Flood Risk Assessment and Drainage Strategy

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EAS

Colesdale Farm

Northaw

Hertfordshire

EAS

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1 Introduction

1.1 EAS has been commissioned to prepare a Flood Risk Assessment (FRA) to support an outline application for proposed residential development at Colesdale Farm, Northaw Road West, Potters Bar, EN6 4QZ, Hertfordshire. A site location plan is enclosed in **Appendix A**.

1.2 Proposals include the development of 34 residential dwellings with associated parking, car ports and public open space. The development proposals are enclosed in **Appendix B**.

1.3 The site is located in Flood Zone 1 and covers an area of 1.31 hectares; therefore a full Flood Risk Assessment has been prepared.

1.4 This report also considers the proposed surface water drainage for the site and looks at other risks of flooding such as from surface water.

1.5 This document includes:

Section 2 describes relevant policy;

Section 3 describes site description, including site levels, proximity to watercourses etc;

Section 4 describes potential sources of flooding;

Section 5 outlines the likely mitigation measures;

Section 6 describes the existing site hydrology and outlines a surface water drainage strategy

Section 7 details the likely maintenance tasks required for the drainage systems

Section 8 provides a summary and conclusions

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2 Policy Context

Introduction

2.1 This section sets out the policy context. The contents of this FRA are based on the advice set out in The National Planning Policy Framework (NPPF) published in February 2019 and the Planning Practice Guidance (PPG), published March 2014.

National Planning Policy Framework

2.2 Paragraph 164 footnote 50 of the NPPF states:

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

2.3 The flood zones are defined as:

- Flood Zone 1 – Land assessed as having a less than 1 in 1,000 (<0.1%) annual probability of flooding from fluvial sources;
- Flood Zone 2 – Land assessed as having between a 1 in a 100 and 1 in 1,000 (1% to 0.1%) annual probability of flooding from fluvial sources;
- Flood Zone 3a – Land assessed as having a 1 in 100 or greater (>1%) annual probability of flooding from fluvial sources, or at least 0.5% annual probability of tidal flooding;
- Flood Zone 3b – Land where water has to flow or be stored in times of flood.

2.4 Paragraph 155 discusses the suitability of development location, particularly with regards to future risks induced by climate change:

"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere".

2.5 Paragraph 156 of the National Planning Policy Framework (NPPF) sets out how:

"Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards".

2.6 Paragraphs 165 NPPF discusses the application of sustainable drainage systems:

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

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

2.7 The Flood Map for Planning (available at https://flood-map-for-planning.service.gov.uk/) shows the area of the site in which the property is to be located is located in Flood Zone 1. The Flood Map for Planning is enclosed in **Appendix C.**

Welwyn Hatfield Local Plan

2.8 Welwyn Hatfield Borough Council is in the process of completing their Local Development Framework and the Core Strategy, to guide development in the borough until 2029. As the Local Plan has not been finalised yet, the relevant document which outlines the Council's plans for development within the borough is the 'Emerging Core Strategy (2012)'.

2.9 Emerging Core Strategy Policy CS 1: *Delivering Sustainable Development* highlight's the requirement for adaption and mitigation principles to be included in the design and construction of new development. This includes water efficiency measures and the use of sustainable drainage systems (SuDS).

2.10 Emerging Core Strategy Policy CS11: *Protection of Critical Assets* notes the importance of the water environment, stating: "The boroughs floodplains will be protected by avoiding development in Flood Zones 2 and 3 unless it is for a compatible use."

2.11 The Welwyn Hatfield Emerging Core Strategy Sustainability Appraisal Report was produced in September 2012 and outlines the sustainability aims of the borough. This document notes that the borough has relatively few areas within the EA medium and high flood risk zones, but the impact of climate change is likely to exacerbate the frequency and severity of flooding events. The long-term objective is therefore to avoid locating new development in flood risk areas and avoid development that will increase flood risk elsewhere. It is also stated that the capacity of the surface water drainage systems of new developments should be capable of accommodating more development; therefore use of sustainable drainage systems is necessary where possible.

2.12 Policies CS1, CS11 and the Sustainability Appraisal Report were considered during the preparation of this FRA, and the proposed SuDs discussed within this report will

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demonstrate that the proposed development will be consistent with the core strategy aims for the borough.

Welwyn Hatfield Borough Council Strategic Flood Risk Assessment (SFRA)

2.13 The Welwyn Hatfield Borough Level 1 SFRA was published in May 2009, and provides an overview of the flooding issues within the borough. This report was updated and replaced in May 2016 by the Level 1 and 2 Strategic Flood Risk Assessment.

2.14 Figure 2 of the SFRA notes the site to be located within the Lee-Stort/Thames Catchment.

2.15 Figure 5 confirms the site is located in Flood Zone 1.

2.16 Figure 7 show historic flood events across the district. The site is shown not to have been affected by any recorded historic flood events.

2.17 Figure 10 highlights areas across the district which are potential sources of overland flow. The site is shown not to be located within such an area however the land adjacent to the western boundary of the site is shown to be located in an area which could be a source of overland flow.

2.18 Figure 11 of the SFRA indicates the site has not previously experienced groundwater flooding. Likewise, Figure 14 shows the site is not located within a postcode where there have been recorded sewer flooding incidents.

2.19 Figure 15C highlights that the Northaw Brook has a low flooding frequency.

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3 Existing Site Assessment

Site Description

3.1 The site is located Colesdale Farm, Northaw Road West, Potters Bar, Hertfordshire. The site currently consists of areas of hardstanding and agricultural/industrial warehouses with several cottages located to the south of the site.

3.2 A site plan is located in **Appendix B**.

3.3 To the north east and west the site is bounded by agricultural land. To the south, the site is bounded by the B156.

3.4 The site is located approximately 1km south west of the centre of Cuffley.

Local Watercourses

3.5 The Hempshill Brook, noted to be an EA 'Main River' is located approximately 220m north east of the site. An ordinary water course, a tributary of the Hempshill Brook, is located approximately 500m north of the site and appears to discharge into the Hempshill Brook.

3.6 The Northaw Brook, also noted to be an EA 'Main River', is located approximately 450m south of the site. The Northaw Brook and Hempshill Brook, have a confluence approximately 470m south east of the site.

3.7 There is a small pond located approximately 15m north east of the site.

Geology

3.8 The online British Geological Survey (BGS) mapping shows the site to be located in an area with a bedrock of Lambeth Group - Clay, Silt And Sand with no superficial deposits recorded. This type of geology is not usually particularly permeable.

Site Levels

3.9 A topographical survey enclosed in **Appendix D** shows the site falls to the north east. Levels along the western perimeter are around 64m AOD. Levels along the southern boundary of the site are around 61m AOD. Levels in the north-eastern corner fall to a low of 59m AOD. Levels in the central region of the site are around 62m AOD.

3.10 There is a shallow ditch along the northern boundary which falls toward the east. This is likely to be a field drain to collect runoff from both the site and the fields to the north and direct it towards the Hempshill Brook to the east.

Sewer records

3.11 Thames Water records, enclosed in **Appendix E**, show a 225mm foul sewer flowing south following the course of the Hempshill Brook. There appears to be a small section of combined sewer in the field to the east of the site, which discharges to the Hempshill Brook. There are no public surface water sewers nearby.

Existing Drainage

3.12 There is no formal drainage system in place on site. All buildings drain unrestricted to the ground and follow the natural topography towards the shallow ditch on the northern boundary.

Site Visit

3.13 A site visit was carried out in February 2019. The ditch on the northern boundary was inspected and it was noted to be shallow and overgrown. There also appeared to be a slight bund in this area to prevent water from the ditch from reaching the site. The ditch was followed to the east where it ran along the field boundary. It was determined that this was a historic field drain to catch surface water flowing over the fields and direct it to the Hempshill Brook. The Hempshill Brook was inspected and although the topographic survey does not extend this far, it was clear that this was significantly lower than the site.

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4 Potenital Sources of Flooding

Fluvial

4.1 A copy of the Flood Map for Planning is enclosed in **Appendix C**. The site is shown to be located within Flood Zone 1, at low risk of fluvial flooding.

Surface Water

4.2 Surface water flooding refers to flooding caused when the intensity of rainfall, particularly in urban areas, can create runoff which temporarily overwhelms the capacity of the local drainage systems or does not infiltrate into the ground. The water ponds on the ground and flows towards low-lying land. This source of flood risk is also known as 'pluvial'.

4.3 Figure 4.1 below is an extract from the Long-Term Flood Map from the GOV.UK website.

4.4 The majority of the site is shown to be at 'very low' risk of surface water flooding meaning each year this area has a chance of flooding of less than 0.1% (1 in 1000).

4.5 There is a marginal area in the north of the site shown to be at low risk of surface water flooding meaning that each year this area has a chance of flooding of between 0.1% and 1% (1 in 100 and 1 in 1000).

