Ashwood Homes Ltd

Sunnydale Close, Surfleet

Flood Risk Assessment & Drainage Strategy

First Issue
November 2021



Revision Schedule

Sunnydale Close, Surfleet

Flood Risk Assessment & Drainage Strategy

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1 INTRODUCTION

1.1 Instructions

1.1.1 This report is prepared in accordance with instructions from Ashwood Homes Ltd to support a planning application to South Holland District Council (SHDC) for a residential development at land to the east of Sunnydale Close, Surfleet PE11 4BS.

1.1.2 The purpose of the report is to assess flood risk in accordance with the National Planning Policy Framework (NPPF) and other current guidelines and determine a drainage strategy for the site. It does not purport to be drainage design for construction purposes.

1.2 Planning Background

1.2.1 A planning application previously submitted to South Holland District Council (ref: H17-0652-15) on land off Sunnydale Close, Surfleet in August 2015. The proposed development was for 26no. residential dwellings was approved by the Local Planning Authority on 3rd April 2017.

1.2.2 The application contained a supporting FRA, which recommended the proposed dwellings be of two storey construction, with the ground floor level raised 900mm above lowest existing ground level at a minimum of +4.0m AOD with 300mm of flood resilient construction.

1.3 Technical Information

National Planning Policy Framework

1.3.1 The National Planning Policy Framework and associated Planning Practice Guidance explains how flood risk should be taken into consideration during the planning and development process. It categorises flood risk by *flood zone* and defines the types of development *appropriate* to each flood zone according to *vulnerability*. The flood zones are defined as:

- Zone 1: Areas with a Low Probability of flooding (annual probability less than 0.1% or 1 in 1000 years).
- Zone 2: Areas with a Medium Probability of flooding (annual probability between 0.1% (1 in 1000 years) and 1.0% (1in 100 years) for rivers, 0.1 – 0.5% (1 in 1000 to 1 in 200 years) for coastal areas.
- Zone 3a: Areas with a High Probability of flooding (annual probability greater than 1.0% (1 in 100 years) for rivers, 0.5% (1 in 200 years) for coastal areas).
- Zone 3b: The Functional Floodplain (probability as Zone 3a).

Environment Agency Flood Maps

1.3.2 The Environment Agency (EA) predicts the likelihood of flooding via a national series of indicative flood maps, available via the GOV.UK website.

1.3.3 The *Flood Map for Planning* shows the flood zones, described above, coloured in different shades of blue. In areas protected by flood defences, this flood map deliberately neglects their presence so as to present a worst-case scenario. Although it does not represent realistic risk, the *Flood Map for Planning* is the authoritative guidance on flood risk for use in the preparation of flood risk assessments for planning applications.

1.3.4 The *Long-Term Flood Risk* maps cover the following topics:

- *Flood Risk from Rivers and the Sea*. This map (previously known as the NaFRA map) shows the risk of fluvial and tidal flooding in a similar manner to the *Flood Map for Planning*, except that, where they exist, defences are recognised. The resulting realistic risk presentation provides useful data for insurance assessors.

- *Flood Risk from Surface Water.* This map shows potential overland flow routes and accumulation of runoff resulting from rainstorm events based on topography, divided into low, medium and high-risk scenarios.

- *Flood Risk from Reservoirs*. This map shows areas which may be subject to flooding from the failure of reservoirs and other water retaining infrastructure, the risk of which is very low.

South Holland District Council Strategic Flood Risk Assessment

1.3.5 Local planning authorities are required to produce a Strategic Flood Risk Assessment (SFRA) which sets the scene for flood risk in their areas. South Holland District Council published its original SFRA, now superseded, in January 2010.

South East Lincolnshire Local Plan

1.3.6 The South East Lincolnshire Local Plan, prepared jointly by South Holland District Council, Boston Borough Council and Lincolnshire County Council, was adopted in March 2019. The South East Lincolnshire SFRA and the 2016 Update of the South Holland District Council SFRA, which includes Surfleet, form part of this Local Plan.

Lincolnshire County Council Preliminary Flood Risk Assessment

1.3.7 Lead Local Flood Authorities (LLFAs) are required to produce a Preliminary Flood Risk Assessment (PFRA) to identify areas where there is significant flood risk from ordinary watercourses and surface water run-off, but not from main rivers or the sea, or from sewers. Lincolnshire County Council, as the LLFA, published its PFRA in June 2011.

Welland & Deepings IDB

1.3.8 Drainage of the site and surrounding area is administered by the Welland and Deepings IDB. The local drain serving the site is Wood's Drain within the Pinckbeck Marsh Catchment, as shown on the IDB's interactive mapping tool.

2 SITE INFORMATION

2.1 Existing Site

Location

2.1.1 The site comprises an irregular parcel of agricultural land to the east of Sunnydale Close, Surfleet. The size has an area of circa 2.1ha. The site location is shown on the attached drawing No. AHL-1583-01-GA-001 *Location Plan*.

Watercourses

2.1.2 The site and the land around are drained to the Welland and Deepings IDB drain known as Wood's Lane Drain which runs in a south-easterly direction from the southern site boundary, joining the Blue Gowt Outfall to form part of the Pinchbeck Marsh Catchment Area.

2.1.3 The Pinchbeck Marsh Catchment system flows to the east through the Blue Gowt Outfall, where the water joins the River Glen, approximately 1km from the site. From here water joins the River Welland and out into the North Sea.

Topography

2.1.4 The site comprises of gently sloping ground in a north-south direction. The ground levels vary between +4.5m AOD at the northern boundary to +3.2m AOD, a range of 1.3m. Topographical details are shown on the attached Drawing No AS2441/1 '*Topographical Survey'* (Appendix 7).

Ground Conditions

2.1.5 According to BGS data, the site is located on tidal flat deposits, overlying the Oxford Clay Mudstone Formation.

2.1.6 The *Combined Phase 1 Desk Study and Phase 2 Exploratory Investigation* by GeoDyne Limited, dated March 2020 (ref: D40008), reported:

- The ground conditions comprise slightly sandy clayey very silty topsoil at a depth of 0.4m begl.
- Beneath the topsoil, firm very silty CLAY was encountered at 1.0m begl.
- The characteristics were concluded to be typical of Tidal Flat Deposits.

2.1.7 Soakaway testing was carried out on the site and is reported in page 24 of the *Combined Phase 1 Desk Study and Phase 2 Exploratory Investigation*. The water

level failed to significantly drop within any of the 5no. trial pits. Therefore, infiltration to ground is not achievable at the site.

2.2 Proposed Development

2.2.1 It is proposed to develop the site for residential use for 48 No. dwellings, as shown on the NKW Design Drawing No 1280-004 Rev A *Planning Layout*.

2.2.2 The ground floor level (FFL) of the new 2-storey dwelling houses will be set at a minimum of +3.7m AOD. Where necessary to achieve adequate falls for drainage, FFLs will be set at higher levels up to +4.9m AOD.

2.2.3 Ground levels around the buildings will be set at 0.15m below FFLs with access roads and public open space at lower levels.

2.2.4 Flood resilient construction will be incorporated up to 300mm above the FFLs.

2.2.5 About 40% of the total site area will comprise impermeable roofs, drives and access roads. The remaining 60% of the total site area will comprise private gardens and soft landscaped public open space and sustainable urban drainage features.

3 FLOODING INFORMATION

3.1 Flood Data

3.1.1 The EA *Flood Map for Planning* is attached at Appendix 1. Except for a small 'ribbon' at centre of Surfleet, this map shows Flood Zone 3 at the site and extending for several kilometres in all directions.

3.1.2 The *Long-Term Flood Risk* maps, including *Flood Risk from Rivers or the Sea* and *Flood Risk from Surface Water* are also attached at Appendix 1.

3.1.3 The *Residual Peak Depth - District 1% Fluvial/0.5% Tidal Event Probability* map for 2116 from the South Holland SFRA 2017 Update is attached at Appendix 2. *Residual Risk Extent, Residual Flood Hazard* and *Residual Peak Velocity Maps* have also been examined.

3.2 Flood History

3.2.1 According to the web-based EA *Historic Flood Map*, there has been no historic incidents of flooding at the site. Increasing the search area on the DEFRA Historic Flood Map tool shows the village of Surfleet has had no historic flood events.

3.2.2 Neither the South Holland SFRA nor the Lincolnshireshire County Council PFRA, make any reference to flood history at the site.

3.3 Potential for Tidal or Fluvial Flooding

EA Flood Map for Planning

3.3.1 The *Flood Map for Planning,* which assumes that no flood defences exist, shows the site to be entirely located in Flood Zone 3 (High Probability) associated with the potential failure of the fluvial defences of the River Glen.

3.3.2 The nearest Flood Zone 1 (Low Probability) is located 310m north on Surfleet Road, adjacent to Saint Laurence's Church.

EA Long Term Flood Map – Flood Risk from Rivers or the Sea

3.3.3 The *Flood Risk from Rivers or the Sea* map, which acknowledges the presence of flood defences, shows the site to be located entirely in an area of 'Medium' flood risk, the equivalent of Flood Zone 3.

South East Lincolnshire SFRA

3.3.4 As can be seen from the attached *Flood Map for Planning*, almost the entire area of South East Lincolnshire is in Flood Zone 3. Strict adherence to the guidelines would

consequently result in no development being permitted across a very large area, which is clearly impracticable. The South East Lincolnshire SFRA has therefore been developed to ensure that there is a consistent evidence base against which to take development decisions, particularly with respect to mitigation requirements.

3.3.5 The guidance on finished floor levels (FFLs) provided by Appendix C of the SFRA is shown in table 1 below.

Table 1 - South East Lincolnshire SFRA Appendix C Guidance

Flood Depth	Appendix C Guidance
0 – 0.25m	+0.3m above GL with flood resilient construction to a height of 300mm above flood depth.
0.25 – 0.5m	+0.5m above GL with flood resilient construction to a height of 300mm above flood depth.
0.5m – 1m	+1.0m above GL with flood resilient construction to a height of 300mm above flood depth.
1m – 1.6m	+1.0m above GL with 300mm flood resilient construction above flood depth and 600mm demountable defences.
>1.6m	Minimum of two storeys with no ground floor habitable rooms. First floor living accommodation above highest flood depth.

South Holland SFRA 2017 Update Maps

3.3.6 Whereas the *Flood Map for Planning* simply assumes that defences are non-existent, the SFRA 2017 Update maps are based on modelling a theoretical series of breaches in the tidal defences. The map generally referred to in assessing development applications is the which not only forecasts the consequences of a defences breach but also the effect of climate change over the next 100 years. This map shows various flood depths in the ranges, 0.0m-0.25m (yellow) and 0.25m-0.5m (light orange) across the site for this conjectured event – see Appendix 2.

3.3.7 As can be seen from AHL-1583-01-DR-003 *Flood Risk Areas* (Appendix 8), there is a small area of the site categorised as ‘dark orange’, with a ground level of +3.3m AOD and predicted flood depth of 1.0m. It is considered that this predicted flood level is an anomaly in the data given that the lowest ground level on the site is 3.2m, with a flood depth of 0.5m. Therefore, it is considered that the peak level would be across the full site would not exceed 0.5m. Thus, this document sets out the mitigation measures in accordance with Appendix C or the SFRA up to 0.5m flood depth.

3.4 Potential for Surface Water Flooding

EA Flood Risk from Surface Water Map

3.4.1 The EA *Flood Risk from Surface Water* map shows low risk of surface water flooding at the site.

Lincolnshire County Council PFRA

3.4.2 There is no specific mention of flood risk at the site in the LCC *Preliminary Flood Risk Assessment* (PFRA).

Welland & Deepings IDB

3.4.3 The site and surrounding land are well drained by the system of Welland & Deepings IDB maintained drains, thereby preventing surface water flooding.

