2.000	2	3	5.105	0.600	8.750	8.700	0.050	102.1	225	5.07	50.0
1.001	3	4	22.591	0.600	8.550	8.475	0.075	301.2	375	5.80	50.0
1.002	4	6	10.364	0.600	8.475	8.400	0.075	138.2	375	5.91	50.0
3.000	5	6	9.990	0.600	8.450	8.400	0.050	199.8	225	5.18	50.0
1.003	6	7	10.436	0.600	8.250	8.200	0.050	208.7	375	6.05	50.0
1.004	7	8	30.331	0.600	8.125	8.075	0.050	606.6	375	6.74	50.0
1.005	8	9	34.113	0.600	8.075	8.025	0.050	682.3	375	7.57	50.0
1.006	9	9_OUT	10.763	0.600	8.025	8.000	0.025	430.5	375	7.78	50.0
4.000	10	12	38.104	0.600	8.900	8.500	0.400	95.3	225	5.47	50.0
5.000	11	12	19.984	0.600	8.500	8.300	0.200	99.9	225	5.25	50.0
4.001	12	15	26.345	0.600	8.300	8.200	0.100	263.5	300	5.93	50.0
6.000	13	14	30.306	0.600	8.900	8.700	0.200	151.5	300	5.40	50.0
6.001	14	15	29.564	0.600	8.700	8.400	0.300	98.5	300	5.71	50.0
4.002	15	15_OUT	17.641	0.600	8.200	8.100	0.100	176.4	300	6.18	50.0
9.000	20	21	13.001	0.600	8.000	7.950	0.050	260.0	450	5.17	50.0
9.001	21	22	33.034	0.600	7.700	7.500	0.200	165.2	225	5.72	50.0
9.002	22	22_OUT	4.855	0.600	7.500	7.475	0.025	194.2	225	5.80	50.0
7.000	16	17	33.541	0.600	8.575	8.500	0.075	447.2	375	5.66	50.0
7.001	17	19	12.982	0.600	8.500	8.450	0.050	259.6	375	5.85	50.0
8.000	18	19	15.000	0.600	8.900	8.825	0.075	200.0	225	5.27	50.0
7.002	19	19_OUT	12.022	0.600	8.450	8.425	0.025	480.9	375	6.10	50.0

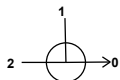
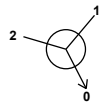
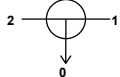
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.235	136.4	10.3	0.550	0.500	0.076	0.0
2.000	1.293	51.4	2.6	0.625	0.675	0.019	0.0
1.001	1.038	114.7	21.4	0.675	0.675	0.158	0.0
1.002	1.539	170.0	24.9	0.675	0.825	0.184	0.0
3.000	0.921	36.6	10.0	0.850	0.975	0.074	0.0
1.003	1.250	138.1	38.5	0.975	1.225	0.284	0.0
1.004	0.728	80.4	42.0	1.300	1.550	0.310	0.0
1.005	0.686	75.8	57.1	1.550	1.200	0.421	0.0
1.006	0.867	95.7	57.1	1.200	1.150	0.421	0.0
4.000	1.340	53.3	5.4	0.875	1.025	0.040	0.0
5.000	1.308	52.0	5.4	1.275	1.225	0.040	0.0
4.001	0.964	68.1	16.3	1.150	1.375	0.120	0.0
6.000	1.275	90.1	5.4	0.550	0.850	0.040	0.0
6.001	1.584	111.9	10.8	0.850	1.175	0.080	0.0
4.002	1.180	83.4	27.1	1.375	1.300	0.200	0.0
9.000	1.256	199.7	0.0	1.050	1.100	0.000	0.0
9.001	1.014	40.3	0.0	1.575	1.275	0.000	0.0
9.002	0.935	37.2	0.0	1.275	1.300	0.000	0.0
7.000	0.850	93.9	10.8	0.600	0.625	0.080	0.0
7.001	1.120	123.6	21.7	0.625	0.700	0.160	0.0
8.000	0.921	36.6	9.5	0.475	0.475	0.070	0.0
7.002	0.819	90.5	36.3	0.700	0.725	0.268	0.0