4.6 Figure 4.2, an extract from the Long-Term Flood Map shows a surface water flow path located within the site flowing towards a ditch located along the northern perimeter of the site. The velocity is shown to be above 0.25 m/s with depths below 300mm. The site layout has been overlaid with the extract from the Long-Term Flood Map (**Appendix F**) and shows all properties are located outside of the flow path. This means the proposed dwellings will not block the existing flowpath and will not be at risk of surface water flooding as a result of the flowpath.

4.7 Given the above, the risk from surface water flooding can be considered low.

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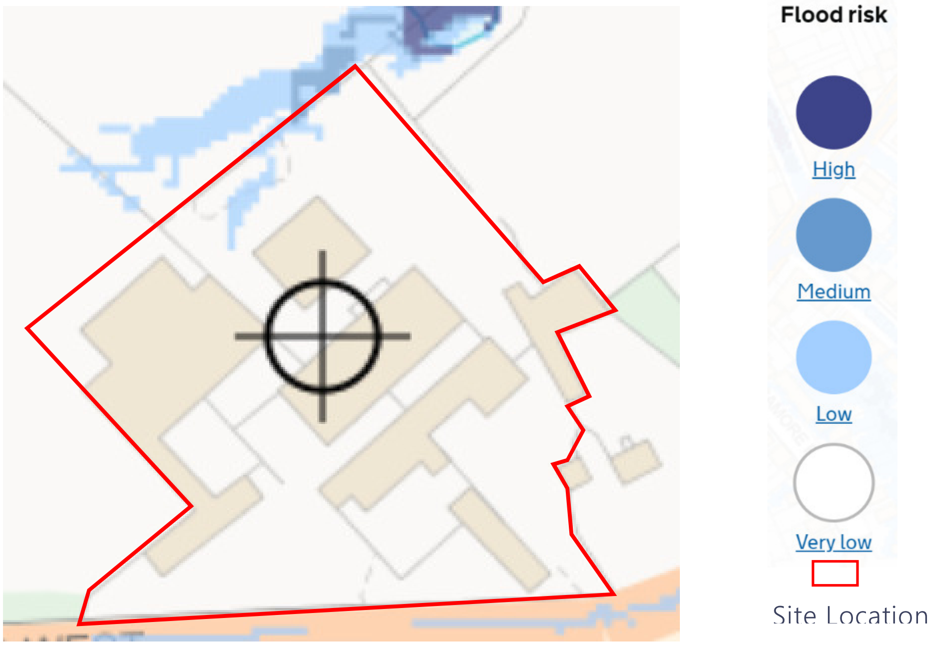

Contains public sector information licensed under the Open Government Licence v3.0.

Figure 4.1: Extract from EA Surface Water Flood Map
Source: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=529692&northing=201836

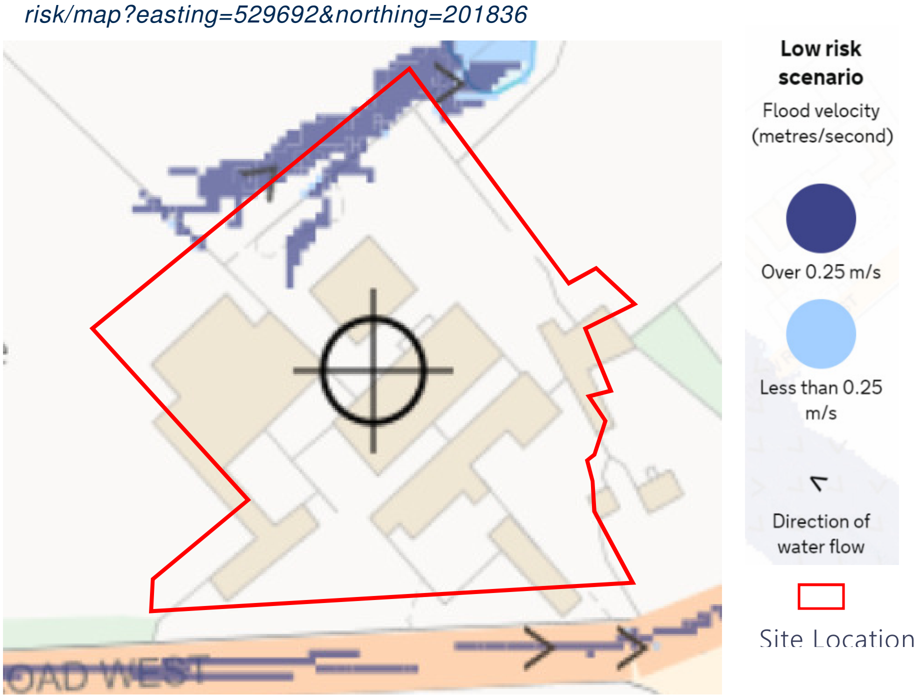

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Figure 4.2: Extract from EA Surface Water Flood Map
Source: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=529692&northing=201836

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Groundwater

4.8 The EA groundwater mapping located in MAGIC Maps (available at: http://magic.defra.gov.uk/MagicMap.aspx) shows the site is not located in a source protection zone.

4.9 The SFRA notes the site has not previously experienced groundwater flooding.

4.10 There are no local borehole records available.

4.11 Given the above, and the local geology, the risk of flooding from groundwater is considered low.

Sewer Flooding

4.12 The SFRA notes the site is not located within a postcode which has experienced sewer flooding. Given the distance to the nearest public sewer, the risk of sewer flooding is considered to be low.

Artificial

4.13 The GOV.UK website does not indicate the site to be within a reservoir flood risk extent. There are no other artificial sources in the area, therefore the risk of flooding to the site from artificial sources is considered to be low.

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5 Mitigation Measures

5.1 As the site is located in Flood Zone 1, no specific measures are considered necessary to address fluvial flood risk.

5.2 To mitigate the surface water flood risk identified along the northern perimeter of the site, it is recommended the ditch which is present along the northern boundary is made formal, improving conveyance and preventing any surface from the field directly north from entering the site. The addition of a French filter drain and bund along the northern perimeter of the site running parallel to the ditch will also prevent any surface water flowing into the site.

5.3 This, combined with an effective drainage system, will reduce the surface water flood risk. The use of lined permeable paving is likely to remove the surface water flow path currently identified flowing towards the ditch within the site.

6 Drainage Strategy

Pre-development Runoff Rate

6.1 The existing site covers an area of approximately 1.31 ha with an impermeable area of 1.22 ha consisting of roof area and hardstanding. Using the Modified Rational Method detailed in Butler, D and Davies, J. (2006), Urban Drainage, 2nd ed., SPON, the surface water runoff for the existing site has been calculated as follows:-

Q = CiA where Q = maximum flow rate (l/s)

C= PIMP/PR

i= rainfall intensity (mm/hr),

A=area (ha)

6.2 It should be noted that a fixed rainfall intensity of 50mm/hr is used in this case, which has been recommended by Butler & Davies (2006) to avoid using inappropriately high intensities for very low concentration times, i.e. small sites.

6.3 Using the Modified Rationale Method (Butler and Davies, 2006), and a measured impermeable area on the existing site of 12224.77m2, the total rate of runoff from the impermeable areas of the existing site is estimated to be 16.87 l/s. The run off calculations are enclosed in Appendix G.

6.4 To improve the existing situation runoff from the proposed development should therefore be restricted to the greenfield rate to reduce flood risk in the area.

6.5 Greenfield runoff rates calculations have been carried out using the WINDES MicroDrainage software. The ICP SUDS Mean Annual Flood method was used. Greenfield runoff rates at the site for QBAR, 1 year, 30 year and 100-year events are summarised below per hectare and for the total proposed impermeable area of 0.50 hectares:

- QBAR –4.3 l/s/ha (2.15l/s)
- 1 in 100 year- 13.7l/s/ha (6.85l/s)
- 1 in 30 year- 9.7 l/s/ha (4.85l/s)
- 1 in 1 year-3.7 l/s/ha (1.85l/s)

6.6 The WINDES MicroDrainage runoff output is included in **Appendix H.**

Relevant SUDS Policy

6.7 SUDS mimic the natural drainage system and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. In addition to reducing flood risk, these features can improve water quality and provide biodiversity and amenity benefits.

6.8 The SUDS management train incorporates a hierarchy of techniques and considers all three SUDS criteria of flood reduction, pollution reduction, and landscape and wildlife benefits. In decreasing order of preference, the preferred means of disposal of surface water runoff is:

- Discharge to ground.
- Discharge to a surface water body.
- Discharge to a surface water sewer.
- Discharge to a combined sewer.

6.9 The philosophy of SuDS is to replicate as closely as possible the natural drainage from a site predevelopment and to treat runoff to remove pollutants, resulting in a reduced impact on the receiving watercourses. The benefits of this approach are as follows:

- Reducing runoff rates, thus reducing the flood risk downstream;
- Reducing pollutant concentrations, thus protecting the quality of the receiving water body;
- Groundwater recharge;
- Contributing to the enhanced amenity and aesthetic value of development areas; and
- Providing habitats for wildlife in developed areas, and opportunity for biodiversity enhancement.

Site Specific SUDS

6.10 The various SUDS methods have been considered in relation to site-specific constraints. Table 1 outlines the constraints and opportunities to each of the SUDS devices in accordance with the hierarchical approach outlined in The SUDS Manual CIRIA C753. It also indicates what could and could not be incorporated within the development, based upon site-specific criteria.