3.5 Potential for Flooding from Reservoirs

3.5.1 There is no risk of flooding from reservoirs as shown by the EA *Flood Risk from Reservoirs* map.

3.6 Potential for Flooding from Groundwater or Sewers

3.6.1 Flood risk from other sources such as groundwater or sewers is considered to be negligible in comparison with that for tidal at this site. It is considered that the ground raising proposed for the latter will address flood risk from these sources which, consequently, are not addressed further in this assessment.

4 FLOOD RISK ASSESSMENT

4.1 Approach to Development

4.1.1 As can be seen from the *Flood Map for Planning* at Appendix 1, the area around Surfleet is situated in Flood Zone 3. This means that the village can only expand by permitting development in Flood Zone 3, as supported by the SFRA, using suitable mitigation measures.

4.1.2 Such development has been in progress during the past several years; planning permission on land off Station Road for 30no. dwellings (Ref H17-0562-16), is a typical example. In permitting residential development on such sites, the authorities generally consider the contingency scenario represented by the *Residual Peak Depth - District 2115 1% Fluvial/0.5% Tidal Event Probability* map from the SFRA to be an appropriate guideline and typically require that finished floor levels (FFLs) be set in accordance with the guidance provided in Appendix C of the SFRA.

4.1.3 Additionally, the site of this proposed development was previously subject to a planning application (Ref H17-0625-15) for the residential development of 26 dwellings. A Flood Risk Assessment was prepared for this previous application and was considered acceptable by South Holland District Council.

4.2 Tidal Flooding

Predicted Flood Levels

4.2.1 The EA *Long Term Flood Risk from Rivers or the Sea map* (previously known as the NaFRA map), represents the current defended state of the site and is used by insurers to assess the actual likelihood of a flood occurring. This map shows part of the site to be at 'Medium' flood risk, the equivalent of Flood Zone 3 and consistent with the *Flood Map for Planning*.

4.2.2 The South Holland SFRA maps are based on modelling the theoretical breaching of the coastal defences; however, based on the historical records over the past 50+ years, the chances of this happening in the foreseeable future must be regarded as extremely low.

4.2.3 The reference SFRA map, *Residual Peak Depth - District 2115 1% Fluvial/0.5% Tidal Event Probability* – see Appendix 2 - shows areas of the site having flood depths of 0m-0.25m (yellow) areas having flood depths of 0.25m-0.5m (light orange).

4.2.4 As shown on the attached Drawing No AS2441/1 '*Topographical Survey'*, the ground levels lie in the range +3.2m AOD and +4.5m AOD.

4.2.5 There are two flood depth zones at the site, as follows:

- Flood depths 0m-0.25m (yellow) – FFL set 300mm above existing ground level with 300mm of flood resilient construction.
- Flood depths 0.25-0.5 (light orange) – FFL set a minimum of 500mm above existing ground level with 300mm of flood resilient construction.

4.2.6 While the FFLs will be set at a minimum of +3.7m AOD, where necessary to achieve adequate falls for drainage, they will be set at higher levels up to +4.9m AOD. Gardens, driveways and access roads will be set at lower levels as appropriate. As it would remain possible that some areas between the dwellings might flood, it would be prudent for the occupants to operate a flood management plan so as to assure their safety in an extreme event – see Section 5 below.

4.2.7 As the Flood Zone 3 area indicated at the site extends as far as the coast without a break – see attached *Flood Map for Planning* - raising ground levels at the site will not occupy flood storage volume. Consequently, no floodplain compensation is required and there will be no increase in flood risk elsewhere as a result of the development.

4.3 Surface Water Flooding

4.3.1 As stated in 3.4.1 above, there is low risk of surface water flooding at the site. This is achieved by the site and surrounding land being well drained by the system of Welland & Deepings IDB maintained drains, thereby preventing surface water flooding.

4.3.2 Although the impermeable area of the proposed development will be increased by the introduction of roofs, driveways and access roads, the corresponding increase in surface water flood risk will be fully mitigated by the SUDS-based surface water drainage system described in Section 6 below.

5 FLOOD MANAGEMENT

5.1 Flood Management

5.1.1 As the site is at risk of flooding in a residual risk breach event, even though there is a very low risk of floodwater entering the buildings, a Flood Management Plan containing the following robust flood management provisions will be prepared and implemented.

5.2 Warnings and Evacuation

5.2.1 The occupants of the new dwellings will register for the EA's *Floodline Warnings Direct* service which is available for the site. Should a flood warning be received or a flood event otherwise be predicted, occupants will evacuate in good time before any local flooding occurs to dry ground either at St Laurence's Church, about 350m to the north, or other locations clear of the flood zones.

5.2.2 Alternatively, residents might remain in their houses and ascend to safe refuge on the upper floors so as to remain well clear of flooding outside the buildings or even of any floodwater entering at ground floor level. In the event of a need for evacuation of any personnel, e.g., for medical reasons, attendance by the emergency services would not be precluded by the depth of the floodwater in the access roads.

5.2.3 In neither case would the occupants be exposed to any danger.

5.3 Sequential Test

5.3.1 There are no sites available outside the flood zones in Surfleet or the surrounding area, there is no alternative but to build in the flood zones, as recognised by the South Holland SFRA. This has been the case for some years and the established practice is to mitigate the flood risk by raising ground levels to lift new developments out of the floodplain.

5.3.2 Additionally, the site is allocated in the adopted Local Plan (site ref: Sur006). As part of the Local Plan process, the sequential test has already been undertaken and therefore considered to be satisfied.

5.4 Exception Test

5.4.1 Notwithstanding the above, in order to ensure the safety of the occupants it is necessary to satisfy the NPPF Exception Test. The following points are relevant:

5.4.2 The development of new housing with easy access to the existing urban facilities, will provide significant sustainability benefits to the village of Surfleet.

5.4.3 The occupants of the new dwellings will register for the EA's *Floodline Warnings Direct* service which is available for the site. Should a flood warning be received or a flood event otherwise predicted, occupants will evacuate in good time before any local flooding occurs to dry ground either at St Laurence's Church, about 350m to the north, or other location clear of the flood zones.

5.4.4 As the Flood Zone 3 area indicated at the site extends as far as the coast without a break, raising ground levels at the site will not occupy flood storage volume. Consequently, no floodplain compensation is required and there will be no increase in tidal or fluvial flood risk elsewhere because of the development.

5.4.5 Similarly, because of the SUDS-based site drainage scheme, there will be no increase in surface water flood risk elsewhere as a result of the development.

5.4.6 Consequently, the Exception Test is considered to be satisfied.

5.5 Flood Resilience

5.5.1 In line with this requirement, flood resilient construction will be incorporated up to 300mm above the +3.7m AOD FFLs.

6 DRAINAGE STRATEGY

6.1 Surface Water Drainage

Existing Site Drainage

6.1.1 The site drains at present to the Welland and Deepings IDB maintained drain known as Wood's Drain, which runs in a south-easterly direction from the southern site boundary, joining Blue Gowt Outfall to form part of the Pinchbeck Marshes Catchment. From here, the water runs into the River Glen and discharges into the River Welland.

Sustainable Urban Drainage Systems (SUDS)

6.1.2 The drainage system will be based on SUDS techniques for the disposal of surface water run-off, as described below.

6.1.3 The first consideration in the SUDS hierarchy is infiltration to ground. As recorded in para. 2.1.7 above, it is considered that infiltration to the ground will not be feasible.

6.1.4 The second consideration in the SUDS hierarchy is discharge to watercourse. As the nearest receiving watercourse is the IDB drain at the southern site boundary, Wood's Drain, this is the principal feasible option.

6.1.5 The presence of the watercourse which receives the current runoff, makes the third consideration in the SUDS hierarchy, discharge to sewer, unnecessary.

Proposed Site Drainage

6.1.6 The proposed surface water drainage system, therefore, will collect future runoff from the impermeable areas of the site, 40% of the total area, as shown on Drawing No AHL-1583-01-DR-002 *Drainage Strategy*, and discharge the outflow to the IDB drain. Hydraulic calculations are attached at Appendix 4.

6.1.7 The proposed system will collect runoff from the roofs, driveways and access roads and convey it via filter drains alongside the access roads to a normally dry detention basin in the public open space at the north-east corner of the site. The attenuated flow will be discharged to the adjacent IDB drain via a flow control device at the standard IDB runoff rate of 1.4 l/s/ha, which equates to 5 l/s for the whole site – see Appendix 4. This discharge rate may be increased by agreement with the IDB at a later date.

6.1.8 As shown in the hydraulic calculations at Appendix 4, the proposed storage volume in the detention basin will be sufficient to accommodate the 1 in 100-year rainfall event with 40% climate change allowance in accordance with the EA Guidance *Flood Risk Assessments: Climate Change Allowances*, March 2020.

6.1.9 The permeable areas of the site, 60% of the total area, will comprise private gardens and soft landscaping in the public open spaces and therefore offer a measure of bioretention through shallow infiltration into topsoil and the evapotranspiration of the vegetation.

Treatment

6.1.10 Adequate treatment of runoff from the access roads and driveways will be provided by the filter drains running alongside the access roads which convey the runoff to the outfall.

Allowance for Urban Creep

6.1.11 An allowance of 10% urban creep has been made in the hydraulic calculations in accordance with BS 8582:2013 *Code of practice for surface water management for development sites*.

Long Term Maintenance

6.1.12 The drainage system and SUDS features will be maintained in the long term by public authorities where adoption is feasible and by individual householders and/or a private management company where it is not.

6.1.13 An operation and maintenance manual for the SUDS elements will be prepared and administered.

Surface Water Approvals

6.1.14 The proposed drainage system is illustrated on Drawing No AHL-1583-01-DR-002 *Drainage Strategy* with hydraulic calculations attached at Appendix 4. Discharge to the IDB maintained drain will be subject to approval by the North Levels Internal Drainage Board.

6.1.15 All relevant authorities will be kept fully informed regarding the detailed design of the surface water drainage system. It is normal practice for detailed surface water drainage design to be subject to the approval of the local planning authority subsequent to the grant of planning permission and this will be sought from South Holland District Council at the appropriate time.

6.2 Foul Sewerage

Existing Foul Sewerage

6.2.1 There is no foul sewerage currently serving the site.

Proposed Foul Sewerage

6.2.2 As shown on Drawing No AHL-1583-01-DR-002, the foul sewage from the proposed development will be conveyed by gravity to the existing foul sewer on Wood's Lane.

Foul Sewerage Approvals

6.2.3 At the detailed design stage, application will be made to the Statutory Water Authority, Anglian Water, under the Water Industry Act 1991 for consent to discharge foul sewage from the proposed development into the public sewer system.

6.2.4 All relevant authorities will be kept fully informed regarding the detailed design of the foul sewerage system. It is normal practice for detailed foul water drainage design to be subject to the approval of the local planning authority subsequent to the grant of planning permission and this will be sought from South Holland District Council at the appropriate time.

7 CONCLUSIONS

7.1.1 The EA *Flood Map for Planning* shows the site to located in Flood Zone 3, High Probability of flooding.

7.1.2 The SFRA map *Residual Peak Depth – District 2115 1% Fluvial/0.5% Tidal Event Probability* map, which forecasts the consequences of a defences breach and the effect of climate change over the next 100 years, shows depths in the ranges 0m-0.25m (yellow) and 0.25m-0.5m (light orange).

7.1.3 In accordance with the guidance in Appendix C of the SFRA, finished floor levels (FFLs) of the buildings will be set at a minimum of +3.7m AOD.

7.1.4 In accordance with the guidance in Appendix C of the SFRA, flood resilient construction will be incorporated up to a minimum level of 300mm above FFLs of +3.7m AOD.

7.1.5 As the Flood Zone 3 area indicated at the site extends as far as the coast without a break, raising ground levels at the site will not occupy flood storage volume.

