# Land off Bullen's Green Lane, Colney Heath
# St Albans

## Flood Risk Assessment and Drainage Strategy

August 2020

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# Report Reference

**18770/FRA and DS**

# Revision History

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# Introduction

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# Introduction

**The following paragraphs state the purpose of this document, and its constraints. A summary of existing and future site details; together with relevant pre-planning correspondence is also provided.**

1.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been prepared by Woods Hardwick Infrastructure LLP on behalf of Canton Ltd; in support of an Outline Planning Application for a proposed residential development comprising up to 100 residential dwellings on a site known as 'Land off Bullen's Green Lane, Colney Heath'. A copy of the Site Location Plan is provided in **Appendix A**.

1.2 The application boundary for the site covers an area of approximately 5.25ha of undeveloped land. In terms of flood risk, the proposed development is situated in Flood Zone 1, land which has less than a 1 in 1,000 annual probability of river or sea flooding.

1.3 Although the site is not shown as being at risk of flooding on the EA mapping, this report has been prepared on the basis that the total site area exceeds 1ha.

1.4 This document has been written in accordance with the guidance contained within the Flood Risk and Coastal Change section of the Government's Planning Practice Guidance (FRCC, PPG).

1.5 This FRA concludes that the proposed development will not lead to the impedance of flood flows and will not increase the risk of flooding on the site itself, adjacent properties or to third parties situated either upstream or downstream of the site.

1.6 This document includes a Surface Water Drainage Strategy that identifies a suitable sustainable strategy for the disposal of surface water from the proposed development site that conforms with the guidance contained within the following documents:

- CIRIA C753 SuDS Manual (2015)
- Hertfordshire Council's LLFA Summary Guidance for Developers

1.7 The drainage principles were agreed during a pre-application meeting with the Lead Local Flood Authority (LLFA) in July 2020.

1.8 The proposed Drainage Strategy is based on a maximum allowance of 40% climate change in accordance with the Supplementary Planning Document for Sustainable Drainage Systems.

1.9 A suitable foul water outfall by way of direct connection to Thames Water assets located north east of the site in Bullens Green Lane has also been identified for the proposed development.

1.10 **From the findings of this report, the development proposals are considered appropriate for the site location; therefore, should be fully supported through the Planning process in terms of Flood Risk, Foul and Surface Water Drainage.**

# Existing Site and Proposed Development

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# Existing Site and Proposed Development

**The following paragraphs provide detail on the existing and proposed future residential development site; in relation to location, land uses, topography, as well as accessibility by travel and utilities.**

2.1 The proposed development site, which sits within both St Albans District Council and Welwyn Hatfield Borough Council, is located in the eastern part of Colney Heath, approximately 3km south west of Hatfield Town Centre and over 6km south east of St Albans Town Centre.

2.2 By road, Colney Heath is accessible from the A1(M) via the A414 North Orbital Road at Junction 3. The A414 North Orbital Road runs south of St Albans and provides a link between the A1 and M1. Colney Heath is also accessible from the M25 Junction 22 via Coursers Road.

2.3 The existing site covers an area of approximately 5.25ha of undeveloped agricultural land.

2.4 The site is bounded by Bullen's Green Lane and Fellows Lane to the east and south, respectively. Roestock Park abuts part of the western site boundary whilst existing residential properties abut the northern site boundary.

2.5 A Topographic Survey of the site was carried out by Woods Hardwick in June 2020. During the survey, information was recorded on the location and type of land features observed, including type of surface finishes, land boundaries, access routes, existing building outlines, vegetation and the geometric constraints of adjacent open channel ditches. All surveyed elevations were recorded at heights in metres above Ordnance Datum (mAOD). Ground levels and spot levels are also indicated on the drawing where they were recorded onsite. A copy of the Topographical Survey is provided in **Appendix B.**

2.6 In terms of existing drainage utilities, the Thames Water Wastewater Plans identifies the presence of existing Thames Water foul and surface water sewers serving the residential properties to the north and south of the site. There are no existing public sewers identified within the site boundary.

2.7 The topographical survey identifies existing sections of ditches adjacent to the site boundaries. However, the ditches do not appear to have an outfall beyond the site. It is considered likely that the ditches would have been put in place to drain the site with surface water eventually soaking into the ground. A drawing showing the existing drainage regime has been prepared and provided in **Appendix C**.

2.8 A Drainage Survey was carried out by Midland Survey Ltd in July 2020, following a pre-application meeting with the LLFA. The surveyors traced the Thames Water (TW) surface water networks to the north and south west of the site. Whilst the surveyors were unable to trace the entire routes due to third party land they confirmed it was highly likely that the network to the north discharges to the existing ditch north of Roestock Lane and the network to the south west discharges to the River Colne located west of the site.

2.9 The OS map indicates there is an existing drain which crosses the site. However, both the topographical and subsequent drainage survey could not find any evidence of this drain.

2.10 Notwithstanding this, the Ground Investigation Report prepared by Paddock Geo Engineering notes that the historic land drain running across the centre of the site was infilled in the last twenty years. A plastic suspected land drain pipe was observed at 0.9m depth.

2.11 Development proposals comprise up to 100 residential dwellings, with associated infrastructure. The main vehicular access will be provided via a new access road off Bullens Green Lane. A copy of the Illustrative Sketch Layout is provided in **Appendix D.**

# Flood Risk

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# Flood Risk

**The following paragraphs will identify whether or not there are any flood risks associated with the future development which may affect the proposals impact on the surrounding environment.**

3.1 Following the increased frequency of flooding during recent years, much work has been undertaken at a national level to assess the relationship between new development and flood risk. This work resulted in the publication of Planning Policy Statement 25 (PPS25) in early 2007 with an update being released in March 2010.

3.2 Alongside the release of the National Planning Policy Framework in March 2012 the Technical Guidance to the NPPF (TGNPPF) was released serving as a flood risk-based addendum to the national planning guidance. These documents replaced PPS25; however, many of the principles set out in PPS25 remain relevant. The TGNPPF has since been replaced by the Planning Practice Guidance which continues to follow the same principles.

3.3 Table 1 of the FRCC, PPG seeks to define Flood Risk Zones. An extract of this table is shown in Figure 3.1 which follows.

3.4 The definition of the flood zones noted in Figure 3.1, reaffirms the guidance and categorisation included within PPS25 and TGNPPF.

3.5 Table 2 of the FRCC, PPG defines 'Flood Risk Vulnerability Classification'. Residential dwellings are classified under the 'More Vulnerable' category, as such the proposed development is considered to be a 'More Vulnerable' type of development.

3.6 The Environment Agency (EA) Flood Map demonstrates that the site lies within Flood Zone 1 and is therefore classified as having less than a 1 in 1,000 annual probability of flooding from rivers or seas. A copy of the EA Flood Map covering the immediate surrounding area for the proposed development is shown in **Appendix E**.

3.7 Table 3 of the FRCC, PPG compares the suitability of a development within a particular Flood Zone based on its corresponding Flood Risk Vulnerability Classification. Developments like the proposed which are classified as 'More Vulnerable', are deemed appropriate for development within Flood Zone 1. Therefore, there is no need to carry out a Sequential Test or Exception Test.

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

Figure 3.1: Flood Zone Definitions - Planning Practice Guidance Extract

**Risk of Flooding to the Development from Known Sources**

3.8 Notwithstanding the above, presented below is a summary and analysis of the potential for the site to flood from known sources.

Flooding from Rivers and/ or Watercourses

3.9 The topographical survey identifies sections of existing ditches adjacent to the site boundaries.

3.10 The nearest EA watercourse is the River Colne, which is located over 0.5km south west of the site.

2.12 The EA Flood Map enclosed in **Appendix E** shows that the proposed development land is situated in Flood Zone 1, land which has less than a 1 in 1,000 annual probability of river or sea flooding.

Flooding from the Sea

3.11 The nearest sea to the site is the North Sea, which is located some 90km to the east. Given this distance and the fact that the site lies above 74m AOD; the proposed residential scheme is not considered to be at risk of flooding from this source.

Flooding from Land

3.12 The potential for overland flows needs to be considered to ensure that neither the development nor adjacent land and/ or property, including that which may be under the responsibility of a third party is placed at an unacceptable risk of flooding.

3.13 From the EA Surface Water Flood Map for the site, which is enclosed in **Appendix F**, parts of the site are shown to be at low to high risk of surface water flooding. The area associated with high risk of surface water flooding on site is significantly small. Only areas adjacent to the north eastern and south western site boundaries are identified to be at medium risk of surface water flooding. In both scenarios flood depts are below 300mm.

3.14 It would appear that the surface water flooding shown on the EA maps is due to surface water runoff emanating on the site following existing flow route/natural depressions towards the lower areas within the site.

3.15 It should be noted that, the SFRA for the area did not identify any historic surface water flood incidents in the vicinity of the site.

3.16 Notwithstanding the above, any surface water flows which may emanate on site will be managed within the drainage strategy following the development of the site.

Flooding from Groundwater

3.17 A Ground Investigation (GI) for the site was carried out by Paddock Geo Engineering (PGE) in July 2020, which included groundwater monitoring and Infiltration testing using the BRE Digest 365 methodology in machine excavated pits. A copy of the relevant extracts from the PGE Report Trial is included in **Appendix G**.

3.18 From the results of the intrusive ground sampling carried out by PGE; it can be concluded that the sub-strata composition of the site typically consists of topsoil/made ground underlain by Lowestoft Formation.

3.19 The report also notes that Groundwater was encountered within two of the shallow trial pits and within four of the six boreholes undertaken at depth of 0.9m to 4m, typically as seepages within the sand band and pockets of gravel. Subsequent groundwater monitoring of the standpipes indicates groundwater levels of between 1.40m and 4.30m.