Pipeline Schedule

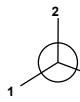
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	32.069	213.8	375	Circular	9.800	8.875	0.550	9.600	8.725	0.500
2.000	5.105	102.1	225	Circular	9.600	8.750	0.625	9.600	8.700	0.675
1.001	22.591	301.2	375	Circular	9.600	8.550	0.675	9.525	8.475	0.675
1.002	10.364	138.2	375	Circular	9.525	8.475	0.675	9.600	8.400	0.825
3.000	9.990	199.8	225	Circular	9.525	8.450	0.850	9.600	8.400	0.975
1.003	10.436	208.7	375	Circular	9.600	8.250	0.975	9.800	8.200	1.225
1.004	30.331	606.6	375	Circular	9.800	8.125	1.300	10.000	8.075	1.550
1.005	34.113	682.3	375	Circular	10.000	8.075	1.550	9.600	8.025	1.200
1.006	10.763	430.5	375	Circular	9.600	8.025	1.200	9.525	8.000	1.150
4.000	38.104	95.3	225	Circular	10.000	8.900	0.875	9.750	8.500	1.025
5.000	19.984	99.9	225	Circular	10.000	8.500	1.275	9.750	8.300	1.225
4.001	26.345	263.5	300	Circular	9.750	8.300	1.150	9.875	8.200	1.375
6.000	30.306	151.5	300	Circular	9.750	8.900	0.550	9.850	8.700	0.850
6.001	29.564	98.5	300	Circular	9.850	8.700	0.850	9.875	8.400	1.175
4.002	17.641	176.4	300	Circular	9.875	8.200	1.375	9.700	8.100	1.300
9.000	13.001	260.0	450	Circular	9.500	8.000	1.050	9.500	7.950	1.100
9.001	33.034	165.2	225	Circular	9.500	7.700	1.575	9.000	7.500	1.275
9.002	4.855	194.2	225	Circular	9.000	7.500	1.275	9.000	7.475	1.300
7.000	33.541	447.2	375	Circular	9.550	8.575	0.600	9.500	8.500	0.625
7.001	12.982	259.6	375	Circular	9.500	8.500	0.625	9.525	8.450	0.700
8.000	15.000	200.0	225	Circular	9.600	8.900	0.475	9.525	8.825	0.475
7.002	12.022	480.9	375	Circular	9.525	8.450	0.700	9.525	8.425	0.725