Device	Description	Constraints / Comments	Appropriate
Living roofs (source control)	Provide soft landscaping at roof level which reduces surface water runoff.	Unlikely to be viable due to the pitch of the roof proposed.	No
Infiltration devices & Soakaways (source control)	Store runoff and allow water to percolate into the ground via natural infiltration.	Unlikely due to geology of Lambeth Group - Clay, Silt and Sand.	No

Pervious surfaces (source control)	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and/or slowly release to sewers.	It is proposed to use lined permeable paving for the internal road and footpaths within the development.	Yes
Rainwater harvesting (source control)	Reduces the annual average rate of runoff from the Site by reusing water for non-potable uses e.g. toilet flushing, recycling processes.	May be possible to include these in design. Features such as water butts could be incorporated into design.	Possibly
Swales (permeable conveyance)	Broad shallow channels that convey / store runoff, and allow infiltration (ground conditions permitting).	Not included due to spatial limitations of the site.	No
Filter drains & perforated pipes (permeable conveyance)	Trenches filled with granular materials (which are designed to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration.	Not proposed for this development. The required attenuation is achieved using lined permeable paving.	No
Infiltration basins (end of pipe treatment)	Depressions in the surface designed to store runoff and allow infiltration.	Unlikely due to geology of Lambeth Group - Clay, Silt And Sand	No
Wet ponds & constructed wetlands (end of pipe treatment)	Provide water quality treatment & temporary storage above the permanent water level.	An attenuation pond has been included to attenuate the outfall from the permeable paving.	Yes
Attenuation Underground (end of pipe treatment	Oversized pipes or geo-cellular tanks designed to store water below ground level.	Not proposed for this development. The required attenuation has been provided by lined permeable paving.	No

Table 1: Site-Specific Sustainable Drainage Techniques

6.11 Infiltration methods are unlikely to be suitable at the site given the geology of Lambeth Group - Clay, Silt And Sand. An attenuation strategy with a restricted outfall to the Hempshill Brook has been proposed. This will require a new pipe connection across the fields to the east, which are understood to be within the same ownership as the site and therefore will not require any third-party consents.

Proposed Drainage Strategy

Public Open Space Footpath

6.12 It is proposed not to formally drain the footpath linking the north an east of the site via the proposed pond feature. It is anticipated the footpath will consist of free drainage gravel and drain directly to the surrounding ground. The topographic survey indicates the natural fall of the ground is to the north east, therefore runoff would ultimately flow in this direction towards the ditch on the field boundary where it would be directed away from the site.

Lined Permeable Paving

6.13 It is proposed that the internal road, footpaths and parking areas will be constructed using lined permeable paving. The roof area of the properties and car ports will be directed into the sub-base of the permeable paving. The permeable paving will therefore be sized to manage runoff from the roofs as well as from the roads and parking areas.

6.14 WINDES MicroDrainage was used to estimate the sub-base depth required for the permeable paving in order to provide adequate attenuation for surface water runoff for rainfall events up to and including a 1 in 100yr +40%CC storm.

6.15 WINDES MicroDrainage estimated that whilst restricting the outfall from the sub-base of the permeable area to 2.3 l/s via a 35mm orifice plate the sub-base would require a minimum depth of 372mm. The WINDES calculations are enclosed in **Appendix I.**

6.16 The following typical construction would be expected for the permeable paving (based on guidance from Marshalls for the popular Priora Paving system):

- 80mm paving course
- 50mm laying course (generally a 6mm aggregate)
- 80mm layer of perforated Asphalt Concrete (DBM)
- A calculated depth of course grade aggregate (generally 250mm – 350mm of a 30mm aggregate)
- An additional sub-base / capping layer if required

6.17 The depth of the course graded aggregate layer will be designed to meet both structural and attenuation requirements.

6.18 Unlike other attenuation systems, the pollutants carried within the surface water run-off are filtered out as they pass through the course grade aggregate and sub-base. Once trapped they are then broken down over time; figures from the Construction Industry Research and Information Association have shown that 60-95% of suspended solids and 70-90% of hydrocarbons are removed by permeable pavements; as such no further filtration of pollutants will be required.

Attenuation Pond

6.19 It is proposed that the restricted outfall from the permeable paving will be directed to an attenuation pond in the north eastern corner of the site.

6.20 The attenuation pond provides a number of benefits such as filtering runoff and removing many urban pollutants, has high ecological, aesthetic and amenity benefits and can be designed to cater for all storm events. The pond will be designed to have a permanent water level of at least 200mm depth; the attenuation volume will be provided above the permanent water level.

6.21 The pond will have an outfall to the proposed surface water sewer which will cross the field to the east. Following comments from a previous submission, the LLFA asked for confirmation of land ownership. **Appendix J** contains confirmation of the relevant parties regarding landownership and consent.

6.22 The new pipe will discharge to the Hempshill Brook at greenfield runoff rates. The outfall from the pond will have a flow control chamber containing a control device such as a Hydrobrake which will restrict outfall to the proposed pipe connection to a maximum of 2.1l/s for all events up to and including the 1 in 100 plus 40% climate change event. This will achieve the QBAR greenfield runoff rate for the proposed development.

6.23 The cover level is at 60.7m AOD with a proposed depth of 1.0m. A permanent body of water to provide an aesthetic feature has been included into the design with a water level of 200m, resulting in an invert level of 59.9m AOD. The maximum surface area of the pond is 105.9 m^2. This is based on a pond with 1:3 side slopes. The shape and design of the pond can be determined at detailed design stage, but at this stage the WINDES calculations provide an indication of the required volume within the pond. The volume available in the pond is $45m^3$ which would manage the runoff from the lined permeable paving. The WINDES calculations are enclosed in **Appendix K.**

6.24 LIDAR data available at (*https://environment.data.gov.uk/DefraDataDownload/?Mode=survey*) shows that the base of the Hempsill Brook is approximately 51m AOD therefore a gravity connection from the site to the Brook can be achieved. The LIDAR data can be viewed in **Appendix L.**

6.25 A total outfall from the attenuation pond and the lined permeable paving is 2.1l/s for all events up to and including the 1 in 100 year plus 40% climate change events. This matches the 1 in 30 greenfield runoff rate and a significant reduction compared to the existing situation.

6.26 The SuDS layout is enclosed in **Appendix M.**

Foul Water Drainage

6.27 A Thames Water predevelopment capacity check was undertaken and it was confirmed there is capacity in the nearby foul sewer (which is adjacent to the Hempshill Brook) to accept flows from the proposed development. The Thames Water response in enclosed in **Appendix N**.

7 Maintenance of Drainage Strategy

7.1 The maintenance of the SuDs features will remain private and the responsibility of the site owner or an appointed management/maintenance company.

7.2 Regular inspections and maintenance should be carried out for each of these elements, particularly after periods of heavy rainfall. Maintenance tasks and frequency are detailed in the CIRIA SUDS Manual (C753) and have been summarised below in Tables 2 and 3.

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Brushing and vacuuming.	Three times per year at end of winter, mid-summer, after autumn leaf fall, or as required based on site specific observations of clogging or manufacturer's recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas. Removal of weeds.	As required. As required.
Remedial actions	Remediate any landscaping which, through vegetation maintenance of soil slip, has been raised to within 50mm of the level of the paving. Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance of a hazard to the user. Rehabilitation of surface and upper sub-surface.	As required As required As required (if infiltration performance is reduced as a result of significant clogging.)
Monitoring	Initial inspection Inspect for evidence of poor operation and/or weed growth. If required, take remedial action. Inspect silt accumulation rates and establish appropriate brushing frequencies. Monitor inspection chambers.	Monthly for 3 months after installation. 3 monthly, 48 hours after large storms. Annually. Annually.

Table 2: Maintenance tasks for permeable paving (Source: CIRIA C753, The SUDS Manual)

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter and debris removal Grass cutting to retain grass height within specified design range. Manage other vegetation and remove nuisance plants. Inspect inlets, outlets and overflows for blockages and clear if required. Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies.	Monthly, or as required Monthly (during growing season) or as required. Monthly (at start, then as required). Monthly Half yearly
Occasional Maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where possible. Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions if required.	Annually Annually, or if bare soil is exposed over 10% or more of the swale treatment area.
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding. Re-level uneven surfaces and re-instate design levels. Scarify and spike topsoil level to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface. Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip. Remove or dispose of oils or petrol residues using safe standard practices.	As required. As required. As required. As required. As required.
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required. Inspect infiltration surface for ponding, compaction, silt accumulation. Record areas where water is ponding for >48 hours. Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly Monthly, or when required. Half yearly.

Table 3: Maintenance tasks and frequencies for ponds (The SUDS Manual C753, CIRIA)

8 Summary and Conclusion

8.1 EAS has been commissioned to prepare a Flood Risk Assessment (FRA) to support an outline application for residential development at Colesdale Farm, Northaw Road West, Potters Bar, EN6 4QZ, Hertfordshire

8.2 Proposals include the development of 34 residential dwellings with associated parking, car ports and public open space.