3.20 The Level 1 Strategic Flood Risk Assessment (SFRA) for the area shows that the site does not lie within an area susceptible to groundwater flooding. In addition, the SFRA did not identify any historic groundwater flooding incidents in the vicinity of the site.

3.21 Based on the above information, it is anticipated that groundwater flooding should not be an issue to the proposed development.

Flooding from Sewers

3.22 A copy of the Thames Water Wastewater Plan illustrating the site extents and the immediate surrounding areas on Ordnance Survey (OS) mapping; together with approximate locations of Thames Water assets is enclosed in **Appendix H**.

3.23 From the plan, it can be seen that there are no Thames Water assets located within the site extent. However, Thames Water Wastewater Plans identifies the presence of existing Thames Water foul and surface water sewers serving the residential properties to the north and south of the site.

3.24 As previously mentioned, the OS map indicates there is an existing drain which crosses the site. However, it is noted this was infilled in the last twenty years.

3.25 Based on the evidence provided above, the proposed site is not considered to be at risk of flooding from this source.

Flooding from Reservoirs, Canals and Other Artificial Sources

3.26 The EA Reservoir Flood Map was acquired by Woods Hardwick Infrastructure LLP on the 13th July 2020 from the EA's website. A copy of this mapping is enclosed in **Appendix I**. No part of the site or any immediate neighbouring land is shown to be at risk of flooding form reservoirs.

3.27 It should be noted that an occurrence of flooding from reservoirs is considered by the EA to be extremely rare. There has been no loss of life in the UK from reservoir flooding since 1925.

**Risk of Flooding from the Proposed Development**

3.28 Presented below is a summary and analysis of the potential for the site to exacerbate the risk of flooding to third parties both upstream and downstream.

Encroachment onto Floodplain

3.29 As outlined above, the site does not lie within the floodplain, there is therefore no risk of encroachment upon the floodplain.

Impedance of Flood Flows

3.30 As the site lies out of the floodplain there is no risk of the site impeding flood flows.

Contribution of Flood Flows by Development Drainage

3.31 As previously mentioned, the existing site covers an area of approximately 5.25ha of undeveloped open land.

3.32 The proposed development comprises up to 100 residential dwellings with associated infrastructure such as access roads, footways, and car parking. These elements will all contribute to the development's surface water discharge.

3.33 If considered appropriate at the detailed design stage, flooding routing measures will be incorporated to ensure that flood waters in excess of those for which the site has been designed to accommodate, will be routed away from the more vulnerable areas of the site.

3.34 The surface and foul water disposal strategies for the site are described in greater detail in the following 'Chapter 4 – Proposed Development Drainage Strategy'.

Climate Change

3.35 There is an increasing body of scientific evidence that suggests that the global climate is changing as a result of human activity. Past, present and future emissions of greenhouse gases are expected to cause significant climate change during this century.

3.36 The nature of climate change will vary for the UK. Projections of future climate change indicate that more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall can be expected. These kinds of changes will have implications on river-flooding and also localised flash flooding.

3.37 The Planning Practice Guidance requires developments to consider the potential impacts of climate change. In February 2016 the EA released new guidance titled 'Flood risk assessments: climate change allowances' (FRA:CC), in which the peak rainfall intensity allowance in small and urban catchments is assessed.

3.38 Considering the above, the climate change allowance that the proposed development's drainage strategy will be based on, is set at a value of +40% ('Upper End' value i.e. 90th Percentile, taken from Table 2 of the FRA: CC, representing the total potential change anticipated for 2070 to 2115).

# Proposed Development
# Drainage Strategy

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# Proposed Development Drainage Strategy

**The following paragraphs will provide detail on the proposed site generated foul and surface water disposal methods, design criteria, maintenance regimes and potential third-party legal agreements.**

4.1 In addition to ensuring that the development is not at risk of flooding from external sources, it is also important to ensure that the scheme itself does not exacerbate flood risk for others. It is therefore essential that the arrangements for storm and foul water disposal are fully assessed to guarantee that the effects are mitigated and that there will be no impact on the existing land drainage regime.

**Surface Water Drainage Strategy**

4.2 All of the recent guidance on the arrangements for storm water disposal from new developments has encouraged the application of a hierarchy for surface water disposal. This has now been formalised in the Building Regulations Part H. The hierarchy is also the basis of the advice on surface water disposal recommended by Bedford Borough Council, in their role as Lead Local Flood Authority (LLFA) in the BBC publication, 'Supplementary Planning Document for Sustainable Drainage Systems (February 2018).

4.3 The first choice for surface water disposal which should be pursued is via infiltration. Only where it has been determined that the ground conditions are not suitable should the second choice of disposal to a ditch and/ or watercourse be considered. If there is no alternative the third and last choice of disposal to the public sewer can be considered.

Method of Surface Water Discharge

Infiltration

3.39 Infiltration testing was carried out onsite by PGE for 7 trial pits in accordance with the BRE 365 methodology. The results indicate that significant infiltration was not noted within any of these trial pits.

3.40 It is therefore considered that the use of infiltration techniques such as traditional soakaways will not be suitable for surface water discharge at the proposed site. For full copies of the infiltration data and trial pit logs, see **Appendix G**.

3.41 It is also noted that there is an Affinity Water abstraction point immediately north west of the site, therefore infiltration is not appropriate in this area.

### Ditch and/ or Watercourse

4.4 As previously mentioned, the nearest watercourse to the site is the River Colne, which is located over 0.5km south west of the site.

4.5 The topographical survey identified existing sections of ditches adjacent to the site boundaries. However, the ditches are too shallow to be a feasible solution and they do not appear to have an outfall beyond the site.

4.6 In light of the above, it is therefore considered that surface water disposal to a ditch/watercourse will not be a feasible option.

### Discharge to Public Sewer

4.7 In accordance with the hierarchy for surface water disposal, the next option to be explored is disposal to the public sewer.

4.8 It is therefore proposed to discharge surface water runoff from the development site to the existing Thames Water public surface sewer located in Bullens Green Lane, north east of the site.

4.9 Thames Water have already confirmed they would accept a connection to the public surface water sewer at MH1150 in Roestock Gardens, at a maximum rate of 9.3l/s which is equivalent to the previously calculated QBAR rate. However, a new connection at this manhole would require crossing third party land. As such, Woods Hardwick have written to Thames Water, requesting a new point of connection at MH3010 in Bullens Green Lane, north east of the site. Their response is currently awaited. Copies of the correspondence with Thames Water are contained in **Appendix J**.

4.10 At the detailed design stage, the proposed surface water network will be designed and tested within the relevant software package, to ensure that surface water flows generated from the site will not exceed this prescribed rate during a 1 in 100 year plus 40% climate change rainfall event.

**Discharge Strategy**

Rainfall Data

4.11 The Flood Estimation Handbook (FEH) methodology has been used in order to determine the requirements of the drainage network.

Runoff Rate

4.12 The impermeable area of the site has been calculated from the Illustrative Sketch Layout. This impermeable area comprises surfaces occupied by the proposed houses, garages, private drives, the access roads including adjacent footpaths.

Attenuation Volume Requirement

4.13 The site is currently undeveloped, therefore the proposed development will generate an increase in impermeable area. Based upon the illustrative layout drawing submitted with the application, the proposed development would generate an impermeable area of 3.15ha.

4.14 Woods Hardwick recently contacted Thames Water, requesting confirmation that they would accept a new connection to the public sewer network in Bullens Green Lane, north east of the site. Their response is currently awaited.

4.15 Notwithstanding the above, a minimum rate of 5l/s has been used for the storage calculations at this stage. This is considered to be a robust approach as the minimum rate is lower than the calculated QBAR rate for the site; 9.6l/s. A copy of the Greenfield Calculation is provided in **Appendix K**.

4.16 It is necessary to ensure that sufficient attenuation is provide to accommodate the runoff from 3.15ha of impermeable surfacing during 1 in 100-year (+40% climate change) storm event. The drainage calculations demonstrate that the proposed attenuation basin is capable of accepting flows from the 100 year rainfall event, including 40% allowance for climate change.

4.17 It should be noted that the final discharge rate and storage volume requirement will be dependent upon the Thames Water's response and the final impermeable area. At the detailed design stage, calculations will be re-run and the strategy will be refined as necessary. Depending upon the final proposals it may therefore be necessary to provide additional storage volumes.

Method of Attenuation

4.18 In accordance with current guidelines and best practice, the Developer's best endeavours will be made to ensure that appropriate Sustainable Urban Drainage Systems (SuDS) are used wherever practicable. There are a number of primary methods available, the appropriateness of which has been considered and summarised in Table 4.1 below;

Table 4.1: SuDS Feasibility Consideration

| SuDS System | Feasibility | Comments |
|---|---|---|
| Green Roofs | X | Cost is likely to adversely affect the scheme's viability. |
| Permeable Paving | ✓ | Lined permeable paving is proposed within the private areas for surface water treatment. |
| Soakaways | X | Infiltration testing confirm that the use of soakaways is not viable for the proposed development. |
| Rainwater Harvesting | ✓ | Feasible and will be utilised where practicable, although not accounted for within currently proposed drainage strategy or attenuation calculations. |
| Swales | ✓ | Swales are proposed alongside to the main road for surface water treatment. |
| Attenuation Basin | ✓ | An attenuation basin is currently proposed on this scheme to provide surface water storage and treatment. |
| Geo-cellular Storage Crates | X | Not currently proposed as the proposed attenuation basin offers a more sustainable solution. |

4.19 Based upon the assessment above, which takes into account the topography of the site and the underlying conditions, it is proposed to provide surface water storage within the proposed attenuation basins. The attenuation basins, which will be placed at the north western extent of the site, will provide a total of $2092m^3$ of surface water storage. The south western basin, will be constructed to a maximum depth of 1.5m, whilst the north eastern basin is only 0.6m deep and acts as an overflow for the main pond. Both basins will have side slopes of 1 in 3 and at 0.6m depth, the north eastern basin is expected to be dry most of the time and will provide a multi-functional space.