7.1.6 The EA *Flood Risk from Surface Water* map shows no significant risk of surface water flooding at the site. Surface water run-off will continue to discharge to the adjacent IDB drain, as it does at present. The new impermeable areas of the site will be drained using SUDS techniques which will provide flow attenuation to reduce flood risk and treatment to improve water quality.

7.1.7 Climate change allowance will be made in accordance with the latest EA guidelines.

7.1.8 In order to address the risk of flooding, a Flood Management Plan will be prepared for the safety of occupants, involving early warning and either evacuation to dry ground or refuge on an upper floor, as required.

7.1.9 As the site is allocated within the South Holland Local Plan, the NPPF Sequential Test is considered to be satisfied. Additionally, level raising is the normally acceptable mitigation practice for similar developments in the Holbeach area and supported by the South Holland SFRA.

7.1.10 As the proposed buildings will be made safe by raising the finished floor levels to the residual risk flood level and adopting of a Flood Management Plan which includes early warning from the EA and options of evacuation, the NPPF Exception Test is considered to be satisfied.

7.1.11 Foul sewerage will be connected to the public sewerage system on Peterborough Road by gravity.

7.1.12 With regard to flood risk and drainage, therefore, the site is suitable for the proposed use and is compliant with the guidance set out within Appendix C of the SFRA. The development may be occupied safely and adequately drained without increasing flood risk elsewhere.

APPENDIX 1

EA FLOOD MAPS

Flood map for planning

Your reference	Location (easting/northing)	Created
Surfleet	**525210/327881**	**1 Nov 2021 15:03**

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see www.gov.uk/guidance/flood-risk-assessment-standing-advice)

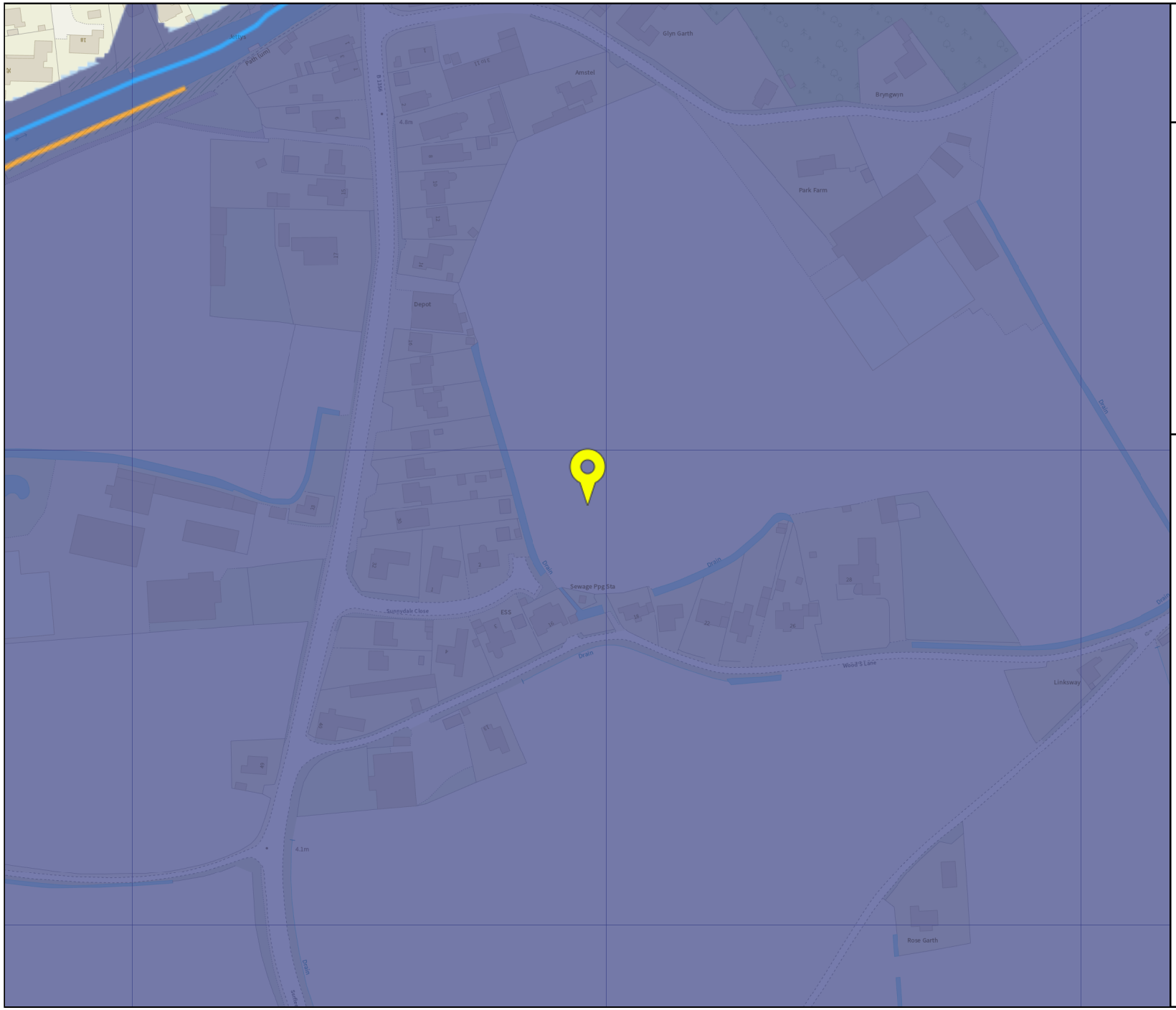
Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2021 OS 100024198. https://flood-map-for-planning.service.gov.uk/os-terms