8.3 The site is located in Flood Zone 1, at low risk of flooding from fluvial sources.

8.4 A minor surface water flow path has been identified along the northern boundary of the site where flow enters a ditch located along the boundary and continues to flow towards the Hempshill Brook. A surface water flow path is also sourced from the field directly north of the site. All properties are located outside of the surface water flow path.

8.5 Mitigation measures including an effective drainage system is likely to remove the surface water flow path sourced on the site. It is recommended the ditch is formalised to improve conveyance to prevent the flow path from the field to the north entering the site. A bund or French drain could also be introduced along the northern perimeter which is parallel to the ditch. It is also recommended that the finished floor levels of the dwellings located in the northern part of the site are raised by 300mm.

8.6 It is proposed that surface water runoff from all roof areas, including car port roof area, will be directed to the lined permeable paving. The internal road, footpaths and parking areas will be constructed using lined permeable paving. WINDES estimated that whilst restricting the outfall from the sub-base of the permeable area to 2.3 l/s via a 35mm orifice plate the sub-base would require a minimum depth of 372mm.

8.7 The lined permeable paving will outfall into an attenuation pond located in the low point in the north eastern corner of the site. The pond will have an outfall to the new pipe which crosses the field to the east and discharges to the Hempshill Brook. The outfall will have a flow control chamber containing a control device such as a Hydrobrake which will restrict outfall to the ditch to a maximum of 2.1 l/s for all events up to and including the 1 in 100 plus 40% climate change event.

8.8 A total outfall from the site is 2.1 l/s for all events up to and including the 1 in 100 year plus 40% climate change events, matching QBAR greenfield run off rate, providing a significant improvement to the existing situation.

8.9 The proposed drainage features are to remain private and the responsibility of the site owner or an appointed management company. Maintenance tasks associated with the permeable paving and pond have been included in this report.

8.10 We believe that the development proposals comply with the guidance provided by the NPPF and local policies, and that no reason exists to object to the proposals in terms of flood risk or drainage.

9 Appendices

Appendix: A - Location Plan
Appendix: B – Site Layout
Appendix: C – Flood Map for Planning
Appendix: D – Topographical Survey
Appendix: E – Thames Water Sewer Records
Appendix: F – Surface Water Flow Path Overlaid With Site Layout
Appendix: G- Exisiting Run Off Calculations
Appendix: H- Greenfield Runoff Rate
Appendix: I- WINDES Permeable Paving Calculations
Appendix: J- Land Ownership Confirmation
Appendix: K- WINDES Pond Calculations
Appendix: L- LIDAR Data
Appendix: M- SuDs Layout
Appendix: N- Thames Water Pre-Development Enquiry Response

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
Unit 23 The Maltings Stanstead Abbotts Hertfordshire SG12 8HG **Tel 01920 871 777** **e: contact@eastp.co.uk** **www.eastp.co.uk**

Appendix: A - Location Plan

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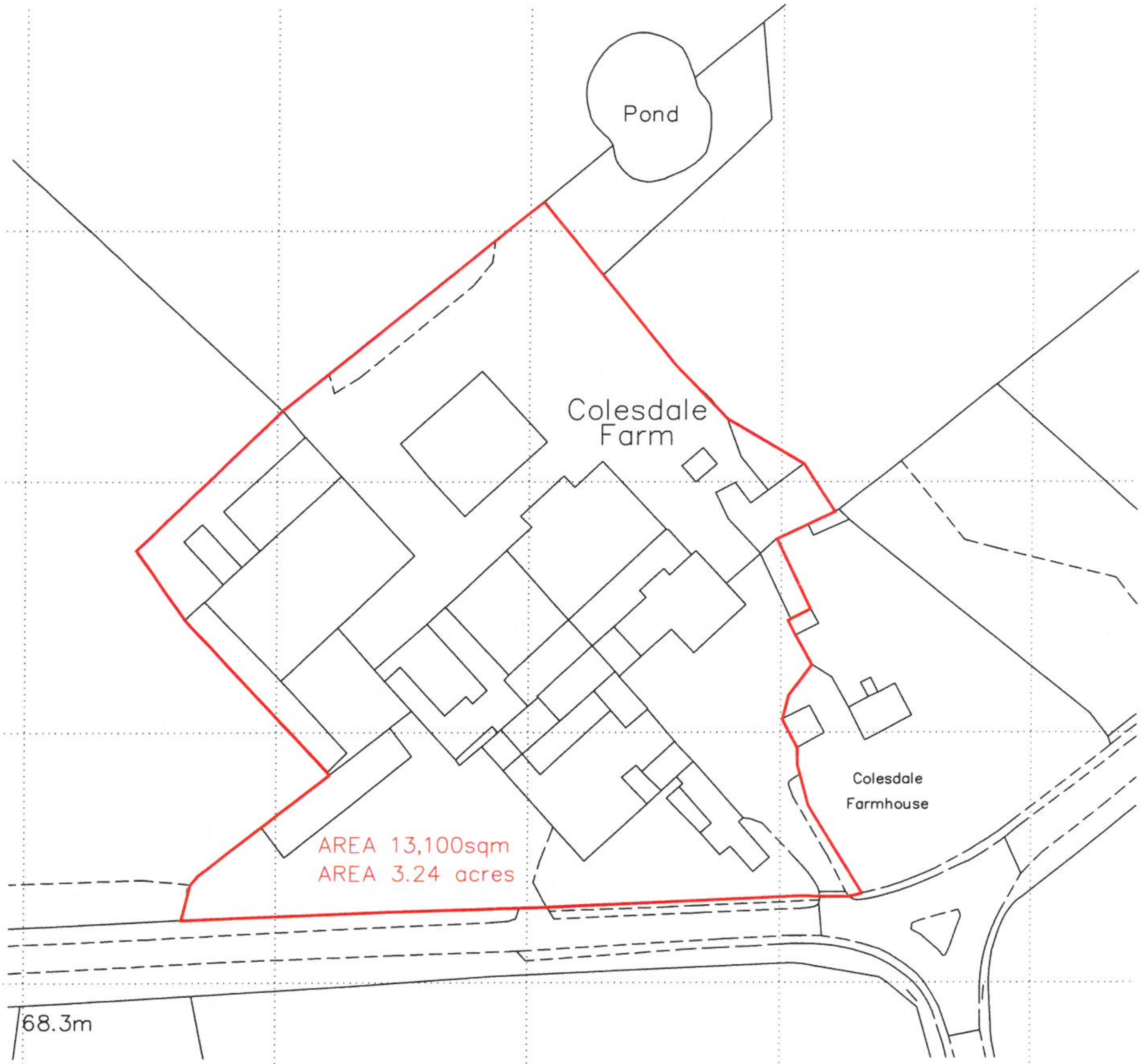

0 5 10 20 30 40 50
SCALE 1:1250

N

LEVEL NOTE.

NOTES.

Dwg. Title
AREA CALCULATION

Project Title
COLESDALE FARM
NORTHAW RD EN6 4QZ

Client
HUMPHREY
BROSNAN

Revisions	Date

Date	MARCH 2018	Drawn	APR
Scale	1:1250	Checked	APR
Dwg. No.	918100	Job No.	918100

THE SURVEY ASSOCIATION

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Block B, 1st Floor
Queens Road
Barnet
London EN5 4DL
t:020 8449 9143
f:020 8449 9153
www.aprservices.net
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Appendix: B – Site Layout

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NOTES:

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ASHLEY.THOMPSON@AT-ARCHITECTURE.UK

NO DIMENSIONS TO BE SCALED FROM DRAWING
ALL DIMENSIONS ARE APPROXIMATE AND TO BE CHECKED ON SITE

THIS DRAWING IS FOR PLANNING PURPOSES ONLY SUBJECT TO BUILDING CONTROL STANDARDS AND COMMENTS

REV:	BY:	DATE:	DETAILS:
B	AJT	08.10.2019	SCHEME AMENDED TO 34 UNITS
A	AJT	26.09.2019	SCHEME REDUCED

AT ARCHITECTURE
www.atarchitectureltd.com

PROJECT:
Colesdale Farm
NORTHAW

DRAWING TITLE:
Proposed Site Plan

SCALE:	STAGE:	DATE:
1:1000 (A3)	Planning	March 2019

DRAWING NO:	REVISION:
A_1921 PL100	**B**

Appendix: C – Flood Map for Planning

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
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Flood map for planning

Your reference	Location (easting/northing)	Created
FMFP	**529692/201836**	**3 Apr 2019 1:05**

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

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.