4.20 In addition to the above, swales are proposed alongside the main road, and permeable paving within private areas for surface water treatment. These features are currently not accounted for within the drainage calculations. The Proposed Drainage Strategy Drawing and associated Flow Calculations are provided in **Appendix L and M**, respectively.

Surface Water Conveyance

4.21 Surface water runoff from the proposed impermeable areas will generally be routed towards the surface water pumping station in the northern extent of the site via a gravity fed piped network.

4.22 Two offline basins will be located in the north eastern extent of the site to provide surface water storage.

4.23 The swine road will drain 'over the edge' or via kerb outlets into the shallow swales alongside the carriageway.

4.24 From the pumping station, surface water flows will be pumped towards the existing public surface water sewer in Bullens Green Lane, north east of the site. The pumping station will also act as a flow control to ensure that discharge rates do not exceed the discharge rate prescribed by Thames Water.

4.25 As previously mentioned, the final discharge rate and storage volume will be dependent upon the Thames water's response and the final impermeable area. At the detailed design stage, the proposed surface water sewer network will be tested against a 1 in 100-year (+40% climate change) rainfall event using the XP Solutions MicroDrainage or Flow software, where the discharge rate at the outfall position must be shown to not exceed the agreed rate.

4.26 Notwithstanding the above, the current calculations are based on a minimum rate of 5l/s, which is lower than the QBAR rate.

Surface Water Drainage Maintenance

4.27 The arrangements for further maintenance of the surface water drainage system needs to be fully considered and, in that respect, it is anticipated that the onsite piped drainage network would be adopted by Thames Water Services Ltd through a Section 104 Agreement (Water Industry Act 1991).

4.28 It is anticipated that the attenuation basins, swales and permeable paving will be maintained by a management company.

4.29 A summary of the likely maintenance requirements for the proposed drainage network is provided in Table 4.2 below.

Table 4.2: Recommended Maintenance for Swales / Attenuation Basins

| Swales / Attenuation Basin | | |
|---|---|---|
| **Monitoring** | **Frequency** | **Responsibility** |
| To be visually inspected after heavy rainfall events to ensure they are free of debris and litter. | As required | Management Company |
| **Regular Maintenance** | | |
| Litter and debris removal from the site | Monthly | Management Company |
| Amenity grass cutting at 35-50mm | As required | |
| Inspect and clear inlets, outlets, control structures and overflows | Monthly | |
| **Occasional Maintenance** | | |
| Remove Leaf Accumulation | As required | Management Company |
| Remove sediments from inlets and structures | As required | |
| **Remedial Work** | | |
| Inspect and repair damage to inlets, outlets, banks and overflows | As required | Management Company |

4.1 It should be noted that the maintenance schedule document should be considered indicative only. The frequency and type of maintenance tasks to be carried out should be reviewed as necessary to ensure that the schedule remains relevant to the nature and location of the proposed residential development.

**Foul Water Drainage Strategy**

4.39 A Pre-Planning Enquiry was submitted to Thames Water, requesting confirmation that the existing foul network to the north east of the site has sufficient capacity to accommodate the foul discharge from the proposed development, via a pumped connection to the public foul network in Bullens Green Lane, north east of the site. In their response dated 20th August 2020, Thames Water confirmed that they would accept a new connection at MH3011 in Bullens Green Lane at 2.3l/s.

4.40 A suitable foul sewer network to discharge the residential development, will be designed in accordance with Thames Water's adoptable standards, providing a direct point of connection between the development site and the agreed Thames Water foul outfall. Further details of this design will be provided at the detailed design stage.

4.41 In accordance with relevant drainage policy, Thames Water are obliged to accept foul water flows from a proposed development, subject to the site receiving planning consent. In anticipation that such a consent will be granted for the proposed residential scheme, it is expected that Thames Water will make the necessary arrangements to ensure that the required provision within their public foul sewer network and treatment works will be available at the time that the Applicant wishes to connect the site's foul sewers to the designated outfall.

Foul Water Drainage Maintenance

4.42 In anticipation that the proposed residential development will be connected to the Thames Water public foul sewer network; it is considered reasonable to expect that Thames Water Services will act in their full capacity as the wastewater provider for the local area, to ensure that maintenance of their public sewers will be carried out as required from the point at which the existing private sewer outfalls connect to the public sewer network.

# Summary and Conclusion

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# Summary and Conclusions

**The following paragraphs summarise the findings of this Flood Risk Assessment and Drainage Strategy. Details of foul and surface water outfalls, SuDS features and legal agreements are also provided.**

5.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been prepared by Woods Hardwick Infrastructure LLP on behalf of Canton Ltd; in support of an Outline Planning Application for a proposed residential development comprising up to 100 residential dwellings on a site known as 'Land off Bullens Green Lane, Colney Heath'.

5.2 The site comprises an area of approximately 5.25 ha and is shown on the EA's Flood map for planning as lying within Flood Zone 1.

5.3 All potential sources of flooding to the proposed development have been considered and it has been demonstrated that the site will not be at any significant risk of flooding. Access and egress to the site will be maintained during extreme storm events.

5.4 It has been demonstrated that the proposed development will not exacerbate the risk of flooding to third parties either upstream or downstream from the site.

5.5 The Surface Water Drainage Strategy has been developed in accordance with the hierarchy for sustainable surface water disposal. The results from the intrusive ground investigation confirm that the underlying soil conditions are not suitable for infiltration techniques. Conveyance of surface water to the nearest ditch or watercourse was also considered; however, the adjacent ditches do not appear to have an outfall beyond the site. As such, in this particular instance it is considered more appropriate to discharge surface water runoff from the development site to the existing Thames water public sewer located in Bullens Green Lane, north east of the site.

5.6 Thames Water have already confirmed they would accept a connection to the public surface water sewer at MH1150 in Roestock Gardens, at a maximum rate of 9.3l/s which is equivalent to the previously calculated QBAR rate. However, a new connection at this manhole would require crossing third party land. As such, Woods Hardwick have written to Thames Water, requesting a new point of connection at MH3010 in Bullens Green Lane, north east of the site. Their response is currently awaited.

5.7 At this stage, a minimum rate of 5l/s has been used for the storage calculations. This is considered to be a robust approach as the minimum rate is lower than the calculated QBAR rate for the site; 9.6l/s. However, it should be noted that the final discharge rate and storage volume requirement will be dependent upon the Thames Water's response and the final impermeable area. At the detailed design stage, calculations will be re-run and the strategy will be refined as necessary. Depending upon the final proposals it may therefore be necessary to provide additional storage volumes.

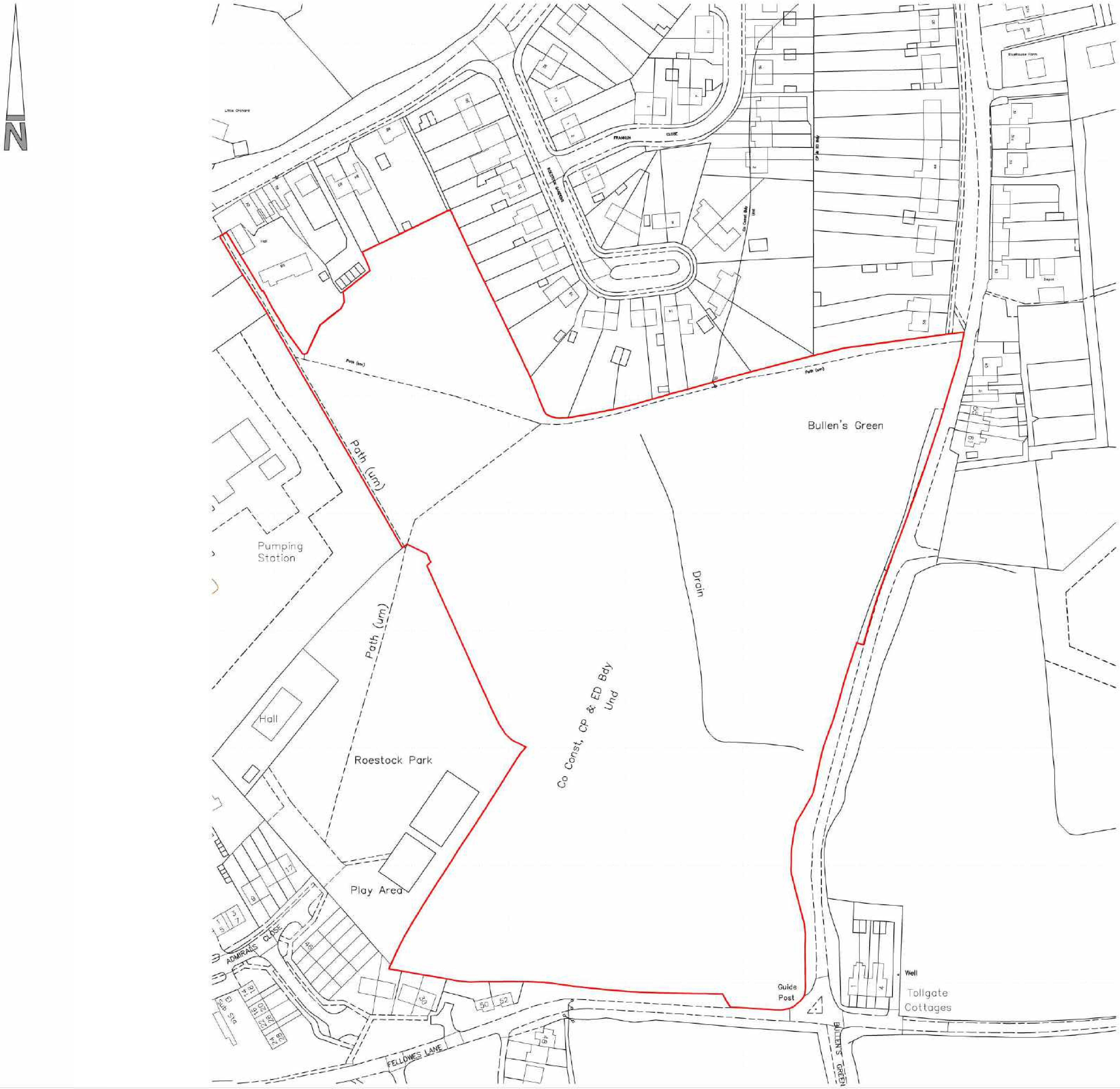
5.8 Surface water runoff from the site will generally be routed towards the surface water pumping station in the northern extent of the site via a gravity fed piped network. From here, surface water flows will be pumped towards the existing public surface water sewer in Bullens Green Lane, north east of the site. Two offline basins will be located in the north eastern extent of the site to provide surface water storage. In addition, swales are proposed alongside the main road, and permeable paving within private areas for surface water treatment.