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1350	Manhole	Adoptable	3	1350	Manhole	Adoptable
2.000	2	1200	Manhole	Adoptable	3	1350	Manhole	Adoptable
1.001	3	1350	Manhole	Adoptable	4	1350	Manhole	Adoptable
1.002	4	1350	Manhole	Adoptable	6	1350	Manhole	Adoptable
3.000	5	1200	Manhole	Adoptable	6	1350	Manhole	Adoptable
1.003	6	1350	Manhole	Adoptable	7	1350	Manhole	Adoptable
1.004	7	1350	Manhole	Adoptable	8	1350	Manhole	Adoptable
1.005	8	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable
1.006	9	1350	Manhole	Adoptable	9_OUT	1350	Manhole	Adoptable
4.000	10	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
5.000	11	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
4.001	12	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
6.000	13	1200	Manhole	Adoptable	14	1200	Manhole	Adoptable
6.001	14	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
4.002	15	1200	Manhole	Adoptable	15_OUT	1200	Manhole	Adoptable
9.000	20	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable
9.001	21	1200	Manhole	Adoptable	22	1200	Manhole	Adoptable
9.002	22	1200	Manhole	Adoptable	22_OUT	1200	Manhole	Adoptable
7.000	16	1200	Manhole	Adoptable	17	1200	Manhole	Adoptable
7.001	17	1200	Manhole	Adoptable	19	1200	Manhole	Adoptable
8.000	18	1200	Manhole	Adoptable	19	1200	Manhole	Adoptable
7.002	19	1200	Manhole	Adoptable	19_OUT	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
1	493658.343	104199.609	9.800	0.925	1350	 0	1.000	8.875	375	
2	493690.301	104204.721	9.600	0.850	1200	 0	2.000	8.750	225	
3	493690.412	104199.617	9.600	1.050	1350	 1 2 0	2.000	8.700	225	
							1.000	8.725	375	
							0	1.001	8.550	375
4	493713.002	104199.819	9.525	1.050	1350	 1	1.001	8.475	375	
							0	1.002	8.475	375
5	493729.387	104204.530	9.525	1.075	1200	 0	3.000	8.450	225	
6	493722.945	104196.895	9.600	1.350	1350	 1 2 0	3.000	8.400	225	
							1.002	8.400	375	
							0	1.003	8.250	375
7	493727.725	104187.618	9.800	1.675	1350	 1 0	1.003	8.200	375	
							0	1.004	8.125	375
8	493727.646	104157.287	10.000	1.925	1350	 1 0	1.004	8.075	375	
							0	1.005	8.075	375
9	493738.972	104125.109	9.600	1.575	1350	 1 0	1.005	8.025	375	
							0	1.006	8.025	375
9_OUT	493730.627	104118.311	9.525	1.525	1350	 1	1.006	8.000	375	
10	493658.975	104147.455	10.000	1.100	1200	 0	4.000	8.900	225	
11	493717.063	104147.455	10.000	1.500	1200	 0	5.000	8.500	225	
12	493697.079	104147.455	9.750	1.450	1200	 1 2 0	5.000	8.300	225	
							4.000	8.500	225	
							0	4.001	8.300	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
13	493673.362	104075.128	9.750	0.850	1200		0	6.000	8.900	300
14	493671.906	104105.399	9.850	1.150	1200		1	6.000	8.700	300
15	493696.950	104121.110	9.875	1.675	1200		0	6.001	8.700	300
							1	6.001	8.400	300
							2	4.001	8.200	300
							0	4.002	8.200	300
15_OUT	493713.471	104114.923	9.700	1.662	1200		1	4.002	8.100	300
20	493732.097	104106.511	9.500	1.500	1200		0	9.000	8.000	450
21	493745.090	104106.067	9.500	1.800	1200		1	9.000	7.950	450
							0	9.001	7.700	225
22	493778.105	104104.940	9.000	1.500	1200		1	9.001	7.500	225
							0	9.002	7.500	225
22_OUT	493782.059	104107.757	9.000	1.525	1200		1	9.002	7.475	225
16	493688.435	104074.568	9.550	0.975	1200		0	7.000	8.575	375
17	493721.976	104074.449	9.500	1.000	1200		1	7.000	8.500	375
							0	7.001	8.500	375
18	493745.703	104073.097	9.600	0.700	1200		0	8.000	8.900	225
19	493733.072	104081.187	9.525	1.075	1200		1	8.000	8.825	225
							2	7.001	8.450	375
							0	7.002	8.450	375
19_OUT	493726.624	104091.333	9.525	1.487	1200		1	7.002	8.425	375



Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	19.400	Additional Storage (m³/ha)	20.0
Ratio-R	0.333	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x
Analysis Speed	Detailed		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	40	10	0

Node 21 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	7.700	Product Number	CTL-SHE-0095-5000-1700-5000
Design Depth (m)	1.700	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node 15 OUT Online Orifice Control

Flap Valve	x	Invert Level (m)	8.038	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.300		

Node 9 OUT Online Orifice Control

Flap Valve	x	Invert Level (m)	8.000	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.375		

Node 19 OUT Online Orifice Control

Flap Valve	x	Invert Level (m)	8.038	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.300		

Node 20 Online Orifice Control

Flap Valve	x	Invert Level (m)	8.000	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.300		

Node 20 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	38.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	8.000	Main Channel Slope (1:X)	1000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.025