Environment Agency

Flood map for planning

Your reference
FMFP

Location (easting/northing)
529692/201836

Scale
1:2500

Created
3 Apr 2019 1:05

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

0 20 40 60m

Appendix: D – Topographical Survey

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
Unit 23 The Maltings Stanstead Abbotts Hertfordshire SG12 8HG **Tel 01920 871 777** **e: contact@eastp.co.uk** **www.eastp.co.uk**

ABBREVIATIONS

AB	Air Brick	DH	Duct Height	PRF	Post & Rail Fence
B	Bollard or Bottom Heights	DP	Down Pipe	PWF	Post & Wire Fence
BB	Belisha Beacon	ECB	Electricity Control Box	R	Render
BD	Back Drop	ELEC	Electricity	RAD	Radiator
BH	Borehole or Beam Height	EP	Electricity Pole	RE	Rodding Eye
BL	Bed Level	FB	Flower Bed	RG	Rough Ground
BP	Brick Paviors	FH	Fire Hydrant	RS	Road Sign
BRW	Brick Retaining Wall	FL	Floor Level	RSJ	Rolled Steel Joist
BS	Bus Stop	G	Gully	RWP	Rain Water Pipe
BT	British Telecom	GV	Gas Valve	S	Spread or Stone
BTCB	BT Control Box	H	Height in Metres	SC	Stop Cock
BW	Brick Wall	H	Window Head Height	SL	Soffit Level or Skylight
BWF	Barbed Wire Fence	HT	Height	SP	Arch Springer Height
C	Window Cill Height	IC	Inspection Cover	SPS	Stone Paving Slabs
CB	Control Box	IL	Invert Level	SW	Stone Wall
CBF	Close Boarded Fence	IRF	Iron Railing Fence	TCSU	Traffic Control
CBW	Concrete Block Wall	IWF	Interwoven Fence	T	Top Heights
CCB	Cable TV Control Box	KO	Kerb Outlet	TL	Traffic Light
CIF	Corrugated Iron Fence	L	Light	TP	Telephone Pole
CL	Cover Level	LP	Lamp Post	TPS	Tactile Paving Slabs
CLF	Chain Link Fence	MH	Manhole	UTL	Unable To Lift
CLSF	Chain Link Security Fence	MKR	Marker	V	Vent
CPF	Concrete Panel Fence	OV	Over Flow Pipe	VP	Vent Pipe
CPS	Concrete Paving Slabs	O/H	Overhead	W	Window
CR	Arch Crown Height	P	Post	WL	Water Level
CRW	Concrete Retaining Wall	PALF	Palisade Fence	WM	Water Meter
CSU	Ceiling Slopes Up	PF	Picket Fence	WMF	Wire Mesh Fence
CTV	Cable Television	PIT	Trial Pit	WPF	Wooden Panel Fence
CW	Concrete Wall	PL	Pavement Light	WV	Water Valve
D	Diameter or Doors	PM	Parking Meter	ø	Diameter

Top / Banks / Bottom

3.28 Floor to Ceiling Height

3.28 F False Ceiling Height

Drop Kerbs

Overhead Detail

Change in Elevation

Fences

Overhead Cables

Change in Surface

Edge of Vegetation

Gate

Survey Station

Foul Water Sewer

Surface Water Sewer

Combined Sewer

LEVEL NOTE.

ALL COORDINATES RELATE TO THE ORDNANCE SURVEY GRID AND DATUM VIA GPS OBSERVATIONS

COORDINATE SCHEDULE

STN.	EASTINGS	NORTHINGS	LEVEL
201	529629.143	201759.956	66.111
202	529700.040	201755.490	62.141
203	529759.021	201758.055	61.195
204	529757.169	201778.899	61.546
205	529734.389	201804.495	62.391
206	529748.357	201819.120	62.596
207	529734.283	201844.998	62.379
208	529725.723	201858.193	62.112
209	529708.109	201883.691	60.854
210	529683.955	201873.653	61.217
211	529658.495	201860.426	62.383
212	529617.001	201837.949	64.857
213	529632.063	201787.885	65.937
301	529714.988	201824.558	62.507
302	529739.083	201872.650	60.952
303	529679.767	201835.875	63.069
304	529636.714	201845.751	63.621
305	529649.731	201878.863	62.310
501	529660.909	201803.454	64.001
502	529678.835	201806.929	63.787
503	529721.061	201791.872	62.142
504	529738.002	201773.786	61.764
505	529718.646	201774.473	61.947
506	529713.016	201795.023	62.567

TREE SCHEDULE

No.	DIA	SPREAD	HEIGHT	TYPE
1	0.2	3	5	LAUREL
2	0.4	5	6	PINE
3	0.1	1	1	BAY
4	0.6	5	6	CYPRESS
5	0.5	5	6	CYPRESS
6	0.5	5	6	CYPRESS
7	1.0	14	12	H/CHESTNUT
8	0.1	1	1	BAY
10	0.2	4	5	ASH
11	0.2	4	5	ASH
12	0.4	6	12	CYPRESS
13	0.4	6	12	CYPRESS
14	0.2	4	8	CYPRESS
15	0.5	3	2	ELDER
16	0.25	5	5	UNKNOWN
17	0.2	3	3	FRUIT
18	0.2	3	5	CYPRESS
19	0.2	3	5	CYPRESS
20	0.25	4	5	CYPRESS
21	0.25	4	5	CYPRESS
22	0.4	4	5	CYPRESS
23	0.4	4	5	CYPRESS
24	0.4	4	5	CYPRESS
25	0.2	5	6	CYPRESS
26	0.25	4	5	ELDER
27	0.25	4	5	ELDER
28	0.1	2	3	ASH
29	0.2	3	4	ASH
30	0.2	5	5	ASH
31	0.1	3	4	ASH
32	0.25	4	4	DEAD
33	0.25	4	4	HAWTHORN
34	0.65	10	15	OAK
35	1.2	14	15	OAK
36	0.4	5	6	ELDER
37	0.4	5	10	CYPRESS
38	0.4	5	10	CYPRESS
39	0.4	5	10	CYPRESS
40	0.2	4	10	CYPRESS
41	0.2	4	10	CYPRESS

N

All underground services information shown on this plan cannot be guaranteed and users should satisfy themselves of the type, size and route before commencing work on site.
Tree types shown on this drawing cannot be guaranteed and if critical should be verified by an arboriculturist.
Tree spreads and diameters are averages unless otherwise indicated.
This plan has been produced for the client detailed below or their appointed agent to an agreed specification and defines the limit of APR Services liability

ISO 9001 :2008
certificate no A4047

THE SURVEY ASSOCIATION

A	HEIGHTS ON SITE ADDED TO BUILDINGS	APRIL 2018
Revisions		Date

Date	APRIL 2018	Drawn	LJC
Scale A1@	1:500	Checked	CPM
Dwg. No.	918128	Job No.	918128

Client

HUMPHREY BROSNAN

Dwg. Title
LAND SURVEY

Project Title
COLESDALE FARM,
NORTHAW ROAD WEST. EN6 4QZ.

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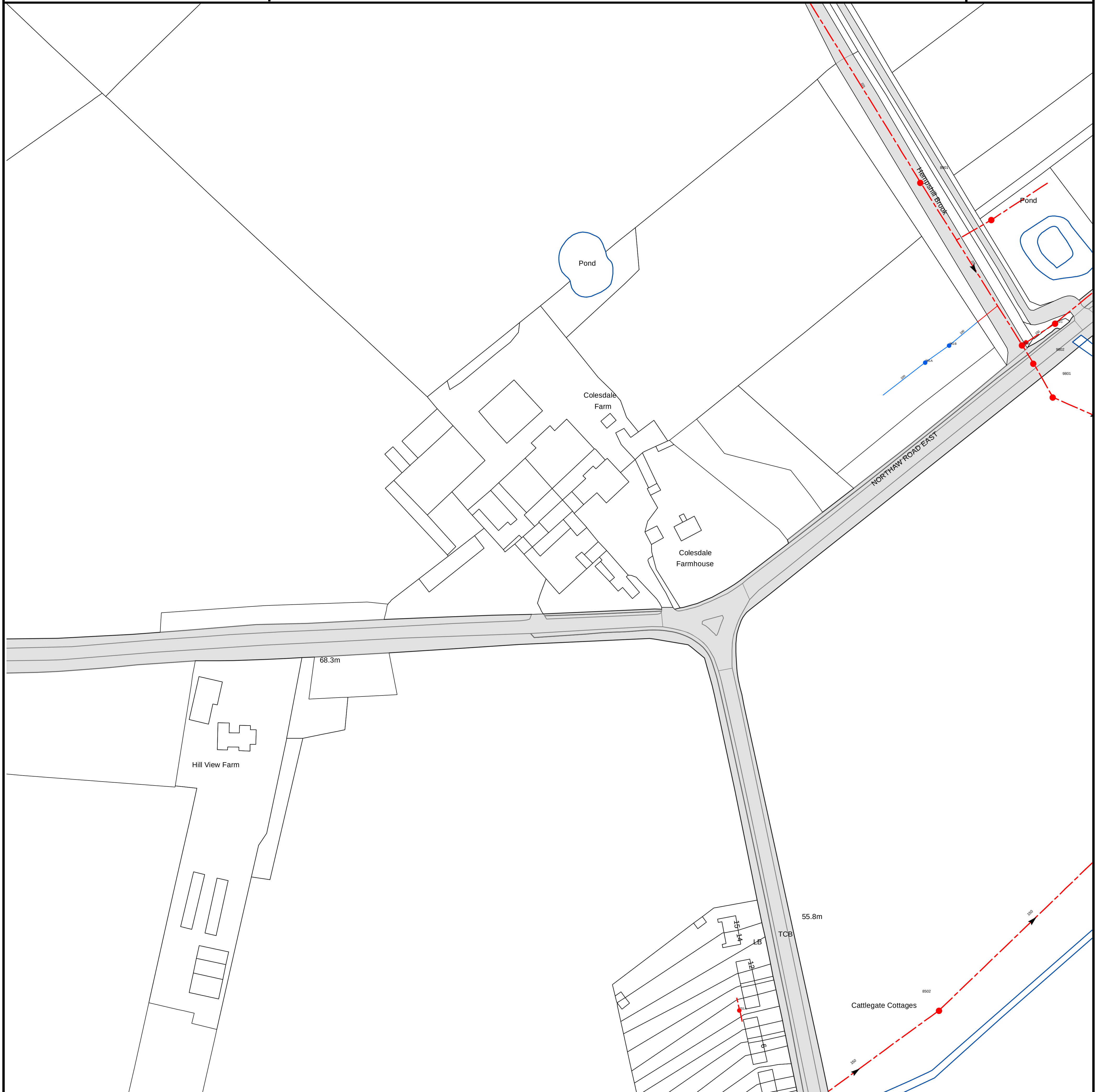
Appendix: E – Thames Water Sewer Records