5.9 It is proposed to discharge the site's foul flows, via a pumped connection, to the public foul network in Bullens Green Lane, north east of the site.

5.10 At the detailed design stage, a suitable foul sewer network will be designed to demonstrate the conveyance of foul flows to the designated Thames Water foul outfall. Following the detailed design of this sewer network, an appropriate means of connection to the public sewer will be progressed via a Section 106 (Water Industry Act 1991) Agreement. In turn, the adoption of any element of proposed foul sewer will be offered for Thames Water adoption will be progressed via a Section 104 (Water Industry Act 1991) Agreement.

5.11 **From the information provided within this report, it is concluded that there is no reason in terms of drainage or flood risk why the residential development proposed at 'Land off Bullen's Green Lane, Colney Heath'; should not be fully supported through the planning process.**

# Appendix A
## Site Location Plan




0 10 20 30 50 100 150 200
SCALE 1:1250

**NOTES**

1. Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be reported to the Architect or Engineer before proceeding. © This drawing is copyright.

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| REV | DESCRIPTION | DRN | CHD | DATE |
|---|---|---|---|---|

■ PRELIMINARY ☐ INFORMATION ☐ TENDER
☐ CONSTRUCTION ☐ AS BUILT

| | | | |
|---|---|---|---|
| SCALE | 1:1250@ A2 | DATE | MAY 20 |
| DRAWN | RR | CHK | TF |
| DRAWING NO. | 17981-1002 | REV | B |

TITLE
Roundhouse Farm, Roestock Lane
Colney Heath

DETAILS
Site Location Plan

Woods Hardwick
Architecture | Engineering | Planning | Surveying


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# Appendix B

## Topographic Survey

Woods Hardwick
Architecture | Engineering | Planning | Surveying

**NOTES**

1. Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be reported to the Architect or Engineer before proceeding. © This drawing is copyright.

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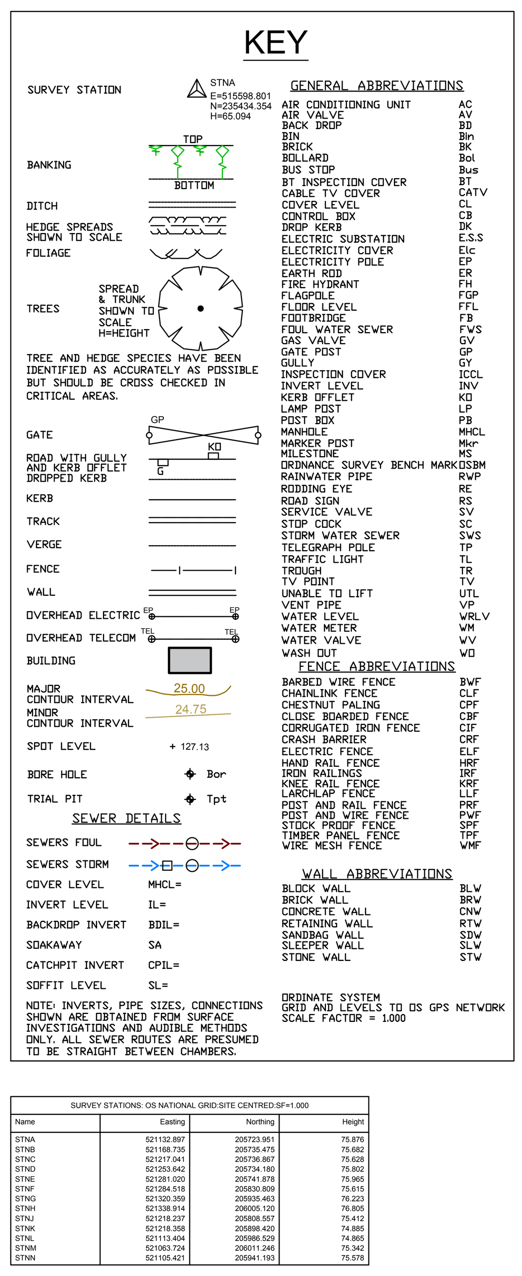




| REV | DESCRIPTION | DRN | CHD | DATE |
|---|---|---|---|---|

■ PRELIMINARY ☐ INFORMATION ☐ TENDER
☐ CONSTRUCTION ☐ AS BUILT

| | | | |
|---|---|---|---|
| SCALE | 1:200 @ A0 | DATE | JUNE 2020 |
| DRAWN | NC | CHK | NC |
| DRAWING NO. | 17981-7-855 | REV | - |

TITLE
FELLOWES LANE
ROESTOCK, COLNEY HEATH

DETAILS
TOPOGRAPHIC SURVEY
OVERALL PLAN


Woods Hardwick
Architecture | Engineering | Planning | Surveying

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PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS DRAWING

# Appendix C

## Existing Drainage Plan


**NOTES**

1. Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be reported to the Architect or Engineer before proceeding.
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3. Until technical approval has been obtained from the relevant authorities, all drawings are issued as preliminary and not for construction. Should the Contractor commence site work prior to approval being given it is entirely at his own risk.

**SAFETY, HEALTH AND ENVIRONMENTAL**

In addition to the hazards, risks normally associated with the type of work detailed on this drawing, note the following significant risks and information.

Construction:

1. There is an existing HV cable which crosses the site.

For information relating to end use, maintenance, demolition, see the health and safety file.

It is assumed that all works will be carried out by a competent Contractor, where appropriate, to an approved method statement.

| REV | DESCRIPTION | DRN | CHD | DATE |
|---|---|---|---|---|

■ PRELIMINARY ☐ INFORMATION ☐ TENDER
☐ CONSTRUCTION ☐ AS BUILT

| | | | |
|---|---|---|---|
| SCALE | 1:500 @ A0 | DATE | 20.08.2020 |
| DRAWN | YK | CHK | JGF |
| DRAWING NO. | 18770-FELL-5-200 | REV | - |

TITLE: Land North of Fellows Lane
Colney Heath

DETAILS: Existing Drainage Plan

Woods Hardwick
Architecture | Engineering | Planning | Surveying


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# Appendix D

## Illustrative Sketch Layout


0 10 20 30 50 100 150

SCALE 1:1000

**NOTES**

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Key:

- Existing Trees & RPAs
- Existing Listed Building
- Denotes Exitsing PRoW
- Denotes Existing 'walked route'
- Denotes Existing Drainage
- Denotes Existing HV Cable
- Proposed Landscape Buffer
- Proposed Trees
- Proposed Green Space
- Denotes Proposed Site Access
- Potential Play Space
- Proposed Location of New Pump Station
- Denotes Proposed Attenuation
- Denotes Key/Focal Buildings
- Denotes New Footpath Route

# DRAFT

| REV | DESCRIPTION | DRN | CHD | DATE |
|---|---|---|---|---|
| D | Redline Boundary updated to suit Title Boundary and new site access location. | AJS | TF | 13.08.2020 |

■ PRELIMINARY ☐ INFORMATION ☐ TENDER
☐ CONSTRUCTION ☐ AS BUILT

| | | | |
|---|---|---|---|
| SCALE | 1:1000 @ A2 | DATE | July 2020 |
| DRAWN | AJS | CHK | TF |
| DRAWING NO. | 17981/1005 | REV | E |

TITLE: Land North of Fellows Lane
Colney Heath

DETAILS: Proposed Illustrative Layout


Woods Hardwick
Architecture | Engineering | Planning | Surveying

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# Appendix E

## Environment Agency – Flood Map for Planning

Woods Hardwick
Architecture | Engineering | Planning | Surveying

Environment Agency

# Flood map for planning

| Your reference | Location (easting/northing) | Created |
|---|---|---|
| **18770** | **521199/205881** | **12 Jul 2020 23:47** |