Inlets

15_OUT | 19_OUT | 9_OUT



Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	307.0	0.0	1.500	650.1	0.0

Node 2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	9.150	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.450
Safety Factor	2.0	Width (m)	15.000	Inf Depth (m)	
Porosity	0.32	Length (m)	20.000		

Node 5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	9.050	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.450
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.32	Length (m)	24.000		

Node 18 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	8.940	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.450
Safety Factor	2.0	Width (m)	6.000	Inf Depth (m)	
Porosity	0.32	Length (m)	45.000		

Node 16 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	8.690	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.450
Safety Factor	2.0	Width (m)	6.000	Inf Depth (m)	
Porosity	0.32	Length (m)	11.000		

Node 12 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	9.150	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.450
Safety Factor	2.0	Width (m)	6.000	Inf Depth (m)	
Porosity	0.32	Length (m)	79.170		

Node 13 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	9.150	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.450
Safety Factor	2.0	Width (m)	6.000	Inf Depth (m)	
Porosity	0.32	Length (m)	19.170		

Node 14 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	8.700	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.450
Safety Factor	2.0	Width (m)	6.000	Inf Depth (m)	
Porosity	0.32	Length (m)	11.670		

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	8.959	0.084	15.0	0.2579	0.0000	OK
15 minute winter	2	10	8.794	0.044	3.8	0.0689	0.0000	OK
15 minute winter	3	10	8.687	0.137	30.5	0.3594	0.0000	OK
15 minute winter	4	11	8.601	0.126	35.1	0.2434	0.0000	OK
15 minute winter	5	10	8.555	0.105	14.7	0.2638	0.0000	OK
15 minute winter	6	11	8.448	0.198	54.3	0.3593	0.0000	OK
360 minute winter	7	344	8.445	0.320	10.2	0.5571	0.0000	OK
360 minute winter	8	344	8.445	0.370	13.6	0.9558	0.0000	OK
360 minute winter	9	344	8.445	0.420	12.7	0.6006	0.0000	SURCHARGED
360 minute winter	9_OUT	344	8.445	0.445	12.1	0.6374	0.0000	OK