Environment Agency

Flood map for planning

Your reference
Surfleet

Location (easting/northing)
525210/327881

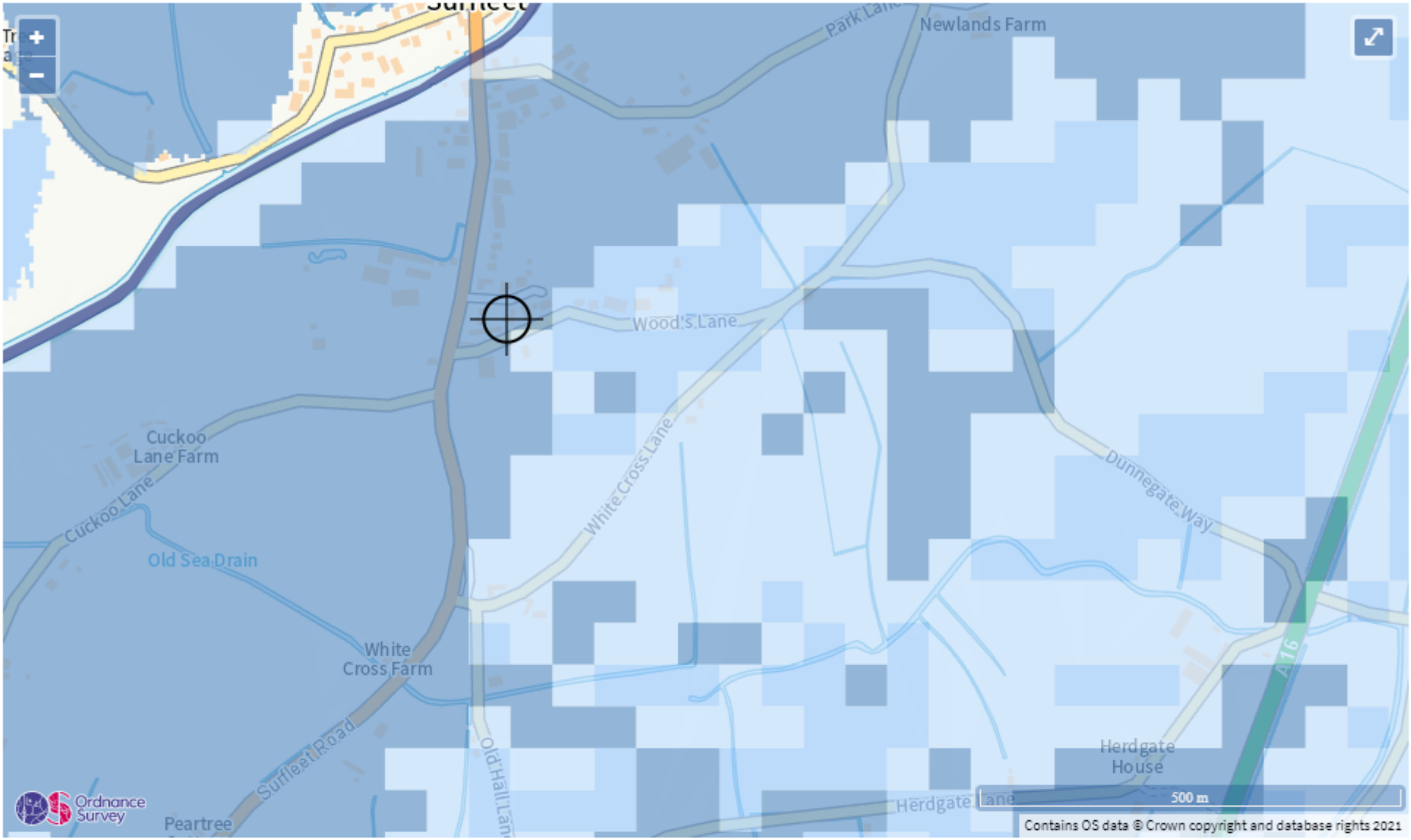
Scale
1:2500

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1 Nov 2021 15:03

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

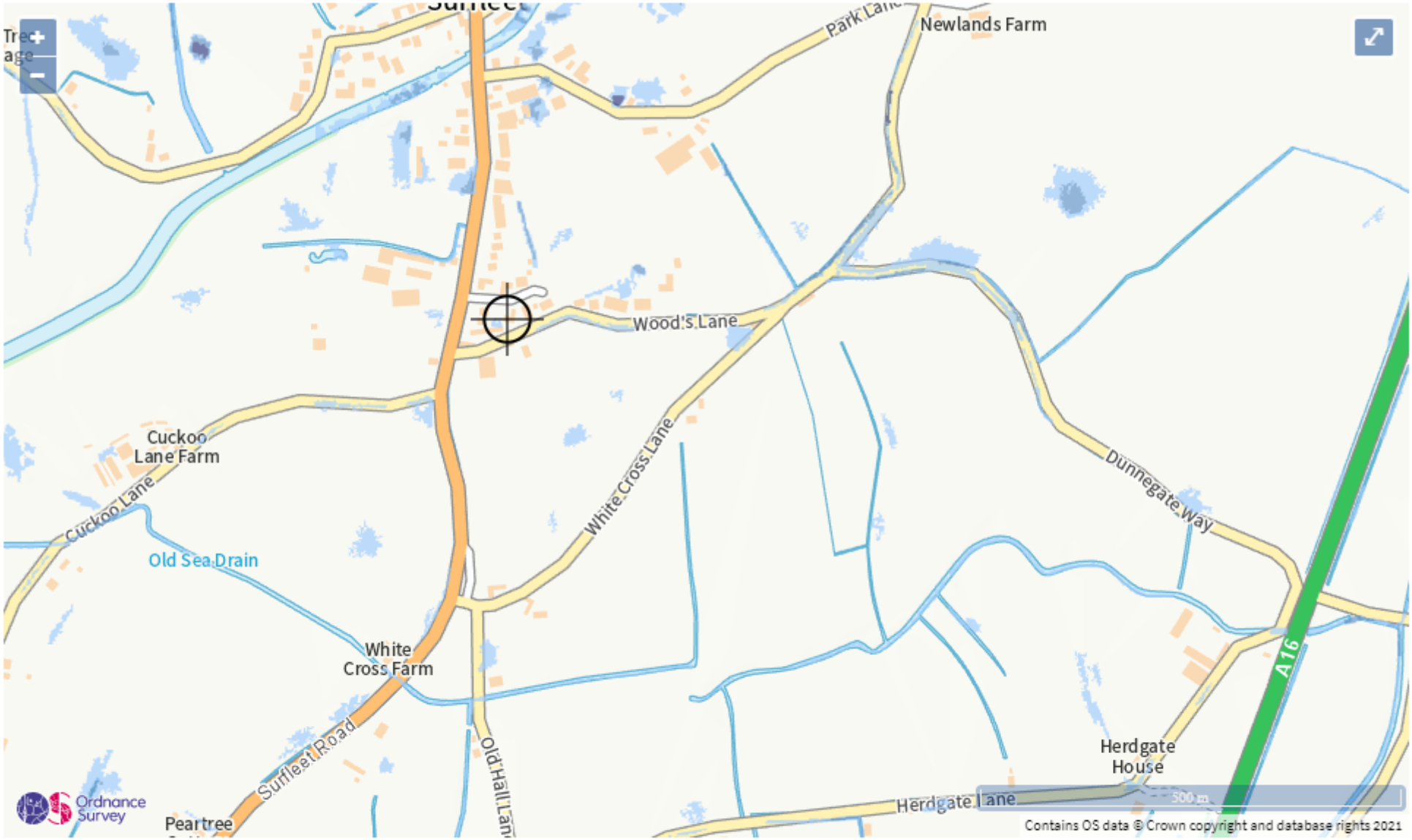
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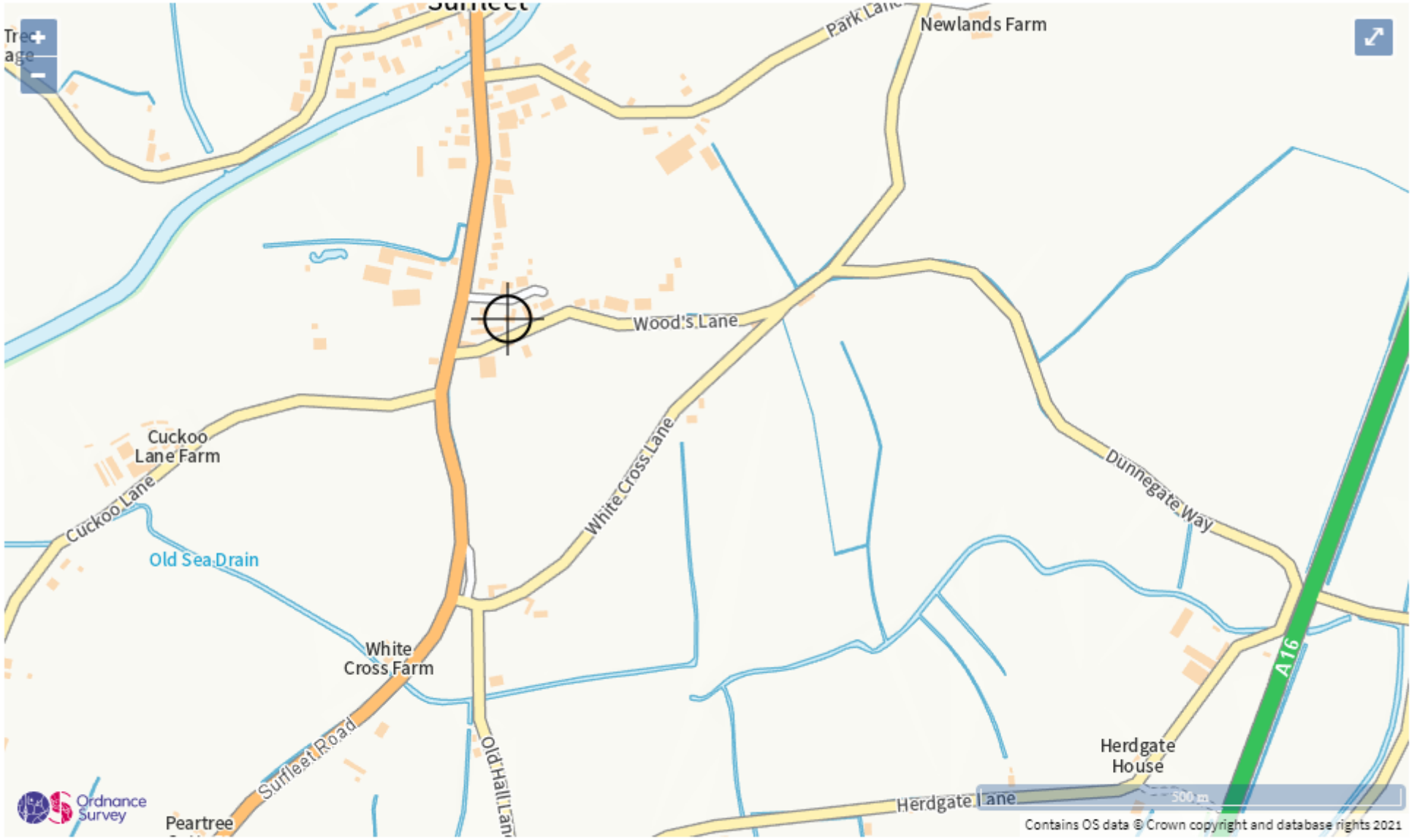
Extent of flooding from rivers or the sea

High Medium Low Very low Location you selected



Extent of flooding from surface water

High Medium Low Very low Location you selected



Extent of flooding from reservoirs

Maximum extent of flooding Location you selected

APPENDIX 2

SOUTH HOLLAND SFRA FLOOD DEPTH MAP

NOTES

1. The potential flooding consequences shown on this map primarily relate to flooding from the sea and main rivers taking into account the presence of current flood risk management measures such as flood defences.

2. This update only included new flood risk information from River Welland (Fluvial), River Glen (Fluvial) and Tidal hazard mapping (River Welland, River Nene and the Wash sea defences). No new information from the Internal Drainage Boards and associated systems was used for this update.

3. In addition to the potential flood extents shown on this map, there may be shallow flooding in low-lying rural areas

4. The consequences designated as being a Residual Risk arise from direct overtopping of defences, where this would occur, together with breach failure which is assumed could occur at any point along the defences.

5. Functional Floodplain encompasses areas where water is intended to flow or be stored in times of flood.

6. Land outside South Holland District is not considered.

7. This map shows the extents only of the flooding probability bands relevant to the map Title

Map Legend

Peak Depth

- 0m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1m
- 1m - 2m
- 2m +
- Functional Floodplain
- South Holland District Boundary

REV	DATE	REMARKS
2	Feb 17	Modelling and Mapping Update
1	Dec 16	Modelling and Mapping Update

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COUNCIL OFFICES
PRIORY ROAD
SPALDING
LINCOLNSHIRE
PE11 2XE

UPDATE OF STRATEGIC FLOOD RISK ASSESSMENT

Residual Peak Depth
Surfleet- Year 2115
1% Fluvial / 0.5% Tidal Event Probability

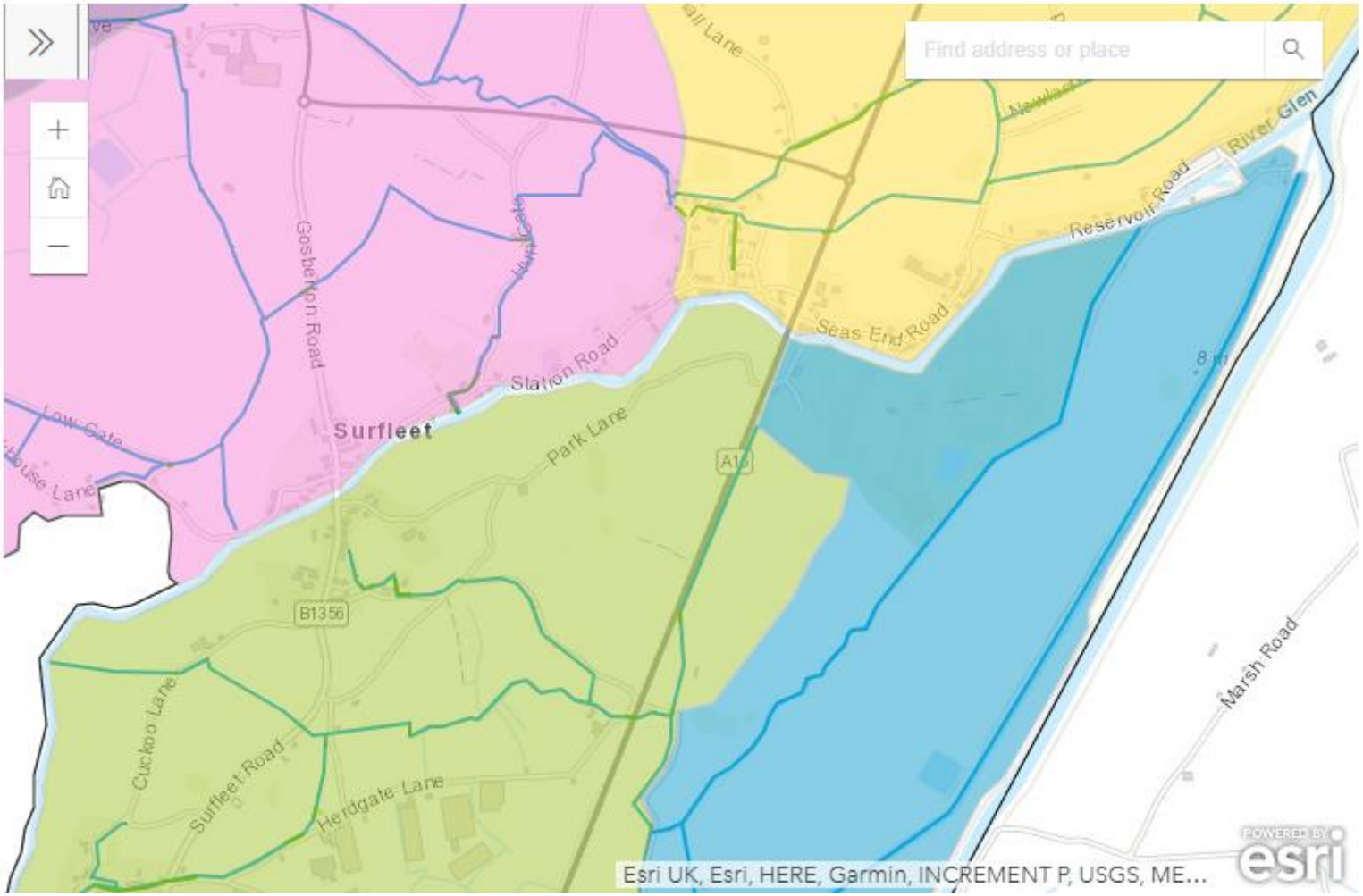
DATE OF ISSUE: Feb 2017 **REV NO:** 2

SCALE: 1 : 7500 @ A1

MAP NO:

APPENDIX 3

WELLAND & DEEPINGS IDB DRAIN MAP


Find address or place
Gosberton Road
Surfleet
Station Road
Park Lane
Low Gate
Seas End Road
Reservoir Road
River Glen
B1356
Cuckoo Lane
Surfleet Road
Herdgate Lane
Marsh Road
Esri UK, Esri, HERE, Garmin, INCREMENT P, USGS, ME...
esri

APPENDIX 4

HYDRAULIC CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	2.000
Ratio-R	0.400	Preferred Cover Depth (m)	1.000
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)
S1	0.095	5.00	4.850	1500	525207.330	328030.741	1.850
S2	0.068	5.00	4.900	1500	525214.121	328007.725	1.952
S3	0.069	5.00	4.810	1500	525234.354	327996.289	1.810
S4	0.067	5.00	4.800	1800	525215.806	327997.123	1.876
S5	0.102	5.00	4.350	1500	525201.247	327972.949	1.500
S6	0.051	5.00	4.300	1500	525202.903	327955.741	1.500
S7	0.074	5.00	4.250	1500	525266.236	327894.577	1.533
S8	0.119	5.00	4.150	1500	525229.561	327884.839	1.515
S9	0.206	5.00	4.150	1800	525222.577	327886.679	1.531
S10	0.038	5.00	4.150	1500	525216.863	327881.146	1.549
S11	0.011	5.00	4.150	1500	525216.193	327876.801	1.559
S12	0.061	5.00	4.150	1500	525209.903	327872.423	1.576
S13	0.000		4.100	1500	525218.129	327847.649	1.634
S14	0.000		3.900	1200	525225.527	327846.525	1.465
HW1	0.000		3.410	1500	525240.762	327842.587	1.040