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

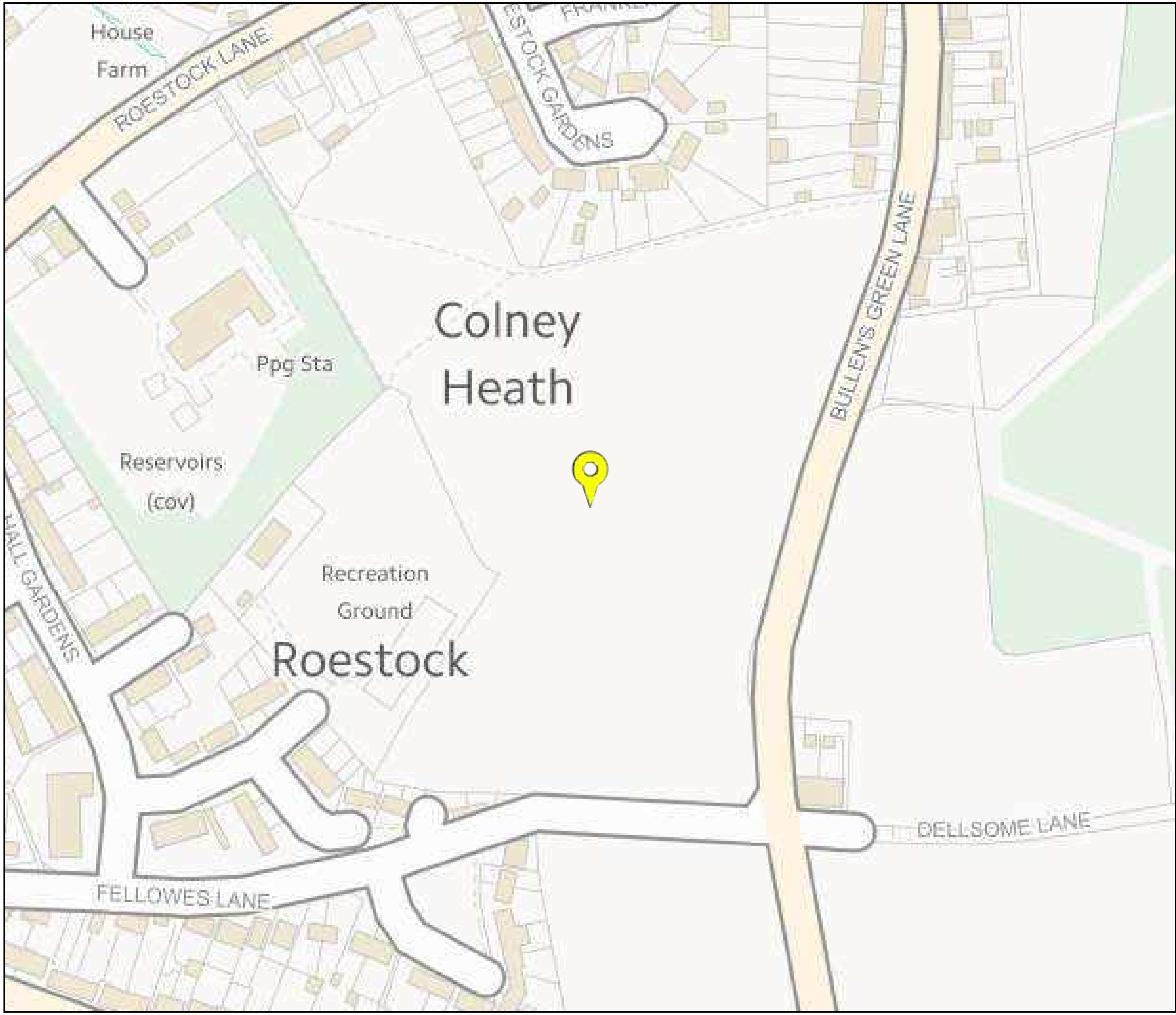
## This means:

- 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
**18770**

Location (easting/northing)
**521199/205881**

Scale
**1:2500**

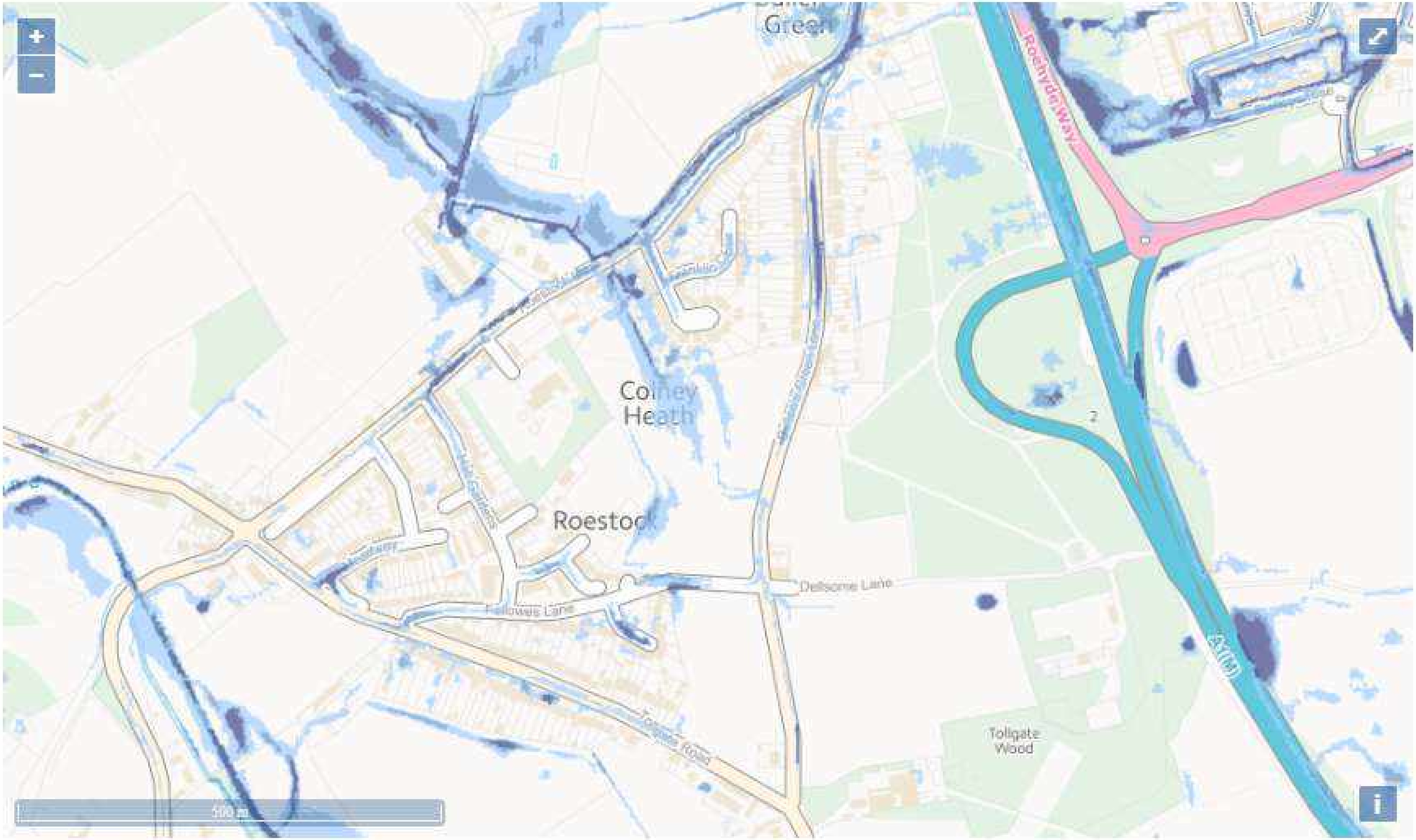
Created
**12 Jul 2020 23:47**

- 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

0 20 40 60m

# Appendix F

## Environment Agency – Surface Water Flood Map




Extent of flooding from surface water

High Medium Low Very low

# Appendix G

## Paddock Geo Engineering Site Investigation Report Extracts

Woods Hardwick
Architecture | Engineering | Planning | Surveying

# Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ

## GROUND INVESTIGATION

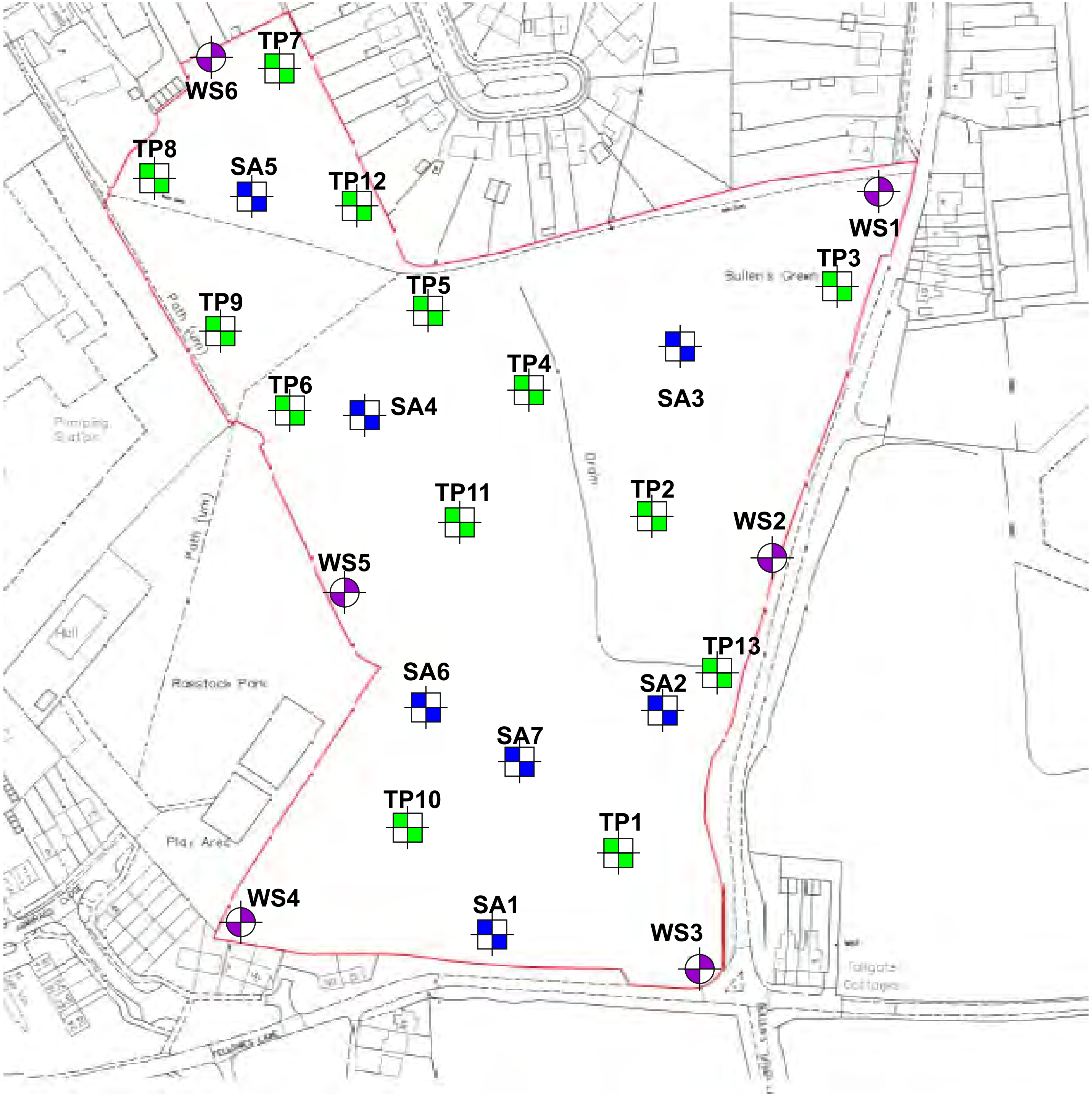
**Canton Ltd**

**July 2020**

**P20-164gi**

**Milton Keynes:** The Log Cabin, Manor Farm, Whaddon Road, Newton Longville, Milton Keynes, MK17 0AU
**Swindon/Oxford:** 21 Tyrell Close, Stanford in the Vale, Oxon, SN7 8EY
**T:** 44 (0) 1908 764032
**M:** 44 (0) 7377 422528
**E:** matt@paddockgeoengineering.co.uk
**W:** www.paddockgeoengineering.co.uk

Company Number: 8613165
VAT Number: GB 166 8087 72




PADDOCK GEO ENGINEERING

**Exploratory Point Location Plan**

**Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ.**

**Canton Ltd**

**July 2020**

**Infiltration testing Locations**

**Trial Pit Locations**

**Window Sample Borehole Locations**

**Not to scale.**
**All positions are approximate.**
**Based on proposed plan provided by the client.**

PADDOCK GEO ENGINEERING

| Site | Number |
|---|---|
| Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | WS1 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Percussion Liner Sampling Techniques | | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description |
|---|---|---|---|---|---|---|
| 0.10 | C | | | | (0.50) | Scrub vegetation onto grey silty gravelly SAND with occasional rootlets. Gravel is flint. (TOPSOIL) |
| | | | | | 0.50 | Soft orange brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to sub-rounded coal, flint, and sandstone. (WEATHERED LOWESTOFT FORMATION) |
| 0.70 | SV 31kPa | | | | | |
| 0.70 | D | | | | | |
| 0.80 | C | | | | | |
| 1.00-1.45 | SPT(C) N=13 | | 3,2/2,3,4,4 | | | |
| 1.20 | SV 73kPa | | | | | |
| 1.20 | D | | | | | |
| 1.60 | SV 70kPa | | | | | |
| 1.60 | D | | | | | |
| | | | | | (2.80) | |
| 2.00-2.45 | SPT(C) N=21 | | 3,4/5,4,6,6 | | | |
| 2.20 | D | | | | | |
| 2.60 | D | | | | | |
| 3.00-3.45 | SPT(C) N=22 | | 2,3/5,6,5,6 | | | |
| 3.20 | SV 62kPa | | | | | |
| 3.20 | D | | | | 3.30 | |
| | | | | | (0.20) | Orange brown clayey SAND. (WEATHERED LOWESTOFT FORMATION) |
| 3.50 | SV 81kPa | | | | 3.50 | |
| | | | | | (0.20) | |
| | | | | | 3.70 | Firm orange brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to sub-rounded coal, flint, and sandstone. (WEATHERED LOWESTOFT FORMATION) |
| 3.70 | D | | | | (0.50) | |
| | | | Water strike(1) at 4.00m. | | | |
| 4.00-4.45 | SPT(C) N=9 | | 2,1/2,3,2,2 | | 4.20 | |
| 4.20 | D | | | | | Loose orange and red brown occasionally mottled grey and black clayey silty SAND. (WEATHERED LOWESTOFT FORMATION) |
| 4.60 | SV 42kPa | | | | (0.80) | |
| 4.60 | D | | | | | Firm grey mottled orange brown variably silty CLAY and silty SAND. (LOWESTOFT FORMATION) |
| | | | | | 5.00 | |
| | | | | | | Complete at 5.00m |

Legend | Water | Instr

▽1

**Remarks**
Monitoring standpipe installed upon completion.
Groundwater encountered within sand band at 4.0m depth.

| Scale (approx) | Logged By |
|---|---|
| 1:50 | SF |

**Figure No.** P20-164.WS1

| PADDOCK GEO ENGINEERING | | | Site: Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | Number: **WS2** |
|---|---|---|---|---|
| **Excavation Method** Percussion Liner Sampling Techniques | **Dimensions** | **Ground Level (mOD)** | **Client** Canton Ltd | **Job Number** P20-164 |
| | **Location** | **Dates** 17/06/2020 | **Engineer** MC | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water | Instr |
|---|---|---|---|---|---|---|---|---|---|
| 0.20 | C | | | | (0.40) 0.40 | Scrub vegetation onto grey silty gravelly SAND with occasional rootlets. Gravel is flint. (TOPSOIL) | | | |
| 0.70<br>0.80<br>1.00-1.45<br>1.20<br>1.60<br>1.80<br>2.00-2.45<br>2.20 | D<br>C<br>SPT(C) N=18<br>D<br>SV 172kPa<br>D<br>SPT(C) N=22<br>D | | <br><br>3,3/3,4,5,6<br><br><br><br>4,5/5,6,5,6 | | (2.00) 2.40 | Very stiff brown slightly sandy slightly gravelly CLAY with roots. 50mm diameter root at 0.6m depth and roots up to 15mm diameter up to 2.2m depth. Gravel is fine to coarse angular to sub-rounded flint and coal. (WEATHERED LOWESTOFT FORMATION)<br>...from 1.0m depth, becoming orange brown mottled grey. | | | |
| 2.60<br>2.80<br>3.00-3.45<br>3.20 | SV 96kPa<br>D<br>SPT(C) N=27<br>D | | <br><br>4,4/5,7,8,7 | | (1.10) 3.50 | Firm grey mottled orange brown slightly sandy silty CLAY. (WEATHERED LOWESTOFT FORMATION) | | | |
| 3.80<br>4.00-4.45<br>4.20 | D<br>SPT(C) N=29<br>D | | <br>9,8/8,8,5,8 | | (0.90) 4.40 | Orange brown, brown and grey clayey SAND. (WEATHERED LOWESTOFT FORMATION)<br>...from 4.0m depth, becoming slightly gravelly. Gravel is fine and angular flint. | | | |
| 4.60<br>4.80 | SV 86kPa<br>D | | | | (0.60) 5.00 | Stiff dark grey silty CLAY. (LOWESTOFT FORMATION) | | | |
| | | | | | | Complete at 5.00m | | | |

**Remarks**
No groundwater encountered.
Monitoring standpipe installed upon completion.

| Scale (approx) | Logged By |
|---|---|
| 1:50 | SF |

**Figure No.** P20-164.WS2

PADDOCK GEO ENGINEERING

| Site | Number |
|---|---|
| Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | WS3 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Percussion Liner Sampling Techniques | | | Canton Ltd | P20-164 |
| | **Location** | **Dates** 17/06/2020 | **Engineer** MC | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water | Instr |
|---|---|---|---|---|---|---|---|---|---|
| 0.20 | C | | | | (0.20) 0.20 | Grass onto grey brown slightly sandy slightly gravelly silty CLAY with frequent rootlets. (TOPSOIL) | | | |
| 0.50<br>0.80<br>0.90<br>1.00-1.45<br>1.20<br>1.20<br>1.80 | D<br>SV 42kPa<br>D<br>SPT(C) N=17<br>SV 47kPa<br>D<br>D | | <br><br><br>3,4/3,4,5,5 | | (1.80) 2.00 | Very stiff brown mottled grey and orange brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to sub-rounded flint. (WEATHERED LOWESTOFT FORMATION)<br>...from 1.0m depth, becoming orange brown slightly mottled grey. | | | |
| 2.00-2.45<br>2.20<br>2.20<br>2.80<br>2.80<br>3.00-3.45<br>3.20<br>3.30 | SPT(C) N=16<br>SV 62kPa<br>D<br>SV 59kPa<br>D<br>SPT(C) N=17<br>D<br>SV 69kPa | | 3,3/4,4,4,4<br><br><br><br><br>3,3/4,4,4,5 | | (1.70) 3.70 | Firm orange brown mottled grey slightly gravelly sandy silty CLAY. Gravel is fine to coarse angular to sub-rounded flint. (WEATHERED LOWESTOFT FORMATION)<br>...from 3.0m depth, becoming grey mottled orange brown. | | | |
| 3.80<br>4.00-4.45<br>4.20 | D<br>SPT(C) N=14<br>D | | <br>Water strike(1) at 4.00m.<br>5,5/3,4,4,3 | | (1.20) 4.90 | Brown and orange brown clayey SAND. (WEATHERED LOWESTOFT FORMATION) | | ∇1 | |
| 4.90 | D | | | | 5.00 | Soft brown slightly sandy silty CLAY. (WEATHERED LOWESTOFT FORMATION) | | | |
| | | | | | | Complete at 5.00m | | | |