15 minute winter	10	11	8.958	0.058	7.9	0.1082	0.0000	OK
15 minute winter	11	10	8.559	0.059	7.9	0.0975	0.0000	OK
360 minute winter	12	344	8.445	0.145	3.9	0.2438	0.0000	OK
15 minute winter	13	10	8.960	0.060	7.9	0.1242	0.0000	OK
15 minute winter	14	12	8.772	0.072	15.7	1.6140	0.0000	OK
360 minute winter	15	344	8.445	0.245	6.5	0.2769	0.0000	OK
360 minute winter	15_OUT	344	8.445	0.407	6.5	0.4603	0.0000	OK
360 minute winter	20	344	8.445	0.445	16.0	0.5030	0.0000	OK
360 minute winter	21	344	8.444	0.744	4.9	0.8417	0.0000	SURCHARGED
60 minute winter	22	29	7.557	0.057	4.6	0.0642	0.0000	OK
60 minute winter	22_OUT	29	7.528	0.053	4.6	0.0000	0.0000	OK
15 minute winter	16	11	8.676	0.101	15.8	0.2789	0.0000	OK
15 minute winter	17	11	8.653	0.153	31.1	0.4188	0.0000	OK
15 minute winter	18	13	8.980	0.080	13.9	1.7832	0.0000	OK
15 minute winter	19	11	8.637	0.187	45.9	0.3432	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	3	14.6	0.810	0.107	0.5771	
15 minute winter	2	2.000	3	3.7	0.724	0.072	0.0263	
15 minute winter	3	1.001	4	30.3	0.881	0.264	0.7762	
15 minute winter	4	1.002	6	35.4	1.161	0.208	0.3162	
15 minute winter	5	3.000	6	14.4	0.833	0.393	0.1726	
15 minute winter	6	1.003	7	54.1	1.029	0.392	0.6371	
360 minute winter	7	1.004	8	9.9	0.396	0.122	3.1861	
360 minute winter	8	1.005	9	12.7	0.410	0.168	3.7566	
360 minute winter	9	1.006	9_OUT	12.1	0.339	0.127	1.1871	
360 minute winter	9_OUT	Flow through pond	20	16.0	0.056	0.001	151.5044	
15 minute winter	10	4.000	12	7.7	0.953	0.144	0.3064	
15 minute winter	11	5.000	12	7.8	0.517	0.150	0.3057	
360 minute winter	12	4.001	15	3.9	0.478	0.057	1.2545	
15 minute winter	13	6.000	14	7.8	0.756	0.087	0.3404	
15 minute winter	14	6.001	15	13.7	1.072	0.122	0.3772	
360 minute winter	15	4.002	15_OUT	6.5	0.626	0.078	1.1642	
360 minute winter	15_OUT	Flow through pond	20	16.0	0.056	0.001	151.5044	
360 minute winter	20	9.000	21	4.9	0.526	0.025	2.0575	
360 minute winter	21	Hydro-Brake®	22	4.6				
60 minute winter	22	9.002	22_OUT	4.6	0.612	0.123	0.0362	75.0
15 minute winter	16	7.000	17	15.3	0.477	0.163	1.1087	
15 minute winter	17	7.001	19	30.1	0.623	0.244	0.6306	
15 minute winter	18	8.000	19	9.2	0.754	0.252	0.1835	
15 minute winter	19	7.002	19_OUT	45.7	0.938	0.505	0.5864	