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	S1	S2	23.997	0.600	3.000	2.948	0.052	461.5	500	5.40	50.0
1.001	S2	S4	10.735	0.600	2.948	2.924	0.024	447.3	500	5.57	50.0
2.000	S3	S4	18.567	0.600	3.000	2.924	0.076	244.3	500	5.22	50.0
1.002	S4	S5	28.220	0.600	2.924	2.850	0.074	381.3	500	6.00	50.0
1.003	S5	S6	17.287	0.600	2.850	2.800	0.050	345.7	500	6.25	50.0
1.004	S6	S9	71.810	0.600	2.800	2.619	0.181	396.7	500	7.35	50.0
3.000	S7	S8	37.946	0.600	2.717	2.635	0.082	462.8	500	5.63	50.0
3.001	S8	S9	7.222	0.600	2.635	2.619	0.016	451.4	500	5.75	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)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.004	197.2	18.0	1.350	1.452	0.095	0.0	101	0.634
1.001	1.020	200.4	30.9	1.452	1.376	0.163	0.0	131	0.746
2.000	1.385	272.0	13.1	1.310	1.376	0.069	0.0	74	0.727
1.002	1.106	217.2	56.7	1.376	1.000	0.299	0.0	173	0.936
1.003	1.162	228.2	76.1	1.000	1.000	0.401	0.0	198	1.049
1.004	1.084	212.9	85.8	1.000	1.031	0.452	0.0	220	1.027
3.000	1.003	196.9	14.0	1.033	1.015	0.074	0.0	89	0.589
3.001	1.016	199.4	36.6	1.015	1.031	0.193	0.0	144	0.781

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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)
1.005	S9	S10	7.954	0.600	2.619	2.601	0.018	441.9	500	7.48	50.0
1.006	S10	S11	4.396	0.600	2.601	2.591	0.010	439.6	500	7.55	50.0
1.007	S11	S12	7.664	0.600	2.591	2.574	0.017	450.8	500	7.68	50.0
1.008	S12	S13	26.104	0.600	2.574	2.516	0.058	450.1	500	8.10	50.0
1.009	S13	S14	7.483	0.600	2.466	2.435	0.031	241.4	300	8.23	50.0
1.010	S14	HW1	15.736	0.600	2.435	2.370	0.065	242.1	300	8.49	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)	Pro Depth (mm)	Pro Velocity (m/s)
1.005	1.027	201.6	161.5	1.031	1.049	0.851	0.0	340	1.136
1.006	1.029	202.1	168.7	1.049	1.059	0.889	0.0	351	1.146
1.007	1.016	199.6	170.8	1.059	1.076	0.900	0.0	358	1.136
1.008	1.017	199.7	182.3	1.076	1.084	0.961	0.0	377	1.146
1.009	1.007	71.2	182.3	1.334	1.165	0.961	0.0	300	1.020
1.010	1.006	71.1	182.3	1.165	0.740	0.961	0.0	300	1.019

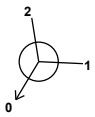
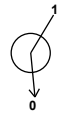
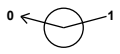
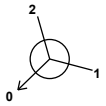
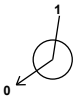
Pipeline Schedule

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	23.997	461.5	500	Circular	4.850	3.000	1.350	4.900	2.948	1.452
1.001	10.735	447.3	500	Circular	4.900	2.948	1.452	4.800	2.924	1.376
2.000	18.567	244.3	500	Circular	4.810	3.000	1.310	4.800	2.924	1.376
1.002	28.220	381.3	500	Circular	4.800	2.924	1.376	4.350	2.850	1.000
1.003	17.287	345.7	500	Circular	4.350	2.850	1.000	4.300	2.800	1.000
1.004	71.810	396.7	500	Circular	4.300	2.800	1.000	4.150	2.619	1.031
3.000	37.946	462.8	500	Circular	4.250	2.717	1.033	4.150	2.635	1.015
3.001	7.222	451.4	500	Circular	4.150	2.635	1.015	4.150	2.619	1.031
1.005	7.954	441.9	500	Circular	4.150	2.619	1.031	4.150	2.601	1.049
1.006	4.396	439.6	500	Circular	4.150	2.601	1.049	4.150	2.591	1.059
1.007	7.664	450.8	500	Circular	4.150	2.591	1.059	4.150	2.574	1.076
1.008	26.104	450.1	500	Circular	4.150	2.574	1.076	4.100	2.516	1.084
1.009	7.483	241.4	300	Circular	4.100	2.466	1.334	3.900	2.435	1.165
1.010	15.736	242.1	300	Circular	3.900	2.435	1.165	3.410	2.370	0.740

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	1500	Manhole	Adoptable	S2	1500	Manhole	Adoptable
1.001	S2	1500	Manhole	Adoptable	S4	1800	Manhole	Adoptable
2.000	S3	1500	Manhole	Adoptable	S4	1800	Manhole	Adoptable
1.002	S4	1800	Manhole	Adoptable	S5	1500	Manhole	Adoptable
1.003	S5	1500	Manhole	Adoptable	S6	1500	Manhole	Adoptable
1.004	S6	1500	Manhole	Adoptable	S9	1800	Manhole	Adoptable
3.000	S7	1500	Manhole	Adoptable	S8	1500	Manhole	Adoptable
3.001	S8	1500	Manhole	Adoptable	S9	1800	Manhole	Adoptable
1.005	S9	1800	Manhole	Adoptable	S10	1500	Manhole	Adoptable
1.006	S10	1500	Manhole	Adoptable	S11	1500	Manhole	Adoptable
1.007	S11	1500	Manhole	Adoptable	S12	1500	Manhole	Adoptable
1.008	S12	1500	Manhole	Adoptable	S13	1500	Manhole	Adoptable
1.009	S13	1500	Manhole	Adoptable	S14	1200	Manhole	Adoptable
1.010	S14	1200	Manhole	Adoptable	HW1	1500	Manhole	Adoptable

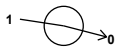
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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1	525207.330	328030.741	4.850	1.850	1500	 0	1.000	3.000	500
S2	525214.121	328007.725	4.900	1.952	1500	 1 0	1.000 1.001	2.948 2.948	500 500
S3	525234.354	327996.289	4.810	1.810	1500	 0	2.000	3.000	500
S4	525215.806	327997.123	4.800	1.876	1800	 1 2 0	2.000 1.001 1.002	2.924 2.924 2.924	500 500 500
S5	525201.247	327972.949	4.350	1.500	1500	 1 0	1.002 1.003	2.850 2.850	500 500
S6	525202.903	327955.741	4.300	1.500	1500	 1 0	1.003 1.004	2.800 2.800	500 500
S7	525266.236	327894.577	4.250	1.533	1500	 0	3.000	2.717	500
S8	525229.561	327884.839	4.150	1.515	1500	 1 0	3.000 3.001	2.635 2.635	500 500
S9	525222.577	327886.679	4.150	1.531	1800	 1 2 0	3.001 1.004 1.005	2.619 2.619 2.619	500 500 500
S10	525216.863	327881.146	4.150	1.549	1500	 1 0	1.005 1.006	2.601 2.601	500 500
S11	525216.193	327876.801	4.150	1.559	1500	 1 0	1.006 1.007	2.591 2.591	500 500
S12	525209.903	327872.423	4.150	1.576	1500	 1 0	1.007 1.008	2.574 2.574	500 500
S13	525218.129	327847.649	4.100	1.634	1500	 1 0	1.008 1.009	2.516 2.466	500 300

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S14	525225.527	327846.525	3.900	1.465	1200	1	1.009	2.435	300
									
						0	1.010	2.435	300
HW1	525240.762	327842.587	3.410	1.040	1500	1	1.010	2.370	300
									

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	0	0	0
30	0	0	0
100	0	0	0
100	40	10	0

Node S13 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	2.466	Product Number	CTL-SHE-0127-9000-1800-9000
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	9.0	Min Node Diameter (mm)	1500

Node S12 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.574
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	390.0	0.0	1.000	390.0	0.0	1.001	0.0	0.0

Node S13 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.466
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

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Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	75.0	0.0	1.000	75.0	0.0	1.001	0.0	0.0

Node S7 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.717
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	165.0	0.0	0.400	165.0	0.0	0.401	0.0	0.0

Node S8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.635
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	3.4	0.0	1.000	3.4	0.0	1.001	0.0	0.0

Node S9 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.619
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	9.9	0.0	1.000	9.9	0.0	1.001	0.0	0.0

Node S11 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.591
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	0.6	0.0	1.000	0.6	0.0	1.001	0.0	0.0

Node S12 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.574
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1.4	0.0	1.000	1.4	0.0	1.001	0.0	0.0

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	11	3.095	0.095	13.4	0.2649	0.0000	OK
15 minute winter	S2	11	3.085	0.137	21.9	0.3367	0.0000	OK
15 minute winter	S3	11	3.076	0.076	9.7	0.1920	0.0000	OK
15 minute winter	S4	11	3.075	0.151	39.4	0.4917	0.0000	OK
15 minute winter	S5	11	3.025	0.175	52.2	0.5475	0.0000	OK
15 minute winter	S6	12	2.973	0.173	58.0	0.4225	0.0000	OK
30 minute winter	S7	26	2.800	0.083	24.3	13.8871	0.0000	OK
15 minute winter	S8	11	2.887	0.252	26.4	1.6961	0.0000	OK
15 minute winter	S9	11	2.886	0.267	82.5	4.0379	0.0000	OK
15 minute winter	S10	11	2.867	0.266	81.0	0.6006	0.0000	OK
15 minute summer	S11	11	2.847	0.256	79.2	0.6420	0.0000	OK
240 minute winter	S12	180	2.746	0.172	25.1	67.6748	0.0000	OK
240 minute winter	S13	184	2.745	0.279	15.8	21.4332	0.0000	OK
240 minute winter	S14	184	2.506	0.071	8.1	0.0798	0.0000	OK
240 minute winter	HW1	184	2.437	0.067	8.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	12.7	0.408	0.064	0.8282	
15 minute winter	S2	1.001	S4	21.3	0.465	0.106	0.4991	
15 minute winter	S3	2.000	S4	9.2	0.328	0.034	0.6346	
15 minute winter	S4	1.002	S5	38.7	0.701	0.178	1.5624	
15 minute winter	S5	1.003	S6	51.2	0.861	0.224	1.0390	
15 minute winter	S6	1.004	S9	56.9	0.701	0.267	5.9189	
30 minute winter	S7	3.000	S8	-16.9	-0.440	-0.086	1.6181	
15 minute winter	S8	3.001	S9	13.0	0.326	0.065	0.7397	
15 minute winter	S9	1.005	S10	76.8	0.814	0.381	0.8430	
15 minute winter	S10	1.006	S11	82.8	0.993	0.409	0.4520	
15 minute summer	S11	1.007	S12	81.6	2.086	0.409	0.3956	
240 minute winter	S12	1.008	S13	15.8	0.581	0.079	1.9177	
240 minute winter	S13	Hydro-Brake®	S14	8.1				
240 minute winter	S14	1.010	HW1	8.1	0.663	0.114	0.1923	143.0