**Remarks**
Groundwater within sand band at 4.0m depth.
Monitoring standpipe installed upon completion.

| Scale (approx) | Logged By |
|---|---|
| 1:50 | SF |

**Figure No.** P20-164.WS3

PADDOCK GEO ENGINEERING

| Site | Number |
|---|---|
| Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | WS4 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Percussion Liner Sampling Techniques | | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records |
|---|---|---|---|
| 0.20 | C | | |
| 0.50 | D | | |
| 0.80 | SV 70kPa | | |
| 0.80 | C | | |
| 0.90 | D | | |
| 1.00-1.45 | SPT(C) N=22 | | 2,3/2,3,5,12 |
| 1.20 | SV 68kPa | | |
| 1.20 | D | | |
| 1.60 | D | | |
| 2.00-2.45 | SPT(C) N=26 | | 12,11/11,5,5,5 |
| 2.20 | D | | Water strike(1) at 2.20m. |
| 2.50 | D | | |
| 2.80 | SV 64kPa | | |
| 2.80 | D | | |
| 3.00-3.45 | SPT(C) N=13 | | 2,2/3,3,3,4 |
| 3.20 | D | | |
| 3.30 | SV 49kPa | | |
| 3.80 | D | | |
| 4.00-4.45 | SPT(C) N=7 | | 2,2/2,2,1,2 |

| Level (mOD) | Depth (m) (Thickness) | Description | Water |
|---|---|---|---|
| | (0.20) 0.20 | Grass onto grey slighlty sandy slightly gravelly silty CLAY with frequent rootlets. (TOPSOIL) | |
| | (1.10) 1.30 | Stiff grey mottled orange brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse angular to sub-rounded coal, flint and sandstone. (WEATHERED LOWESTOFT FORMATION) | |
| | (0.90) 2.20 | Medium dense orange brown sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded flint. (WEATHERED LOWESTOFT FORMATION) | ∇1 |
| | (0.40) 2.60 | Orange brown SAND. (WEATHERED LOWESTOFT FORMATION) | |
| | (0.40) 3.00 | Stiff grey mottled orange brown sandy CLAY. (LOWESTOFT FORMATION) | |
| | (1.00) 4.00 | Firm grey mottled orange brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular flint and chalk. (LOWESTOFT FORMATION) | |
| | | Complete at 4.00m | |

**Remarks**
Groundwater seepages within sand band 2.20-2.60m depth.
Monitoring standpipe installed upon completion.

| Scale (approx) | Logged By |
|---|---|
| 1:50 | SF |

**Figure No.** P20-164.WS4

PADDOCK GEO ENGINEERING

| Site | Number |
|---|---|
| Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | WS5 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Percussion Liner Sampling Techniques | | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water | Instr |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | (0.40) 0.40 | Grass onto grey slighlty sandy slightly gravelly silty CLAY with frequent rootlets. (TOPSOIL) | | | |
| 0.50 | SV 26kPa | | | | | | | | |
| 0.80 | D | | | | | | | | |
| 1.00-1.45 | SPT(C) N=24 | | 3,3/4,6,6,8 | | (1.10) | Stiff orange brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint, coal and occasional chalk and sandstone. (WEATHERED LOWESTOFT FORMATION) | | | |
| 1.20 | D | | | | | | | | |
| | | | Water strike(1) at 1.50m. | | 1.50 | | | ∇1 | |
| 1.60 | D | | | | (0.80) | Medium dense orange brown slightly gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded flint. (WEATHERED LOWESTOFT FORMATION) | | | |
| 2.00-2.45 | SPT(C) N=15 | | 7,6/7,3,3,2 | | | | | | |
| 2.20 | D | | | | 2.30 | | | | |
| 2.60 | D | | | | (0.70) | Firm orange brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint and occasional chalk and sandstone. (WEATHERED LOWESTOFT FORMATION) | | | |
| 2.80 | SV 49kPa | | | | | | | | |
| 3.00-3.45 | SPT(C) N=6 | | 1,1/0,1,1,4 | | 3.00 | Soft grey brown and orange brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (LOWESTOFT FORMATION) | | | |
| 3.20 | D | | | | | | | | |
| 3.60 | SV 73kPa | | | | | ...from 3.50m depth, becoming firm. | | | |
| 3.60 | D | | | | | | | | |
| 4.00-4.45 | SPT(C) N=21 | | 2,3/3,4,7,7 | | (2.00) | ...from 4.0m depth, becoming stiff. | | | |
| 4.20 | D | | | | | | | | |
| 4.80 | D | | | | | | | | |
| | | | | | 5.00 | Complete at 5.00m | | | |

**Remarks**
Groundwater seepages within sand 1.50-2.30m depth.
Monitoring standpipe installed upon completion.

| Scale (approx) | Logged By |
|---|---|
| 1:50 | SF |

**Figure No.** P20-164.WS5

| PADDOCK GEO ENGINEERING | Site: Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | Number: **WS6** |
|---|---|---|

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Percussion Liner Sampling Techniques | | | Canton Ltd | P20-164 |
| | **Location** | **Dates** 17/06/2020 | **Engineer** MC | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water | Instr |
|---|---|---|---|---|---|---|---|---|---|
| 0.10 | C | | | | (0.30) 0.30 | Scrub vegetation onto grey slightly sandy slightly gravelly silty CLAY with frequent rootlets. Gravel is flint. (TOPSOIL) | | | |
| 0.60 | SV 55kPa | | | | | Firm orange brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint, coal and occasional chalk and sandstone. (WEATHERED LOWESTOFT FORMATION) | | | |
| 0.80 | C | | | | | | | | |
| 0.90 | D | | | | | | | | |
| 1.60 | SV 59kPa | | | | | | | | |
| 1.60 | D | | | | (2.70) | | | | |
| | | | | | | ...from 2.0m depth, becoming stiff. | | | |
| 2.60 | SV 109kPa | | | | | | | | |
| 2.60 | D | | | | | | | | |
| | | | | | 3.00 | Very stiff grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to sub-rounded flint and chalk. (LOWESTOFT FORMATION) | | | |
| 3.60 | SV 55kPa | | | | | | | | |
| 3.60 | D | | | | (2.00) | | | | |
| 4.60 | SV 88kPa | | | | | | | | |
| 4.60 | D | | | | | | | | |
| | | | | | 5.00 | Complete at 5.00m | | | |

**Remarks**
No groundwater encountered.
Monitoring standpipe installed upon completion.

| Scale (approx) | Logged By |
|---|---|
| 1:50 | SF |

**Figure No.** P20-164.WS6

| PADDOCK GEO ENGINEERING | Site: Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | Trial Pit Number: TP1 |
|---|---|---|

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Excavated Trial Pits | 1.70m x 0.35m | | Canton Ltd | P20-164 |
| | **Location** | **Dates** 17/06/2020-19/06/2020 | **Engineer** MC | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.30) | Crops onto dark brown grey slightly sandy slightly gravelly clayey loamy SILT with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.20 | C | | | | | | | |
| | | | | | 0.30 | Firm orange brown slightly sandy slightly gravelly silty CLAY. Gravel of fine to medium sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.80 | C | | | | | | | |
| 0.80 | D | | | | | | | |
| 1.00 | SV 78kPa | | | | | | | |
| | | | | | (2.10) | | | |
| 1.60 | D | | | | | | | |
| 1.80 | SV 72kPa | | | | | | | |
| 2.20 | D | | | | | | | |
| | | | | | 2.40 | Complete at 2.40m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP1 |

PADDOCK GEO ENGINEERING

| | | | |
|---|---|---|---|
| | | **Site**<br>Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | **Trial Pit Number**<br>**TP2** |
| **Excavation Method**<br>Machine Excavated Trial Pits | **Dimensions**<br>1.70m x 0.35m | **Ground Level (mOD)** | **Client**<br>Canton Ltd | **Job Number**<br>P20-164 |
| | **Location** | **Dates**<br>17/06/2020-19/06/2020 | **Engineer**<br>MC | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.35) | Crops onto dark brown grey slightly sandy slightly gravelly clayey loamy SILT with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.30 | C | | | | 0.35 | Firm to stiff orange brown mottled grey slightly sandy slightly gravelly silty CLAY. Gravel of fine to medium sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.90 | D | | | | | | | |
| 1.00 | SV 91kPa | | | | | | | |
| | | | | | (1.85) | | | |
| 1.40 | SV 102kPa | | | | | | | |
| 1.50 | D | | | | | | | |
| 2.10 | D | | | | | | | |
| | | | | | 2.20 | Complete at 2.20m | | |

**Remarks**

Trial pit sides remained stable upon completion.
No groundwater encountered.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP2 |

PADDOCK GEO ENGINEERING

| Site | Trial Pit Number |
|---|---|
| Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | **TP3** |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Excavated Trial Pits | 1.70m x 0.35m | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020-19/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.20 | C | | | | (0.30) 0.30 | Crops onto dark brown grey slightly sandy slightly gravelly clayey loamy SILT with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.70<br>0.80 | D<br>SV 78kPa | | | | (0.60) 0.90 | Firm brown to orange brown slightly sandy gravelly silty CLAY with rootlets to 0.50m depth. Gravel of fine to coarse angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 1.10<br>1.80<br>1.90 | D<br>SV 67kPa<br>D | | | | (1.30) 2.20 | Firm orange brown mottled grey slightly gravelly silty CLAY. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | ∇1 |
| 2.40 | B | | Water strike(1) at 2.20m, fell to 2.40m in 5 mins. | | (0.30) 2.50 | Soft to firm orange brown slightly gravelly very sandy CLAY. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | ▼1 |
| | | | | | | Complete at 2.50m | | |

**Remarks**

Trial pit sides remained stable upon completion.
Groundwater encountered at 2.20m depth, filling trial pit to 2.40m upon completion of excavation.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP3 |