Results for 2 year Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
360 minute winter	19_OUT	344	8.445	0.407	8.7	0.4605	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
360 minute winter	19_OUT	Flow through pond	20	16.0	0.056	0.001	151.5044	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	8.993	0.118	28.5	0.3627	0.0000	OK
600 minute winter	2	585	8.830	0.080	0.8	0.1269	0.0000	OK
600 minute winter	3	585	8.830	0.280	6.4	0.7379	0.0000	OK
600 minute winter	4	585	8.830	0.355	7.4	0.6849	0.0000	OK
600 minute winter	5	585	8.831	0.381	3.0	0.9546	0.0000	SURCHARGED
600 minute winter	6	585	8.830	0.580	11.4	1.0547	0.0000	SURCHARGED
600 minute winter	7	585	8.830	0.705	12.0	1.2289	0.0000	SURCHARGED
600 minute winter	8	585	8.830	0.755	16.0	1.9530	0.0000	SURCHARGED
600 minute winter	9	585	8.830	0.805	15.8	1.1525	0.0000	SURCHARGED
600 minute winter	9_OUT	585	8.831	0.831	15.7	1.1892	0.0000	OK
15 minute winter	10	10	8.982	0.082	15.0	0.1522	0.0000	OK
600 minute winter	11	585	8.830	0.330	1.6	0.5497	0.0000	SURCHARGED
600 minute winter	12	585	8.830	0.530	4.8	0.8926	0.0000	SURCHARGED
15 minute winter	13	10	8.983	0.083	15.0	0.1723	0.0000	OK
600 minute winter	14	585	8.830	0.130	3.2	3.0262	0.0000	OK
600 minute winter	15	585	8.830	0.630	7.6	0.7129	0.0000	SURCHARGED
600 minute winter	15_OUT	585	8.831	0.793	7.1	0.8969	0.0000	OK
600 minute winter	20	585	8.830	0.830	18.8	0.9391	0.0000	SURCHARGED
600 minute winter	21	585	8.829	1.129	4.7	1.2774	0.0000	SURCHARGED
30 minute winter	22	15	7.557	0.057	4.6	0.0642	0.0000	OK
30 minute winter	22_OUT	15	7.528	0.053	4.6	0.0000	0.0000	OK
600 minute winter	16	585	8.830	0.255	3.2	3.5599	0.0000	OK
600 minute winter	17	585	8.831	0.331	6.4	0.9027	0.0000	OK
15 minute winter	18	13	9.009	0.109	26.2	4.3789	0.0000	OK
600 minute winter	19	585	8.830	0.380	10.7	0.6993	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	3	27.6	0.967	0.203	0.9201	
600 minute winter	2	2.000	3	0.8	0.470	0.016	0.0934	
600 minute winter	3	1.001	4	6.4	0.610	0.056	2.2197	
600 minute winter	4	1.002	6	7.4	0.746	0.044	1.1317	
600 minute winter	5	3.000	6	3.0	0.538	0.083	0.3973	
600 minute winter	6	1.003	7	11.0	0.662	0.080	1.1511	
600 minute winter	7	1.004	8	11.5	0.349	0.143	3.3454	
600 minute winter	8	1.005	9	15.8	0.351	0.209	3.7626	
600 minute winter	9	1.006	9_OUT	15.7	0.339	0.164	1.1871	
600 minute winter	9_OUT	Flow through pond	20	18.8	0.042	0.001	324.3953	
15 minute winter	10	4.000	12	14.5	1.137	0.272	0.4875	
600 minute winter	11	5.000	12	1.6	0.321	0.031	0.7948	
600 minute winter	12	4.001	15	4.4	0.455	0.064	1.8552	
15 minute winter	13	6.000	14	14.8	0.844	0.164	0.5602	
600 minute winter	14	6.001	15	3.2	0.687	0.029	1.4751	
600 minute winter	15	4.002	15_OUT	7.1	0.573	0.085	1.2423	
600 minute winter	15_OUT	Flow through pond	20	18.8	0.042	0.001	324.3953	
600 minute winter	20	9.000	21	4.7	0.527	0.024	2.0599	
600 minute winter	21	Hydro-Brake®	22	4.6				
30 minute winter	22	9.002	22_OUT	4.6	0.612	0.123	0.0362	64.0
600 minute winter	16	7.000	17	3.2	0.347	0.034	3.0667	
600 minute winter	17	7.001	19	6.4	0.429	0.052	1.3838	
15 minute winter	18	8.000	19	15.9	0.865	0.434	0.2751	
600 minute winter	19	7.002	19_OUT	10.7	0.619	0.118	1.3260	