Asset Location Search Sewer Map - ALS/ALS Standard/2019_3957952



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 529708,201796

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

EAS

Appendix: F – Surface Water Flow Path Overlaid With Site Layout

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KEY

FLOW VELOCITY >0.25m/s
DEPTH BELOW 300mm

DIRECTION OF FLOW

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:

EAS

Unit 23, The Maltings, Stanstead Abbotts, Hertfordshire, SG12 8HG
Tel: 01920 871777

www.eastp.co.uk

CLIENT:

ARCHITECT:

PROJECT:

COLESDALE FARM, NORTHAW
POTTERS BAR

TITLE:

SURFACE WATER FLOW PATH

SCALE @ A3:	DESIGN–DRAWN:	DATE:
1:500	RC	21/10/2019

PROJECT No:	DRAWING No:
2088	SK02 REV A

EAS

Appendix: G- Exisiting Run Off Calculations

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
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Run-off from Existing Site

Methodology

Using the Modified Rational Method, the surface water run-off rate, has been calculated for the proposed site which is assumed to be 100% impermeable.

Ref: Butler, D and Davies, J. (2006), Urban Drainage, 2nd ed, SPON.

Q = CiA

where

$$C = \frac{PIMP}{PR}$$

PIMP = Percentage of impervious area to total area
PR = Percentage Runoff

	Surface Area (m^2)
Existing Impervious Areas	12224.77
Total Area	12224.77

i (Rainfall intensity, mm/hr) = 50.00
i (Rainfall intensity, m/hr) = 0.050
i (Rainfall intensity, m/s) = 1.38×10^{-5}

Percentage run-off (PR)
Existing Impervious Area = 100%

Percentage of impervious area to total area (PIMP)
PIMP = 12224.77/12224.77= 100%

Therefore $C = \frac{PIMP}{PR} = 1$

Runoff from existing site:
Q = CiA
$Q = 1 \times 1.38\text{x}10^{-5} \times 12224.77m^2$
$Q = 0.168\ m^3s^{-1}$
$Q = 16.87ls^{-1}$

Total Q for the existing site = 16.87 l/s

Appendix: H- Greenfield Runoff Rate

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
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ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	1.000	Urban	0.000
SAAR (mm)	687	Region Number	Region 6

Results	**l/s**
QBAR Rural	4.3
QBAR Urban	4.3
Q100 years	13.7
Q1 year	3.7
Q30 years	9.7
Q100 years	13.7

EAS

Appendix: I- WINDES Permeable Paving Calculations

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
Unit 23 The Maltings Stanstead Abbotts Hertfordshire SG12 8HG **Tel 01920 871 777 e: contact@eastp.co.uk www.eastp.co.uk**

Cascade Summary of Results for Permeable Paving REV A.srcx

Upstream Structures	Outflow To	Overflow To
(None)	Pond Rev B.srcx	(None)

Half Drain Time : 1374 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	60.655	0.155	0.0	1.4	1.4	118.3	O K
30 min Summer	60.696	0.196	0.0	1.6	1.6	156.0	O K
60 min Summer	60.736	0.236	0.0	1.8	1.8	192.7	Flood Risk
120 min Summer	60.773	0.273	0.0	1.9	1.9	227.1	Flood Risk
180 min Summer	60.792	0.292	0.0	2.0	2.0	245.0	Flood Risk
240 min Summer	60.804	0.304	0.0	2.1	2.1	256.0	Flood Risk
360 min Summer	60.817	0.317	0.0	2.1	2.1	268.1	Flood Risk
480 min Summer	60.824	0.324	0.0	2.1	2.1	274.8	Flood Risk
600 min Summer	60.828	0.328	0.0	2.1	2.1	278.1	Flood Risk
720 min Summer	60.829	0.329	0.0	2.1	2.1	279.1	Flood Risk
960 min Summer	60.827	0.327	0.0	2.1	2.1	277.1	Flood Risk
1440 min Summer	60.820	0.320	0.0	2.1	2.1	271.2	Flood Risk
2160 min Summer	60.809	0.309	0.0	2.1	2.1	261.2	Flood Risk
2880 min Summer	60.798	0.298	0.0	2.0	2.0	250.2	Flood Risk
4320 min Summer	60.773	0.273	0.0	1.9	1.9	227.8	Flood Risk
5760 min Summer	60.751	0.251	0.0	1.9	1.9	207.0	Flood Risk
7200 min Summer	60.731	0.231	0.0	1.8	1.8	188.6	Flood Risk
8640 min Summer	60.714	0.214	0.0	1.7	1.7	172.4	Flood Risk
10080 min Summer	60.698	0.198	0.0	1.6	1.6	158.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	143.954	0.0	93.5	23
30 min Summer	92.629	0.0	110.3	38
60 min Summer	56.713	0.0	190.3	68
120 min Summer	33.583	0.0	220.1	126
180 min Summer	24.424	0.0	234.3	186
240 min Summer	19.389	0.0	243.1	246
360 min Summer	13.924	0.0	253.8	364
480 min Summer	11.018	0.0	260.5	484
600 min Summer	9.182	0.0	264.6	602
720 min Summer	7.908	0.0	267.1	722
960 min Summer	6.245	0.0	268.9	916
1440 min Summer	4.471	0.0	264.3	1140
2160 min Summer	3.197	0.0	400.3	1516
2880 min Summer	2.518	0.0	412.4	1932
4320 min Summer	1.796	0.0	405.5	2764
5760 min Summer	1.413	0.0	456.1	3568
7200 min Summer	1.172	0.0	465.6	4328
8640 min Summer	1.006	0.0	472.1	5104
10080 min Summer	0.884	0.0	476.4	5856

Cascade Summary of Results for Permeable Paving REV A.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	60.673	0.173	0.0	1.5	1.5	134.4	O K
30 min Winter	60.718	0.218	0.0	1.7	1.7	176.7	Flood Risk
60 min Winter	60.763	0.263	0.0	1.9	1.9	218.0	Flood Risk
120 min Winter	60.805	0.305	0.0	2.1	2.1	256.9	Flood Risk
180 min Winter	60.827	0.327	0.0	2.1	2.1	277.3	Flood Risk
240 min Winter	60.840	0.340	0.0	2.2	2.2	289.9	Flood Risk
360 min Winter	60.856	0.356	0.0	2.2	2.2	304.3	Flood Risk
480 min Winter	60.865	0.365	0.0	2.3	2.3	312.6	Flood Risk
600 min Winter	60.870	0.370	0.0	2.3	2.3	317.1	Flood Risk
720 min Winter	60.872	0.372	0.0	2.3	2.3	319.2	Flood Risk
960 min Winter	60.872	0.372	0.0	2.3	2.3	318.8	Flood Risk
1440 min Winter	60.862	0.362	0.0	2.3	2.3	309.6	Flood Risk
2160 min Winter	60.848	0.348	0.0	2.2	2.2	296.5	Flood Risk
2880 min Winter	60.831	0.331	0.0	2.1	2.1	281.1	Flood Risk
4320 min Winter	60.797	0.297	0.0	2.0	2.0	249.3	Flood Risk
5760 min Winter	60.765	0.265	0.0	1.9	1.9	220.2	Flood Risk
7200 min Winter	60.738	0.238	0.0	1.8	1.8	194.6	Flood Risk
8640 min Winter	60.714	0.214	0.0	1.7	1.7	172.5	Flood Risk
10080 min Winter	60.693	0.193	0.0	1.6	1.6	153.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	143.954	0.0	101.0	23
30 min Winter	92.629	0.0	118.7	37
60 min Winter	56.713	0.0	211.0	66
120 min Winter	33.583	0.0	240.4	124
180 min Winter	24.424	0.0	255.1	182
240 min Winter	19.389	0.0	264.4	242
360 min Winter	13.924	0.0	275.5	358
480 min Winter	11.018	0.0	282.4	474
600 min Winter	9.182	0.0	286.7	588
720 min Winter	7.908	0.0	289.3	700
960 min Winter	6.245	0.0	290.9	918
1440 min Winter	4.471	0.0	285.7	1190
2160 min Winter	3.197	0.0	449.2	1624
2880 min Winter	2.518	0.0	459.3	2080
4320 min Winter	1.796	0.0	446.1	2980
5760 min Winter	1.413	0.0	517.5	3808
7200 min Winter	1.172	0.0	529.5	4616
8640 min Winter	1.006	0.0	538.0	5448
10080 min Winter	0.884	0.0	544.0	6248