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Results for 2 year Critical Storm Duration. Lowest mass balance: 99.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	11	3.117	0.117	17.3	0.3281	0.0000	OK
15 minute winter	S2	11	3.109	0.161	28.5	0.3975	0.0000	OK
15 minute winter	S3	11	3.101	0.101	12.6	0.2547	0.0000	OK
15 minute winter	S4	11	3.099	0.175	50.2	0.5716	0.0000	OK
15 minute winter	S5	11	3.053	0.203	67.3	0.6340	0.0000	OK
15 minute winter	S6	12	2.998	0.198	75.0	0.4840	0.0000	OK
30 minute winter	S7	25	2.830	0.113	33.8	18.9997	0.0000	OK
15 minute winter	S8	11	2.916	0.281	38.0	1.8904	0.0000	OK
15 minute winter	S9	11	2.917	0.298	107.0	4.5063	0.0000	OK
15 minute winter	S10	11	2.890	0.289	101.7	0.6532	0.0000	OK
15 minute winter	S11	10	2.872	0.281	105.1	0.7042	0.0000	OK
180 minute winter	S12	148	2.784	0.210	35.5	82.9159	0.0000	OK
180 minute winter	S13	148	2.784	0.318	20.0	24.4195	0.0000	SURCHARGED
180 minute winter	S14	148	2.507	0.072	8.4	0.0812	0.0000	OK
180 minute winter	HW1	148	2.439	0.069	8.4	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	S1	1.000	S2	16.1	0.414	0.082	1.0735	
15 minute winter	S2	1.001	S4	27.5	0.478	0.137	0.6210	
15 minute winter	S3	2.000	S4	11.6	0.341	0.043	0.8283	
15 minute winter	S4	1.002	S5	49.8	0.735	0.229	1.9130	
15 minute winter	S5	1.003	S6	66.3	0.913	0.291	1.2557	
15 minute winter	S6	1.004	S9	73.4	0.780	0.345	6.9046	
30 minute winter	S7	3.000	S8	-24.7	-0.502	-0.125	2.0313	
15 minute winter	S8	3.001	S9	20.4	0.377	0.102	0.8467	
15 minute winter	S9	1.005	S10	96.3	0.883	0.478	0.9497	
15 minute winter	S10	1.006	S11	103.5	1.087	0.512	0.5062	
15 minute winter	S11	1.007	S12	107.5	2.268	0.539	0.4442	
180 minute winter	S12	1.008	S13	20.0	0.648	0.100	2.4150	
180 minute winter	S13	Hydro-Brake®	S14	8.4				
180 minute winter	S14	1.010	HW1	8.4	0.669	0.118	0.1969	153.4

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	11	3.208	0.208	32.9	0.5798	0.0000	OK
15 minute winter	S2	11	3.203	0.255	52.9	0.6292	0.0000	OK
15 minute winter	S3	11	3.196	0.196	23.9	0.4950	0.0000	OK
15 minute winter	S4	11	3.195	0.271	93.5	0.8825	0.0000	OK
15 minute winter	S5	11	3.161	0.311	124.4	0.9716	0.0000	OK
15 minute winter	S6	11	3.111	0.311	138.6	0.7622	0.0000	OK
240 minute winter	S7	232	2.972	0.255	9.8	42.8112	0.0000	OK
15 minute winter	S8	11	2.998	0.363	83.0	2.4484	0.0000	OK
15 minute winter	S9	11	3.002	0.383	201.6	5.7990	0.0000	OK
180 minute winter	S10	180	2.976	0.375	57.5	0.8462	0.0000	OK
240 minute winter	S11	232	2.973	0.382	46.0	0.9586	0.0000	OK
240 minute winter	S12	232	2.972	0.398	49.5	156.7746	0.0000	OK
240 minute winter	S13	232	2.972	0.506	17.1	38.8320	0.0000	SURCHARGED
240 minute winter	S14	232	2.509	0.074	9.0	0.0841	0.0000	OK
240 minute winter	HW1	232	2.441	0.071	9.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	29.6	0.423	0.150	2.1264	
15 minute winter	S2	1.001	S4	50.4	0.514	0.252	1.1199	
15 minute winter	S3	2.000	S4	21.3	0.377	0.078	1.6626	
15 minute winter	S4	1.002	S5	91.2	0.787	0.420	3.3293	
15 minute winter	S5	1.003	S6	122.0	0.999	0.535	2.2123	
15 minute winter	S6	1.004	S9	138.7	0.971	0.651	10.3796	
240 minute winter	S7	3.000	S8	-5.7	-0.124	-0.029	4.5690	
15 minute winter	S8	3.001	S9	48.9	0.486	0.245	1.1313	
15 minute winter	S9	1.005	S10	158.6	1.028	0.787	1.2283	
180 minute winter	S10	1.006	S11	57.1	0.766	0.283	0.6923	
240 minute winter	S11	1.007	S12	45.6	1.092	0.229	1.2553	
240 minute winter	S12	1.008	S13	17.1	0.589	0.085	4.6234	
240 minute winter	S13	Hydro-Brake®	S14	9.0				
240 minute winter	S14	1.010	HW1	9.0	0.683	0.126	0.2068	210.7

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	11	3.275	0.275	42.7	0.7680	0.0000	OK
15 minute winter	S2	11	3.271	0.323	68.0	0.7954	0.0000	OK
15 minute winter	S3	11	3.264	0.264	31.0	0.6690	0.0000	OK
15 minute winter	S4	11	3.263	0.339	119.1	1.1053	0.0000	OK
15 minute winter	S5	11	3.230	0.380	157.6	1.1877	0.0000	OK
15 minute winter	S6	11	3.182	0.382	176.0	0.9340	0.0000	OK
240 minute winter	S7	236	3.103	0.386	15.4	64.6826	0.0000	OK
240 minute winter	S8	232	3.103	0.468	10.9	3.1502	0.0000	OK
240 minute winter	S9	232	3.102	0.483	55.0	7.3181	0.0000	OK
240 minute winter	S10	232	3.103	0.502	54.9	1.1326	0.0000	SURCHARGED
240 minute winter	S11	236	3.104	0.513	55.4	1.2866	0.0000	SURCHARGED
240 minute winter	S12	236	3.102	0.528	59.9	208.1335	0.0000	SURCHARGED
240 minute winter	S13	236	3.102	0.636	17.5	48.8371	0.0000	SURCHARGED
120 minute winter	S14	160	2.509	0.074	9.0	0.0843	0.0000	OK
480 minute winter	HW1	504	2.441	0.071	9.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	37.7	0.423	0.191	2.9251	
15 minute winter	S2	1.001	S4	63.3	0.520	0.316	1.4756	
15 minute winter	S3	2.000	S4	27.5	0.393	0.101	2.2867	
15 minute winter	S4	1.002	S5	115.6	0.799	0.532	4.2449	
15 minute winter	S5	1.003	S6	154.5	1.015	0.677	2.7645	
15 minute winter	S6	1.004	S9	176.8	1.041	0.830	12.2090	
240 minute winter	S7	3.000	S8	-9.3	-0.147	-0.047	6.6835	
240 minute winter	S8	3.001	S9	7.5	0.183	0.038	1.3868	
240 minute winter	S9	1.005	S10	51.7	0.611	0.257	1.5481	
240 minute winter	S10	1.006	S11	54.5	0.678	0.269	0.8597	
240 minute winter	S11	1.007	S12	54.8	1.178	0.275	1.4991	
240 minute winter	S12	1.008	S13	17.5	0.583	0.088	5.1062	
240 minute winter	S13	Hydro-Brake®	S14	9.0				
120 minute winter	S14	1.010	HW1	9.0	0.683	0.127	0.2073	169.1

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Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	11	3.745	0.745	65.7	2.1593	0.0000	SURCHARGED
15 minute winter	S2	11	3.727	0.779	107.4	1.9744	0.0000	SURCHARGED
360 minute winter	S3	352	3.719	0.719	6.5	1.8740	0.0000	SURCHARGED
360 minute winter	S4	352	3.718	0.794	27.3	2.6446	0.0000	SURCHARGED
360 minute winter	S5	352	3.720	0.870	36.5	2.8372	0.0000	SURCHARGED
360 minute winter	S6	352	3.718	0.918	40.1	2.3096	0.0000	SURCHARGED
360 minute winter	S7	352	3.715	0.998	18.4	68.9046	0.0000	SURCHARGED
360 minute winter	S8	352	3.716	1.081	18.1	7.1806	0.0000	SURCHARGED
360 minute winter	S9	352	3.708	1.089	64.7	15.8982	0.0000	SURCHARGED
360 minute winter	S10	352	3.744	1.143	64.1	2.6372	0.0000	SURCHARGED
480 minute winter	S11	448	3.664	1.073	51.4	2.6632	0.0000	SURCHARGED
360 minute winter	S12	352	3.664	1.090	69.5	394.4499	0.0000	SURCHARGED
480 minute winter	S13	448	3.663	1.197	16.3	77.1518	0.0000	SURCHARGED
120 minute summer	S14	70	2.509	0.074	9.0	0.0843	0.0000	OK
120 minute summer	HW1	70	2.441	0.071	9.0	0.0000	0.0000	OK

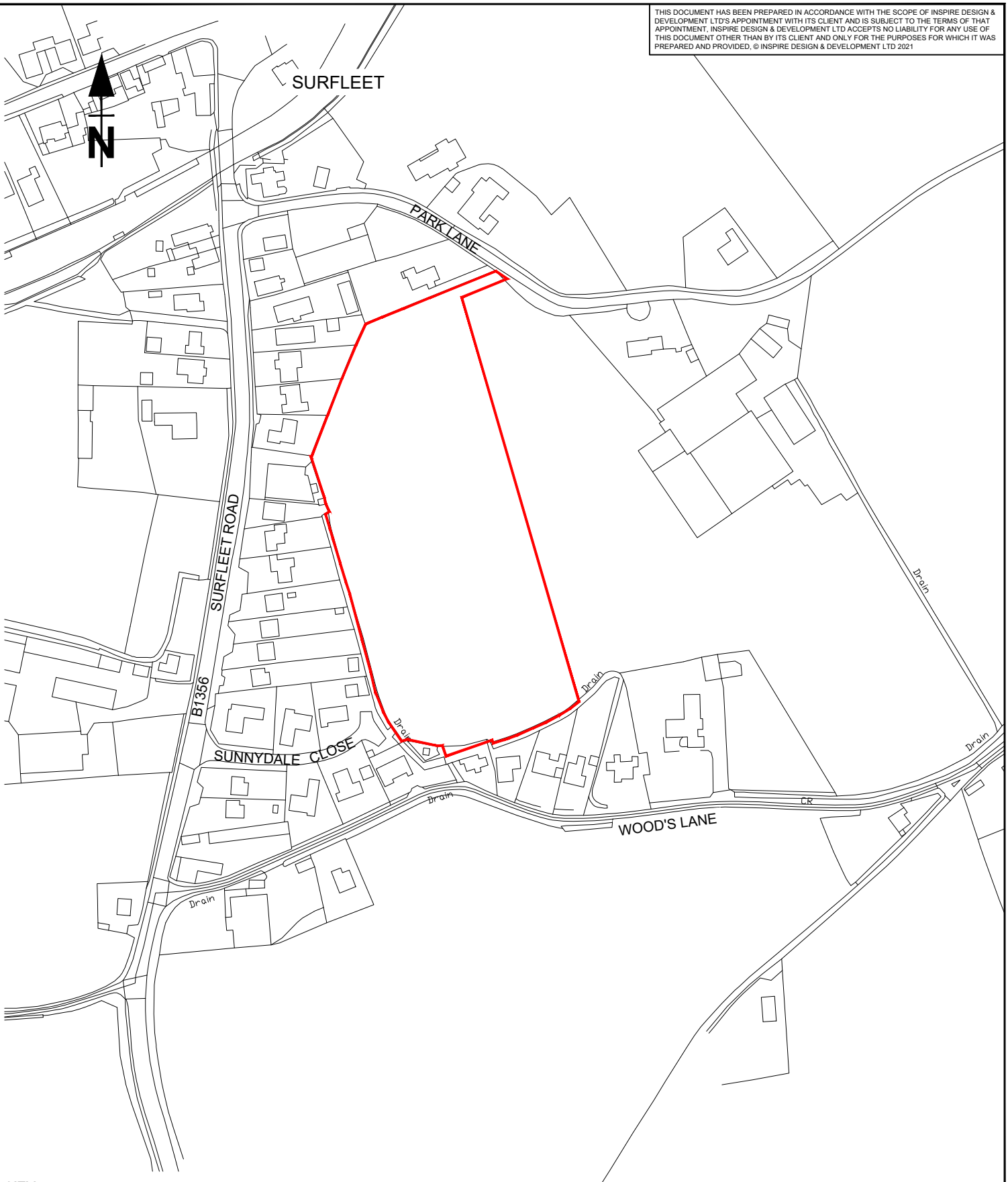
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	63.1	0.432	0.320	4.6940	
15 minute winter	S2	1.001	S4	101.5	0.533	0.506	2.0999	
360 minute winter	S3	2.000	S4	6.3	0.275	0.023	3.6319	
360 minute winter	S4	1.002	S5	27.1	0.627	0.125	5.5201	
360 minute winter	S5	1.003	S6	35.4	0.745	0.155	3.3815	
360 minute winter	S6	1.004	S9	37.6	0.489	0.177	14.0467	
360 minute winter	S7	3.000	S8	-11.5	-0.128	-0.058	7.4226	
360 minute winter	S8	3.001	S9	16.9	0.183	0.085	1.4127	
360 minute winter	S9	1.005	S10	60.8	0.541	0.301	1.5559	
360 minute winter	S10	1.006	S11	62.6	0.603	0.310	0.8599	
480 minute winter	S11	1.007	S12	53.3	1.061	0.267	1.4991	
360 minute winter	S12	1.008	S13	20.2	0.583	0.101	5.1062	
480 minute winter	S13	Hydro-Brake®	S14	9.0				
120 minute summer	S14	1.010	HW1	9.0	0.683	0.127	0.2073	169.4