Results for 30 year Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	19_OUT	585	8.831	0.793	10.7	0.8971	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	19_OUT	Flow through pond	20	18.8	0.042	0.001	324.3953	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	9.100	0.225	36.8	0.6921	0.0000	OK
15 minute winter	2	12	9.104	0.354	9.2	0.5585	0.0000	SURCHARGED
15 minute winter	3	12	9.098	0.548	80.5	1.4430	0.0000	SURCHARGED
15 minute winter	4	12	9.065	0.590	76.2	1.1378	0.0000	SURCHARGED
15 minute winter	5	13	9.069	0.619	35.9	2.1075	0.0000	SURCHARGED
15 minute winter	6	12	9.041	0.791	100.3	1.4373	0.0000	SURCHARGED
720 minute winter	7	705	9.040	0.915	12.8	1.5946	0.0000	SURCHARGED
720 minute winter	8	705	9.041	0.966	17.7	2.4958	0.0000	SURCHARGED
720 minute winter	9	705	9.040	1.015	17.5	1.4530	0.0000	SURCHARGED
720 minute winter	9_OUT	705	9.041	1.041	17.4	1.4899	0.0000	OK
720 minute winter	10	705	9.040	0.140	1.8	0.2609	0.0000	OK
720 minute winter	11	705	9.041	0.541	1.8	0.8995	0.0000	SURCHARGED
720 minute winter	12	705	9.040	0.740	5.2	1.2461	0.0000	SURCHARGED
720 minute winter	13	705	9.040	0.140	1.8	0.2911	0.0000	OK
720 minute winter	14	705	9.040	0.340	3.6	8.1168	0.0000	SURCHARGED
720 minute winter	15	705	9.040	0.840	8.3	0.9505	0.0000	SURCHARGED
720 minute winter	15_OUT	705	9.041	1.003	8.0	1.1346	0.0000	OK
720 minute winter	20	705	9.040	1.040	20.2	1.1767	0.0000	SURCHARGED
720 minute winter	21	705	9.040	1.340	4.8	1.5150	0.0000	SURCHARGED
15 minute winter	22	10	7.557	0.057	4.5	0.0642	0.0000	OK
15 minute winter	22_OUT	10	7.528	0.053	4.6	0.0000	0.0000	OK
720 minute winter	16	705	9.041	0.466	3.6	8.5804	0.0000	SURCHARGED
720 minute winter	17	705	9.041	0.541	7.2	1.4762	0.0000	SURCHARGED
720 minute winter	18	705	9.041	0.141	3.2	7.1919	0.0000	OK
720 minute winter	19	705	9.041	0.591	11.5	1.0854	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	3	38.7	0.986	0.284	2.8737	
15 minute winter	2	2.000	3	11.3	0.847	0.219	0.2030	
15 minute winter	3	1.001	4	64.3	0.993	0.561	2.4917	
15 minute winter	4	1.002	6	66.9	1.284	0.394	1.1431	
15 minute winter	5	3.000	6	30.8	0.948	0.840	0.3973	
15 minute winter	6	1.003	7	100.1	1.021	0.725	1.1511	
720 minute winter	7	1.004	8	12.7	0.329	0.157	3.3454	
720 minute winter	8	1.005	9	17.5	0.360	0.231	3.7626	
720 minute winter	9	1.006	9_OUT	17.4	0.344	0.181	1.1871	
720 minute winter	9_OUT	Flow through pond	20	19.8	0.043	0.001	432.9581	
720 minute winter	10	4.000	12	1.8	0.602	0.034	1.2541	
720 minute winter	11	5.000	12	1.6	0.307	0.031	0.7948	
720 minute winter	12	4.001	15	4.7	0.428	0.070	1.8552	
720 minute winter	13	6.000	14	1.8	0.432	0.020	1.5575	
720 minute winter	14	6.001	15	3.6	0.687	0.032	2.0819	
720 minute winter	15	4.002	15_OUT	8.0	0.532	0.096	1.2423	
720 minute winter	15_OUT	Flow through pond	20	19.8	0.043	0.001	432.9581	
720 minute winter	20	9.000	21	4.8	0.535	0.024	2.0599	
720 minute winter	21	Hydro-Brake®	22	4.6				
15 minute winter	22	9.002	22_OUT	4.6	0.612	0.123	0.0362	61.5
720 minute winter	16	7.000	17	3.6	0.357	0.038	3.6995	
720 minute winter	17	7.001	19	7.0	0.435	0.056	1.4319	
720 minute winter	18	8.000	19	3.2	0.563	0.087	0.4894	
720 minute winter	19	7.002	19_OUT	11.4	0.622	0.126	1.3260	