Cascade Rainfall Details for Permeable Paving REV A.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.450	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.500

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.250	4	8	0.250

Cascade Model Details for Permeable Paving REV A.srcx

Storage is Online Cover Level (m) 61.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	55.6
Membrane Percolation (mm/hr)	1000	Length (m)	55.6
Max Percolation (l/s)	858.7	Slope (1:X)	1000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	60.500	Cap Volume Depth (m)	0.000

Orifice Outflow Control

Diameter (m) 0.035 Discharge Coefficient 0.900 Invert Level (m) 60.500

Appendix: J- Land Ownership Confirmation

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
Unit 23 The Maltings Stanstead Abbotts Hertfordshire SG12 8HG **Tel 01920 871 777** **e: contact@eastp.co.uk** **www.eastp.co.uk**

Claregate
Cattlegate Road
Crews Hill
EN2 8AZ

16 May 2019

To whom it may concern

Colesdale Farm Land Ownership

I, Michael Marrinan of Claregate, Cattlegate Road, Crews Hill EN2 8AZ and Jean Bernadette Marrinan confirm that we jointly own the Colesdale Farm site currently the subject of application reference 6/2019/0882/OUTLINE. This land ownership is partly within HD320427 and partly within HD270820.

We are also joint owners of the land to the north and east within titles HD329634 and HD320427. This includes land to the north and east of the application site including some 450m of the length of Hempshill Brook and including both banks stretching from Northaw Road East to the north.

I confirm that we give agreement for access across our land and for all necessary drainage works to create a positive discharge mechanism from the development site into the main river.

Yours faithfully,

Signed:

Michael Marrinan Jean Marrinan

Dated:

Appendix: K- WINDES Pond Calculations

Cascade Summary of Results for Pond Rev B.srcx

Upstream Structures	Outflow To	Overflow To
Permeable Paving REV A.srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	59.981	0.081	1.4	1.8	O K
30 min Summer	59.990	0.090	1.6	2.0	O K
60 min Summer	60.000	0.100	1.8	2.2	O K
120 min Summer	60.011	0.111	1.9	2.6	O K
180 min Summer	60.021	0.121	2.0	2.8	O K
240 min Summer	60.031	0.131	2.0	3.1	O K
360 min Summer	60.224	0.324	2.0	10.2	O K
480 min Summer	60.250	0.350	2.0	11.4	O K
600 min Summer	60.264	0.364	2.0	12.1	O K
720 min Summer	60.274	0.374	2.0	12.6	O K
960 min Summer	60.286	0.386	2.0	13.2	O K
1440 min Summer	60.294	0.394	2.0	13.7	O K
2160 min Summer	60.284	0.384	2.0	13.1	O K
2880 min Summer	60.251	0.351	2.0	11.5	O K
4320 min Summer	60.017	0.117	1.9	2.7	O K
5760 min Summer	60.007	0.107	1.9	2.4	O K
7200 min Summer	60.001	0.101	1.8	2.3	O K
8640 min Summer	59.996	0.096	1.7	2.1	O K
10080 min Summer	59.993	0.093	1.6	2.1	O K
15 min Winter	59.985	0.085	1.5	1.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	143.954	0.0	92.3	101
30 min Summer	92.629	0.0	108.9	110
60 min Summer	56.713	0.0	189.6	142
120 min Summer	33.583	0.0	219.1	212
180 min Summer	24.424	0.0	233.2	286
240 min Summer	19.389	0.0	241.9	382
360 min Summer	13.924	0.0	252.5	1046
480 min Summer	11.018	0.0	259.1	1088
600 min Summer	9.182	0.0	263.2	1160
720 min Summer	7.908	0.0	265.6	1238
960 min Summer	6.245	0.0	267.3	1400
1440 min Summer	4.471	0.0	259.3	1728
2160 min Summer	3.197	0.0	399.9	2256
2880 min Summer	2.518	0.0	411.7	2852
4320 min Summer	1.796	0.0	404.2	2812
5760 min Summer	1.413	0.0	456.1	3624
7200 min Summer	1.172	0.0	465.6	4408
8640 min Summer	1.006	0.0	472.1	5184
10080 min Summer	0.884	0.0	476.2	5904
15 min Winter	143.954	0.0	99.7	104

Cascade Summary of Results for Pond Rev B.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
30 min Winter	59.995	0.095	1.7	2.1	O K
60 min Winter	60.007	0.107	1.9	2.4	O K
120 min Winter	60.028	0.128	2.0	3.0	O K
180 min Winter	60.234	0.334	2.0	10.7	O K
240 min Winter	60.263	0.363	2.0	12.1	O K
360 min Winter	60.292	0.392	2.0	13.6	O K
480 min Winter	60.310	0.410	2.0	14.5	O K
600 min Winter	60.323	0.423	2.0	15.3	O K
720 min Winter	60.332	0.432	2.0	15.8	O K
960 min Winter	60.344	0.444	2.1	16.5	O K
1440 min Winter	60.354	0.454	2.1	17.0	O K
2160 min Winter	60.348	0.448	2.1	16.7	O K
2880 min Winter	60.326	0.426	2.0	15.4	O K
4320 min Winter	60.254	0.354	2.0	11.6	O K
5760 min Winter	60.013	0.113	1.9	2.6	O K
7200 min Winter	60.003	0.103	1.8	2.3	O K
8640 min Winter	59.996	0.096	1.7	2.1	O K
10080 min Winter	59.991	0.091	1.6	2.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	92.629	0.0	117.3	119
60 min Winter	56.713	0.0	210.1	158
120 min Winter	33.583	0.0	239.3	278
180 min Winter	24.424	0.0	253.9	888
240 min Winter	19.389	0.0	263.1	894
360 min Winter	13.924	0.0	274.1	972
480 min Winter	11.018	0.0	280.9	1064
600 min Winter	9.182	0.0	285.2	1148
720 min Winter	7.908	0.0	287.6	1236
960 min Winter	6.245	0.0	287.9	1406
1440 min Winter	4.471	0.0	277.0	1742
2160 min Winter	3.197	0.0	448.5	2256
2880 min Winter	2.518	0.0	458.3	2784
4320 min Winter	1.796	0.0	444.7	3844
5760 min Winter	1.413	0.0	517.4	3864
7200 min Winter	1.172	0.0	529.4	4640
8640 min Winter	1.006	0.0	537.9	5544
10080 min Winter	0.884	0.0	543.8	6272

Cascade Rainfall Details for Pond Rev B.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.450	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.000

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.000

Cascade Model Details for Pond Rev B.srcx

Storage is Online Cover Level (m) 60.700

Tank or Pond Structure

Invert Level (m) 59.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	19.1	0.800	105.9