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APPENDIX 5

LOCATION PLAN

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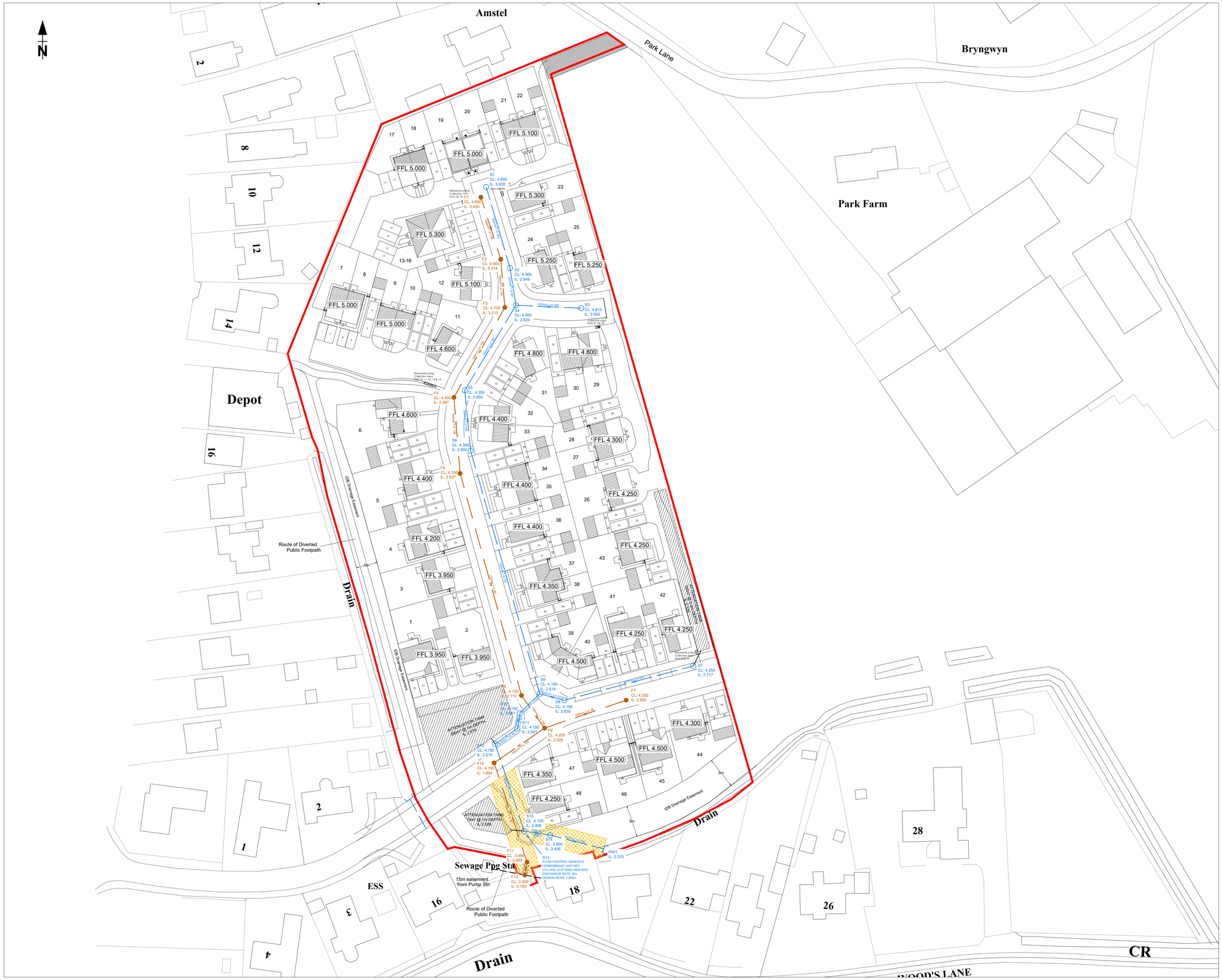
SITE BOUNDARY

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DATE: 03/11/21	DRAWING TITLE: LOCATION PLAN		REV	DATE	NAME	CHECK	NOTES	
DRAWN: NGP								
CHECKED: CR			DRAWING STATUS: FOR APPROVAL					
APPROVED: CR	PROJECT: SUNNYDALE CLOSE SURFLEET	CLIENT: ASHWOOD HOMES LTD	DRAWING No: AHL-1583-01-GA-002				REVISION No:	
SCALE @ A4: 1:2500								

APPENDIX 6

DRAINAGE STRATEGY



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KEY:

- SITE BOUNDARY
- FFL 3.800 FINISH FLOOR LEVEL
- EXISTING FOUL SEWER
- PROPOSED FOUL SEWER/ MANHOLE
- PROPOSED SURFACE WATER SEWER/ MANHOLE
- DRAINAGE EASEMENT

NOTES:

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REV	DATE	NAME	CHECK	NOTE

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CLIENT

ASHWOOD HOMES LTD

PROJECT

SUNNYDALE CLOSE
SURFLEET

DRAWING TITLE

DRAINAGE STRATEGY

DRAWN	CHECKED	APPROVED
NGP	CR	CR

DATE	SCALE @ A1
02/11/21	1:500

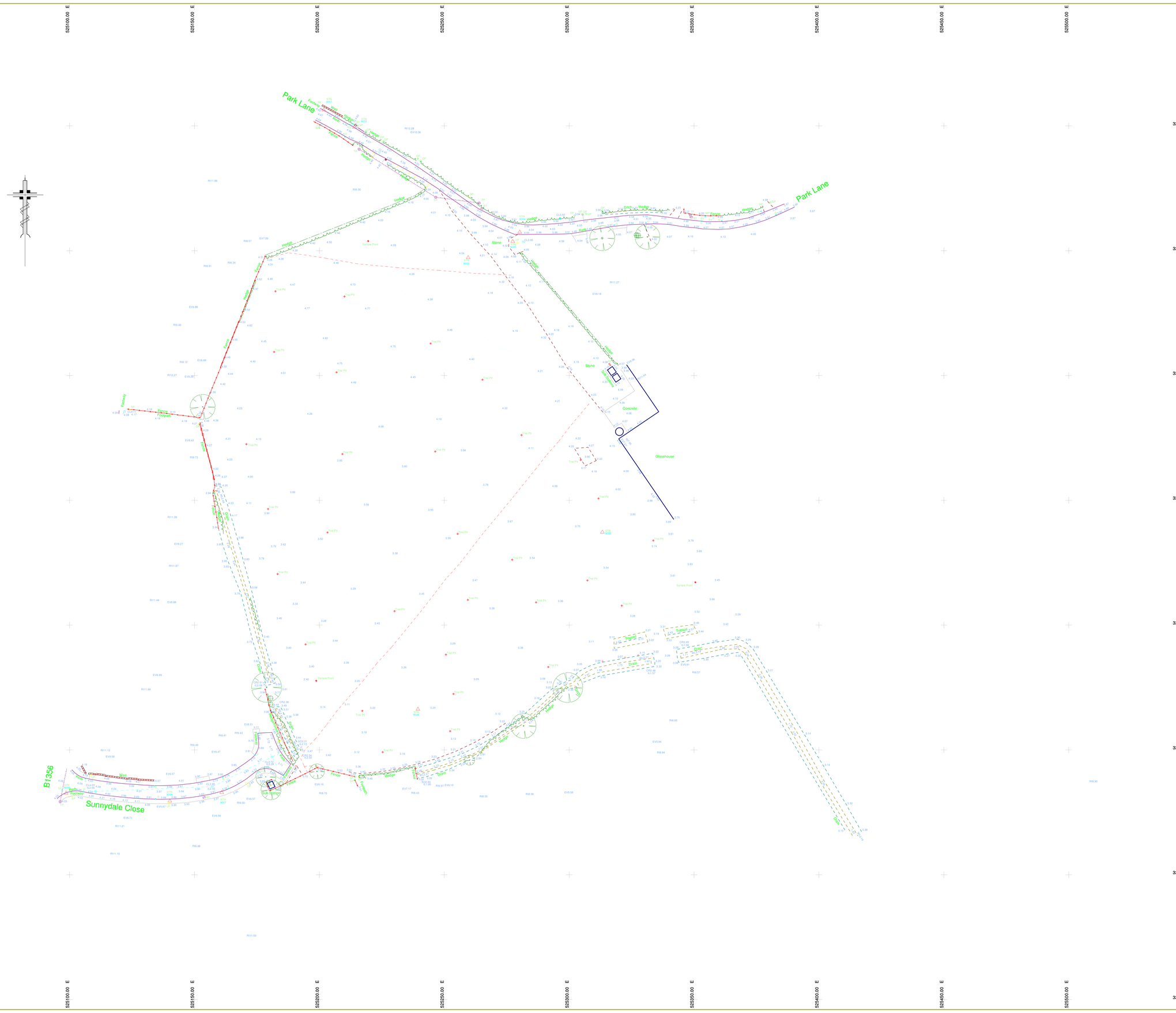
DRAWING No. AHL-1583-01-DR-001

REVISION No.