Results for 100 year Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
720 minute winter	19_OUT	705	9.041	1.003	11.4	1.1348	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
720 minute winter	19_OUT	Flow through pond	20	19.8	0.043	0.001	432.9581	

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	1	930	9.418	0.543	4.2	1.7591	0.0000	SURCHARGED
960 minute winter	2	930	9.418	0.668	3.8	25.8652	0.0000	FLOOD RISK
960 minute winter	3	930	9.418	0.868	8.3	2.3880	0.0000	FLOOD RISK
960 minute winter	4	930	9.418	0.943	9.1	1.8634	0.0000	FLOOD RISK
960 minute winter	5	930	9.418	0.968	4.1	29.9123	0.0000	FLOOD RISK
960 minute winter	6	930	9.418	1.168	14.4	2.1667	0.0000	FLOOD RISK
960 minute winter	7	930	9.418	1.293	15.8	2.2925	0.0000	SURCHARGED
960 minute winter	8	930	9.418	1.343	21.9	3.6266	0.0000	SURCHARGED
960 minute winter	9	930	9.418	1.393	21.7	1.9931	0.0000	FLOOD RISK
960 minute winter	9_OUT	930	9.419	1.419	21.6	2.0304	0.0000	OK
960 minute winter	10	930	9.418	0.518	2.2	0.9999	0.0000	SURCHARGED
960 minute winter	11	930	9.418	0.918	2.2	1.5768	0.0000	SURCHARGED
960 minute winter	12	930	9.418	1.118	6.5	36.5927	0.0000	SURCHARGED
960 minute winter	13	930	9.418	0.518	2.2	10.5698	0.0000	SURCHARGED
960 minute winter	14	930	9.418	0.718	4.4	11.3215	0.0000	SURCHARGED
960 minute winter	15	930	9.418	1.218	9.6	1.3772	0.0000	SURCHARGED
960 minute winter	15_OUT	945	9.419	1.381	9.3	1.5617	0.0000	OK
960 minute winter	20	945	9.418	1.418	23.3	1.6034	0.0000	FLOOD RISK
960 minute winter	21	930	9.417	1.717	5.3	1.9415	0.0000	FLOOD RISK
960 minute winter	22	945	7.560	0.060	5.0	0.0676	0.0000	OK
960 minute winter	22_OUT	945	7.531	0.056	5.0	0.0000	0.0000	OK
960 minute winter	16	945	9.418	0.843	4.5	11.8734	0.0000	FLOOD RISK
960 minute winter	17	930	9.418	0.918	7.6	2.6531	0.0000	FLOOD RISK
960 minute winter	18	930	9.418	0.518	5.4	38.7062	0.0000	FLOOD RISK
960 minute winter	19	945	9.418	0.968	12.9	1.8472	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	1	1.000	3	4.1	0.546	0.030	3.5371	
960 minute winter	2	2.000	3	-2.9	0.485	-0.056	0.2030	
960 minute winter	3	1.001	4	7.7	0.588	0.067	2.4917	
960 minute winter	4	1.002	6	9.0	0.718	0.053	1.1431	
960 minute winter	5	3.000	6	3.9	0.509	0.107	0.3973	
960 minute winter	6	1.003	7	14.3	0.582	0.104	1.1511	
960 minute winter	7	1.004	8	15.7	0.320	0.195	3.3454	
960 minute winter	8	1.005	9	21.7	0.372	0.287	3.7626	
960 minute winter	9	1.006	9_OUT	21.6	0.354	0.226	1.1871	
960 minute winter	9_OUT	Flow through pond	20	23.3	0.045	0.001	653.1845	
960 minute winter	10	4.000	12	2.2	0.589	0.041	1.5154	
960 minute winter	11	5.000	12	2.1	0.290	0.040	0.7948	
960 minute winter	12	4.001	15	6.2	0.397	0.091	1.8552	
960 minute winter	13	6.000	14	2.2	0.445	0.024	2.1341	
960 minute winter	14	6.001	15	4.0	0.641	0.035	2.0819	
960 minute winter	15	4.002	15_OUT	9.3	0.496	0.112	1.2423	
960 minute winter	15_OUT	Flow through pond	20	23.3	0.045	0.001	653.1845	
960 minute winter	20	9.000	21	5.3	0.507	0.026	2.0599	
960 minute winter	21	Hydro-Brake®	22	5.0				
960 minute winter	22	9.002	22_OUT	5.0	0.628	0.135	0.0389	321.2
960 minute winter	16	7.000	17	3.7	0.338	0.039	3.6995	
960 minute winter	17	7.001	19	7.4	0.415	0.060	1.4319	
960 minute winter	18	8.000	19	3.9	0.591	0.106	0.5966	
960 minute winter	19	7.002	19_OUT	12.7	0.602	0.140	1.3260	



Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.49%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
960 minute winter	19_OUT	945	9.419	1.381	12.7	1.5617	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
960 minute winter	19_OUT	Flow through pond	20	23.3	0.045	0.001	653.1845	