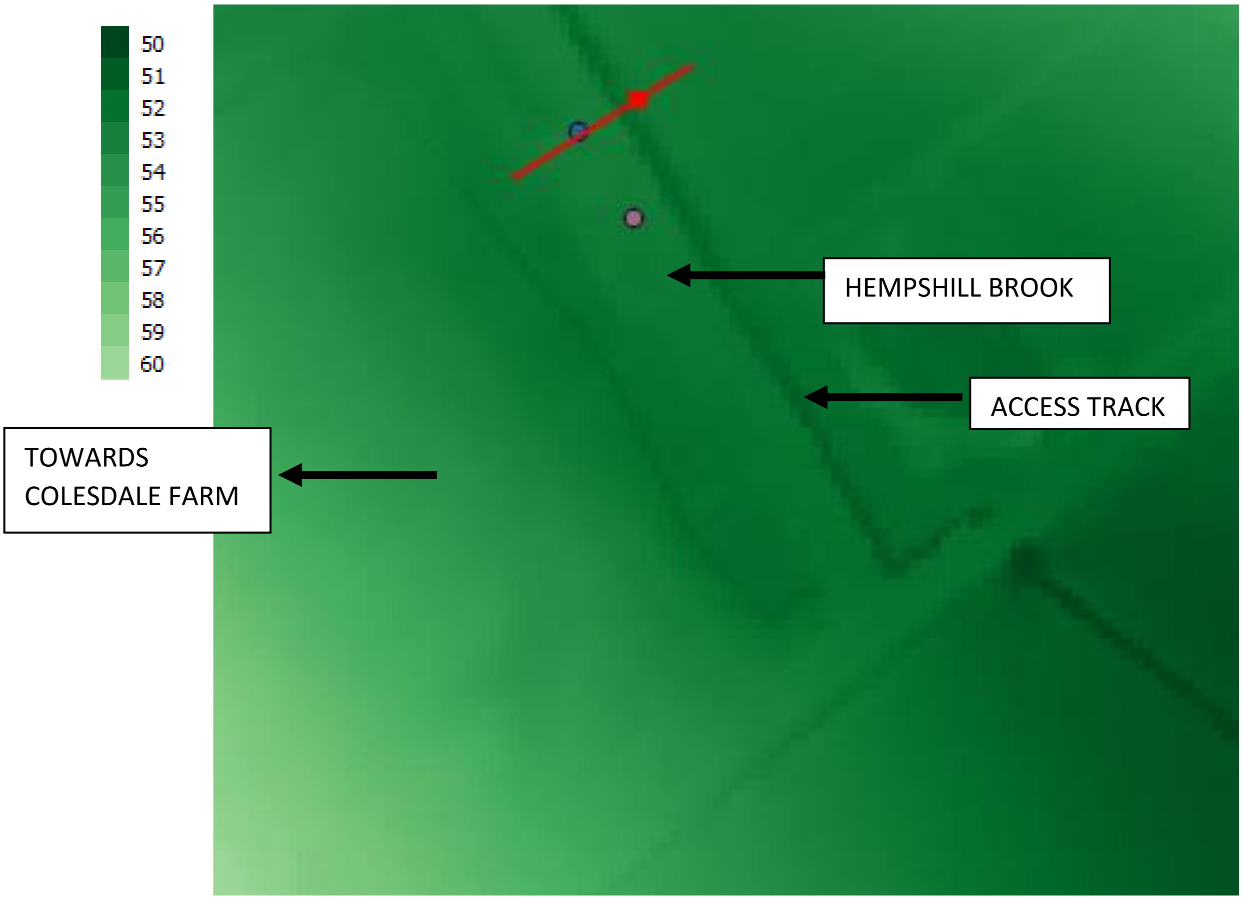
Hydro-Brake® Outflow Control

Design Head (m) 0.600 Hydro-Brake® Type Md4 Invert Level (m) 59.900
Design Flow (l/s) 2.4 Diameter (mm) 63

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	1.200	3.4	3.000	5.4	7.000	8.2
0.200	1.7	1.400	3.7	3.500	5.8	7.500	8.5
0.300	1.7	1.600	3.9	4.000	6.2	8.000	8.7
0.400	2.0	1.800	4.1	4.500	6.6	8.500	9.0
0.500	2.2	2.000	4.4	5.000	6.9	9.000	9.3
0.600	2.4	2.200	4.6	5.500	7.3	9.500	9.5
0.800	2.8	2.400	4.8	6.000	7.6		
1.000	3.1	2.600	5.0	6.500	7.9		

Appendix: L- LIDAR Data

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
Unit 23 The Maltings Stanstead Abbotts Hertfordshire SG12 8HG **Tel 01920 871 777 e: contact@eastp.co.uk www.eastp.co.uk**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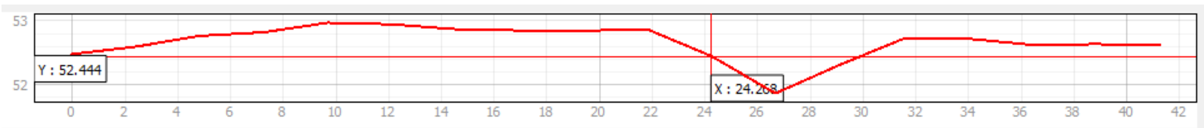
52
53
54
55
56
57
58
59
60
HEMPSHILL BROOK
ACCESS TRACK
TOWARDS COLESDALE FARM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52
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X : 24.268
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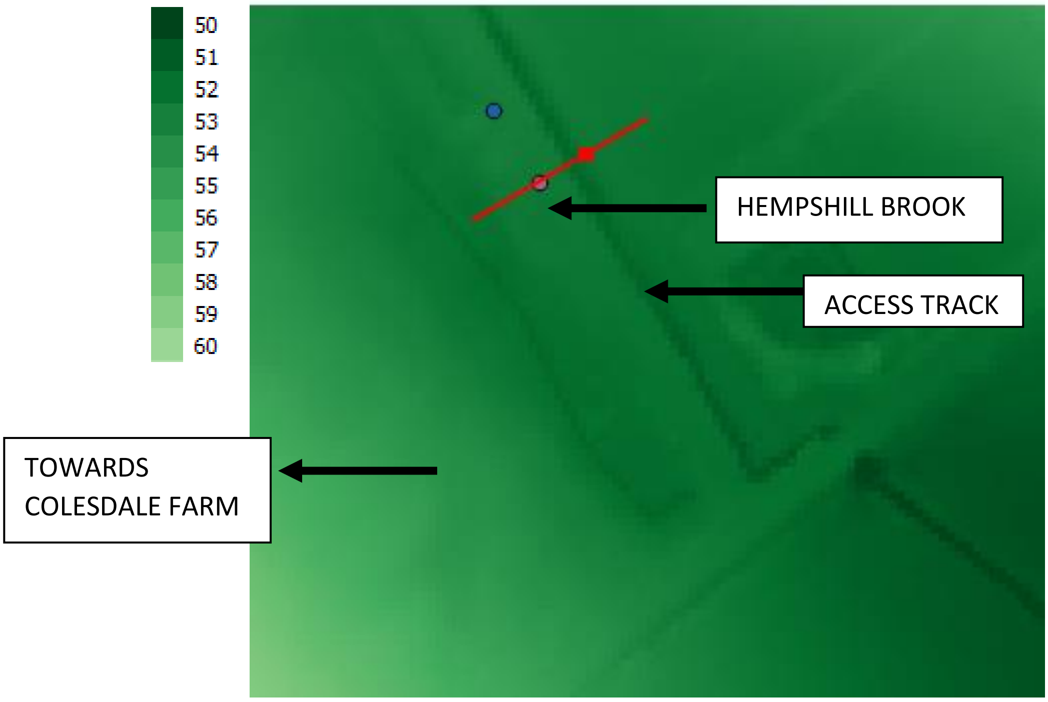
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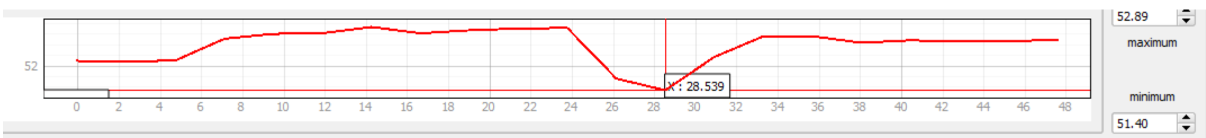
HEMPSHILL BROOK
ACCESS TRACK
TOWARDS COLESDALE FARM


52
X : 28.539
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
52.89
maximum
minimum
51.40

Appendix: M- SuDs Layout

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
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KEY

- LINED PERMEABLE PAVING ($3087m^2$) (REQUIRED SUB-BASE 372mm)
- ROOF AREA INCLUDING CAR PORTS ($1914m^2$)
- PUBLIC OPEN SPACE FOOTPATH TO BE CONSTRUCTED OF FREE DRAINING GRAVEL TO DRAIN TO SURROUNDING LAND

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:

EAS
Unit 23, The Maltings, Stanstead Abbotts, Hertfordshire, SG12 8HG
Tel: 01920 871777
www.eastp.co.uk

CLIENT:

ARCHITECT:

PROJECT:

COLESDALE FARM,
NORTHAW

TITLE:

OUTLINE SUDS LAYOUT

SCALE @ A1:	DESIGN-DRAWN:	DATE:
1:500	RC	21/10/2019
PROJECT No: 2088	DRAWING No: SK02 REV C	

Appendix: N- Thames Water Pre-Development Enquiry Response

Miss Louisa Wade

Unit 23, The Maltings,
Stanstead Abbotts,
Hertfordshire,
SG12 8HG

Wastewater pre-planning
Our ref DS6059061

14 March 2019

Pre-planning enquiry: Capacity Confirmation

Dear Louisa,

Thank you for providing information on your development.

Site: Colesdale Farm, Northaw Road West, Potters Bar, Hertfordshire - EN6 4QZ

Existing site: Brownfield (Farm house).
Existing foul water treated in private package treatment plant with outfall to ditch on site boundary.
Proposed site: Houses (40 units).
Proposed foul water discharge by gravity into manhole TL2901981B or manhole TL29018901.
Proposed surface water discharge to the ditch north of the site and not to Thames Water Sewer.

We're pleased to confirm that there will be sufficient foul water capacity in our sewerage network to serve your development.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

You'll need to keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient capacity.

What happens next?

Please make sure you submit your connection application, giving us at least 21 days' notice of the date you wish to make your new connection/s.

If you've any further questions, please contact me on 020 3577 7608.

Yours sincerely

Zaid Kazi

Development Engineer
Developer Services – Sewer Adoptions Team