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APPENDIX 7

TOPOGRAPHIC SURVEY



KEY:

BUILDING	FENCE
HEDGE	CHANNEL
WALL	BANK EDGE
STORM DRAINAGE	FOUL DRAINAGE
CHANGE OF SURFACE	OVERHEAD ELECTRIC
OVERHEAD TELEPHONE	TREE
BOREHOLE	MANHOLE
CONTROL STATION	

B	BOLLARD	RE	ROD EYE
BIN	BIN	RI	RIDGE
BT	BRITISH TELECOM	SP	SIGN POST
CR	PIPE CROWN	STAY	STAY
CTV	CABLE TELEVISION	SV	STOP VALVE
EA	EARTH	TBM	BENCH MARK
EL	ELECTRIC BOX	TH	THRESHOLD
EP	ELECTRIC POLE	TL	TRAFFIC LIGHT
EV	EAVES	TP	TELEGRAPH POLE
FH	FIRE HYDRANT	TS	TRAFFIC SIGNAL
G	GRID	VC	VENT COLUMN
GA	GAS VALVE	VP	VENT PIPE
IC	INSPECTION CHAMBER	WL	WATER LEVEL
IL	INVERT LEVEL	WM	WATER METER
KO	KERB OFFLET	WT	WALL TOP
LH	LAMP HOLE		
LP	LAMP POST		
MP	MARKER POST		
PB	POST BOX		

NOTES:

1. Survey plotted to OS National Grid.
2. All levels related to OS Datum.
3. GPS/GLONASS ETRS89 observations transformed to OSGB36 using OSTN15 Transformation.
4. ETRS89 ellipsoid heights converted to heights above mean sea level using National Geoid Model OSGM15.

Initial Survey Date:	14 FEB 2020

CONTROL STATIONS

Stn:	Eastings:	Northings:	Height:
9000	525313.293	327937.242	3.761
9001	525201.761	328106.403	4.728
9002	525214.035	328099.487	4.544
9003	525259.567	328047.213	4.116
9004	525280.189	328057.429	4.013
9005	525277.418	328053.703	4.062
9006	525239.435	327866.320	3.292
9007	525160.913	327832.950	3.912
9008	525140.153	327829.536	4.034
9009	525098.604	327832.722	4.189

Revs:	Amendments:	Date:

Client:
ASHWOOD HOMES

Project Title:
SUNNYDALE CLOSE
SURFLEET
LINCOLNSHIRE

Drawing Title:
OGL SURVEY

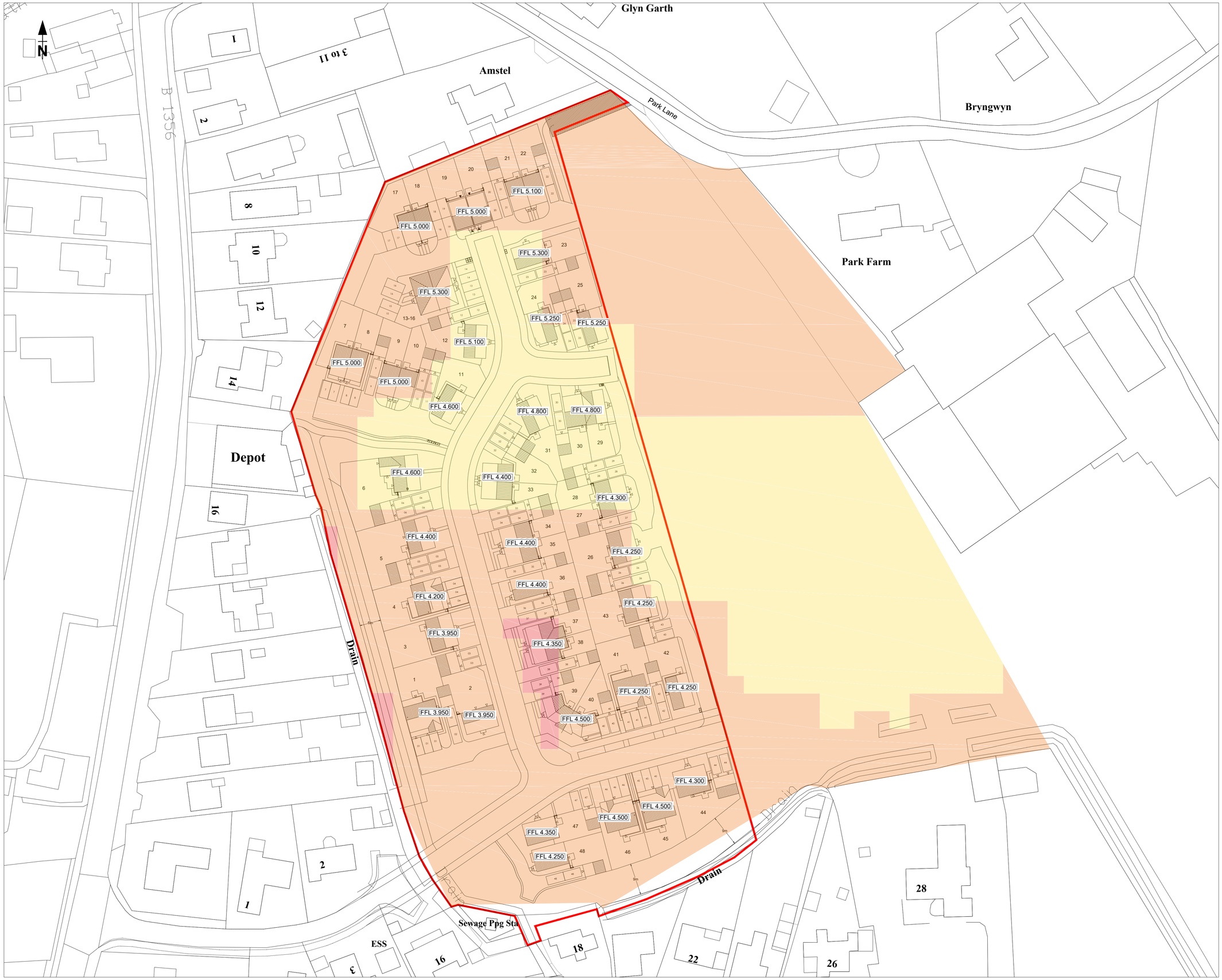
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Drawing No:	AS2441/1	*Revs:*	A0
C.A.D. Title:	ASHWOODHOMESSURF140220		
Drawn By:	D.J.SMITH		

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APPENDIX 8

FLOOD RISK AREAS



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KEY:

- SITE BOUNDARY
- FFL 3.800 FINISH FLOOR LEVEL

SFRA PEAK DEPTHS
(Taken from South Holland District Council)

- 0m - 0.25m = GL + 0.30m
- 0.25m - 0.50m = GL + 0.50m
- 0.50m - 1.00m = GL + 1.00m

NOTES:

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REV	DATE	NAME	CHECK	NOTE

DRAWING STATUS:

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ASHWOOD HOMES LTD

PROJECT

SUNNYDALE CLOSE
SURFLEET

DRAWING TITLE

FLOOD AREAS

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NGP	CR	CR

DATE	SCALE @ A1
02/11/21	1:500

DRAWING No.	REVISION No.
AHL-1583-01-DR-003	

APPENDIX 9

ENGINEERING DRAWING PACK



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KEY:

SITE BOUNDARY

FFL 3.800 FINISH FLOOR LEVEL

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REV	DATE	NAME	CHECK	NOTE

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PROJECT

SUNNYDALE CLOSE
SURFLEET

DRAWING TITLE

FINISH FLOOR LEVELS

DRAWN	CHECKED	APPROVED
NGP	CR	CR

DATE	SCALE @ A1
03/11/21	1:500

DRAWING No. AHL-1583-01-GA-001

REVISION No.

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KEY:

- SITE BOUNDARY
- FFL 3.800 FINISH FLOOR LEVEL
- FLOOD ROUTING

NOTES:

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REV	DATE	NAME	CHECK	NOTE

DRAWING STATUS:

FOR APPROVAL

CLIENT

ASHWOOD HOMES LTD

PROJECT

SUNNYDALE CLOSE
SURFLEET

DRAWING TITLE

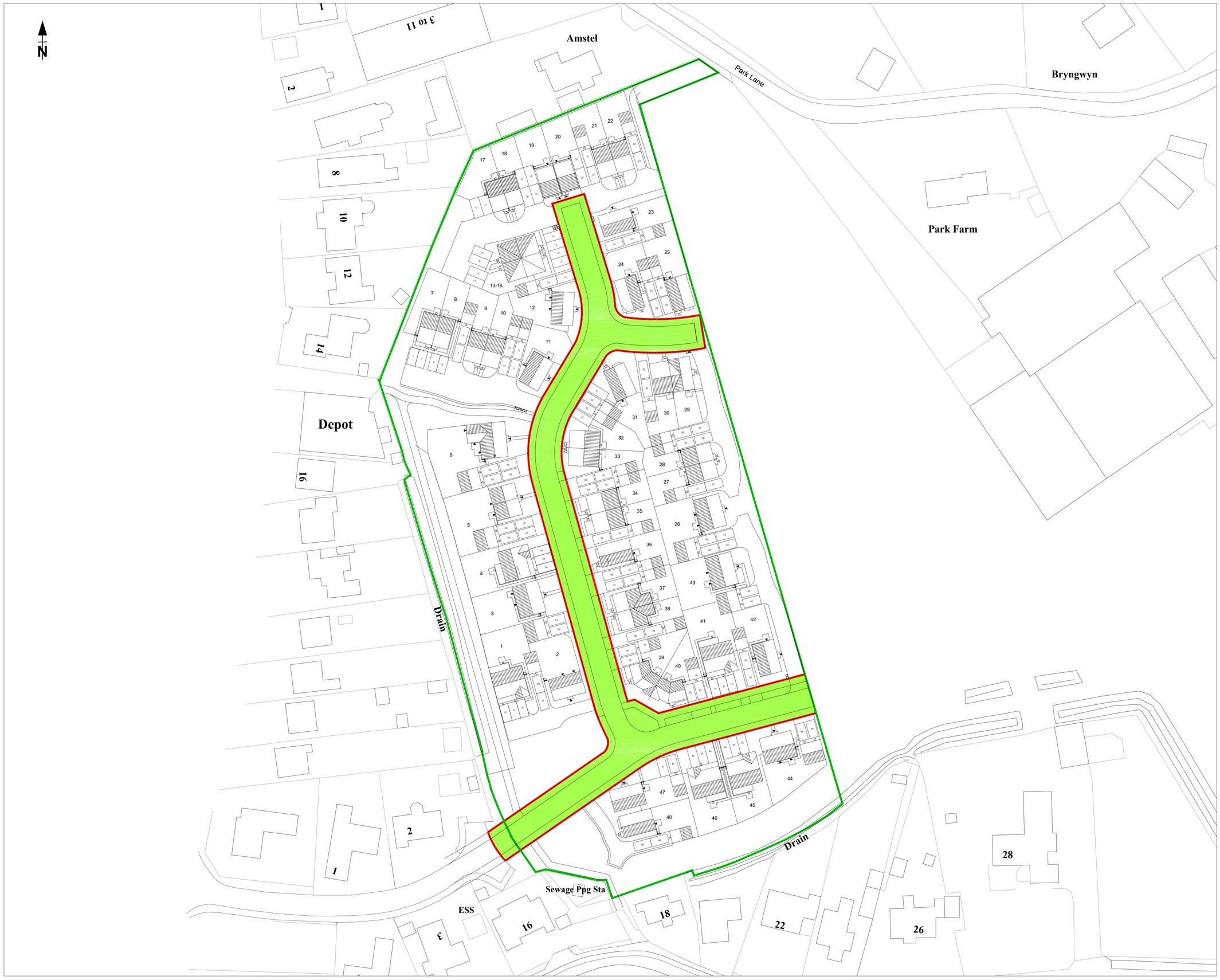
FLOOD ROUTING PLAN

DRAWN	CHECKED	APPROVED
NGP	CR	CR

DATE	SCALE @ A1
02/11/21	1:500

DRAWING No.	REVISION No.
AHL-1583-01-DR-002	

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KEY:

SITE BOUNDARY

EXTENTS OF HIGHWAY OFFERED FOR ADOPTION UNDER SECTION 38 AGREEMENT

REV	DATE	NAME	CHECK	NOTE

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CLIENT

ASHWOOD HOMES LTD

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SECTION 38
ARRANGEMENT PLAN

DRAWN	CHECKED	APPROVED
AJS	CR	CR

DATE	SCALE @ A1
03 November 2021	1:500

DRAWING No.	REVISION No.
AHL-1583-01-HW-001	

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