PADDOCK GEO ENGINEERING

| Site | Trial Pit Number |
|---|---|
| Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | TP4 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Excavated Trial Pits | 1.60m x 0.35m | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020-19/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.40) | Crops onto dark brown grey slightly sandy slightly gravelly silty CLAY with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.30 | C | | | | | | | |
| 0.30 | D | | | | | | | |
| | | | | | 0.40 | | | |
| 0.50 | C | | | | (0.25) | Firm grey occasionally orange brown slightly sandy slightly gravelly silty CLAY. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| | | | | | 0.65 | | | |
| 0.80 | SV 84kPa | | | | | Firm orange brown mottled grey slightly sandy silty CLAY with occasional to rare gravel sized sandy pockets throughout. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.80 | D | | | | | | | |
| 1.40 | SV 101kPa | | | | (1.55) | | | |
| 1.80 | D | | | | | | | |
| 2.00 | SV 91kPa | | | | | ...from 2.0m depth, becoming silty CLAY. | | |
| | | | | | 2.20 | Complete at 2.20m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP4 |

| PADDOCK GEO ENGINEERING | | | Site: Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | Trial Pit Number: **TP5** |
|---|---|---|---|---|
| **Excavation Method**<br>Machine Excavated Trial Pits | **Dimensions**<br>1.60m x 0.35m | **Ground Level (mOD)** | **Client**<br>Canton Ltd | **Job Number**<br>P20-164 |
| | **Location** | **Dates**<br>17/06/2020-19/06/2020 | **Engineer**<br>MC | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.50) | Crops onto dark brown grey slightly sandy slightly gravelly silty CLAY with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.40 | D | | | | | | | |
| | | | | | 0.50 | Firm orange brown slightly sandy slightly gravelly silty CLAY. Gravel of fine to medium sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.70 | D | | | | | | | |
| 0.90 | SV 84kPa | | | | | | | |
| | | | | | (1.80) | | | |
| 1.60 | SV 101kPa | | | | | | | |
| 1.60 | D | | | | | | | |
| 2.20 | D | | | | | | | |
| | | | | | 2.30 | Complete at 2.30m | | |

**Remarks**

Trial pit sides remained stable upon completion.
No groundwater encountered.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP5 |

| PADDOCK GEO ENGINEERING | Site: Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | Trial Pit Number: **TP6** |
|---|---|---|

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Excavated Trial Pits | 1.60m x 0.35m | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020-19/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.20 | C | | | | (0.30) 0.30 | Crops onto dark brown grey slightly sandy slightly gravelly silty CLAY with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.80<br>0.80<br>0.80<br>1.80<br>1.80 | SV 78kPa<br>C<br>D<br>SV 84kPa<br>D | | | | (1.70) 2.00 | Firm to stiff orange brown mottled grey slightly gravelly silty CLAY with occasional gravel sized sand pockets. Gravel of fine to medium sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| | | | | | | Complete at 2.00m | | |

**Remarks**

Trial pit sides remained stable upon completion.
No groundwater encountered.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP6 |

PADDOCK GEO ENGINEERING

| Site | Trial Pit Number |
|---|---|
| Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | **TP7** |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Excavated Trial Pits | 1.60m x 0.35m | | Canton Ltd | P20-164 |

| Location | Dates | Engineer | Sheet |
|---|---|---|---|
| | 17/06/2020-19/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.20 | C | | | | (0.35) | Crops onto dark brown grey slightly sandy slightly gravelly silty CLAY with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| | | | | | 0.35 | | | |
| 0.50 | SV 39kPa | | | | (0.55) | Soft to firm orange brown to mottled grey slightly sandy slightly gravelly silty CLAY. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.60 | C | | | | | | | |
| 0.70 | D | | | | | | | |
| | | | | | 0.90 | | | |
| | | | | | (0.40) | Firm brown to grey slightly sandy very gravelly CLAY. Gravel of fine to coarse angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 1.20 | D | | | | | | | |
| | | | | | 1.30 | | | |
| 1.40 | SV 20kPa | | | | (1.10) | Very soft to soft orange brown occasionally grey sandy to very sandy silty CLAY with very clayey sand lenses throughout. (WEATHERED LOWESTOFT FORMATION) | | |
| 1.80 | SV 20kPa | | | | | | | |
| 1.90 | D | | | | | | | |
| 2.30 | SV 26kPa | | | | | | | |
| | | | | | 2.40 | Complete at 2.40m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP6 |

| PADDOCK GEO ENGINEERING | | | Site<br>Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | Trial Pit Number<br>**TP8** |
|---|---|---|---|---|
| **Excavation Method**<br>Machine Excavated Trial Pits | **Dimensions**<br>1.60m x 0.35m | **Ground Level (mOD)** | **Client**<br>Canton Ltd | **Job Number**<br>P20-164 |
| | **Location** | **Dates**<br>17/06/2020-19/06/2020 | **Engineer**<br>MC | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.20 | D | | | | (0.30)<br>0.30 | Crops onto dark brown grey slightly sandy slightly gravelly silty CLAY with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.80<br>0.80<br>0.80<br>1.20<br>1.40<br>2.00<br>2.10 | SV 91kPa<br>C<br>D<br>D<br>SV 110kPa<br>D<br>SV 97kPa | | | | (2.00)<br>2.30 | Firm to stiff orange brown mottled grey slightly gravelly silty CLAY. Gravel of fine to medium sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION)<br>...from 1.0m depth, gravelly silty CLAY with gravel of flint and occasional chalk. | | |
| | | | | | | Complete at 2.30m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP8 |

| PADDOCK GEO ENGINEERING | Site | Trial Pit Number |
|---|---|---|
| | Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | TP9 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Excavated Trial Pits | 1.60m x 0.35m | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020-19/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.30) | Crops onto dark brown grey slightly sandy slightly gravelly silty CLAY with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.20 | C | | | | | | | |
| | | | | | 0.30 | Soft to firm orange brown mottled grey slightly sandy slightly gravelly silty CLAY. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.50 | SV 39kPa | | | | | | | |
| 0.60 | D | | | | | | | |
| 1.00 | SV 75kPa | | | | | | | |
| | | | | | (1.50) | | | |
| 1.30 | D | | | | | | | |
| 1.80 | SV 44kPa | | | | 1.80 | Complete at 1.80m | | |
| 1.80 | D | | | | | | | |

**Remarks**

Trial pit sides remained stable upon completion.
No groundwater encountered.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP9 |

PADDOCK GEO ENGINEERING

| Site | Trial Pit Number |
|---|---|
| Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | **TP10** |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Excavated Trial Pits | 1.60m x 0.35m | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020-19/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.40) | Crops onto dark brown grey slightly sandy slightly gravelly silty CLAY with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.30 | D | | | | | | | |
| | | | | | 0.40 | Firm to stiff orange brown mottled grey slightly gravelly to gravelly silty CLAY. Gravel of fine to medium sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.90 | SV 88kPa | | | | | | | |
| 0.90 | C | | | | | | | |
| 0.90 | D | | | | | | | |
| | | | | | (1.70) | | | |
| 1.90 | D | | | | | | | |
| | | | | | 2.10 | Medium dense orange brown slightly clayey to clayey very gravelly SAND. Gravel of fine to coarse angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 2.20 | D | | | | (0.20) | | | |
| | | | | | 2.30 | Complete at 2.30m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP10 |

| | | | | |
|---|---|---|---|---|
| PADDOCK GEO ENGINEERING | | | **Site**<br>Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | **Trial Pit Number**<br>**TP11** |
| **Excavation Method**<br>Machine Excavated Trial Pits | **Dimensions**<br>1.60m x 0.35m | **Ground Level (mOD)** | **Client**<br>Canton Ltd | **Job Number**<br>P20-164 |
| | **Location** | **Dates**<br>17/06/2020-19/06/2020 | **Engineer**<br>MC | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.50) | Crops onto dark brown grey slightly sandy slightly gravelly silty CLAY with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.40 | D | | | | | | | |
| | | | | | 0.50 | Stiff orange brown occasional mottled grey slightly gravelly silty CLAY. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.90 | SV 109kPa | | | | | | | |
| 0.90 | D | | | | | | | |
| | | | | | (1.70) | | | |
| 1.60 | SV 104kPa | | | | | | | |
| 1.60 | D | | | | | | | |
| 2.00 | SV 117kPa | | | | | | | |
| 2.10 | D | | | | | | | |
| | | | | | 2.20 | Complete at 2.20m | | |

**Remarks**

Trial pit sides remained stable upon completion.
No groundwater encountered.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP11 |

| PADDOCK GEO ENGINEERING | Site | Trial Pit Number |
|---|---|---|
| | Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | **TP12** |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Excavated Trial Pits | 1.60m x 0.35m | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020-19/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.50) | Crops onto dark brown grey slightly sandy slightly gravelly silty CLAY with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| | | | | | 0.50 | Firm to stiff orange brown slightly gravelly to gravelly silty CLAY. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.70 | SV 65kPa | | | | | | | |
| 0.70 | D | | | | | | | |
| | | | | | (1.80) | | | |
| 1.60 | SV 62kPa | | | | | | | |
| 1.60 | D | | | | | | | |
| 2.00 | SV 75kPa | | | | | ...from 2.0m depth, becoming sandy. | | |
| 2.20 | D | | | | | | | |
| | | | | | 2.30 | Complete at 2.30m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP12 |

PADDOCK GEO ENGINEERING

| Site | | Trial Pit Number |
|---|---|---|
| Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | | TP13 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Excavated Trial Pits | 1.80m x 1.30m | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020-19/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.90) | Vegetation onto brown to dark brown slightly sandy slightly gravelly silty CLAY with roots and rootlets. Gravel of clayware pipe, plastic and flint. (MADE GROUND) | | |
| 0.70 | C | | | | | | | |
| 0.70 | D | | | | | | | |
| | | | | | 0.90 | Firm orange brown occasionally grey slightly gravelly silty CLAY. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) ...at 0.90m depth, black ribbed plastic drainage pipe. | | |
| | | | | | (0.40) | | | |
| 1.20 | C | | | | | | | |
| 1.20 | D | | | | | | | |
| | | | | | 1.30 | Complete at 1.30m | | |

**Remarks**

Trial pit sides remained stable upon completion.
Significant water inflow at 0.90m deoth from historical black ribbed plastic drainage pipe.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.TP13 |

| PADDOCK GEO ENGINEERING | Site: Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | Trial Pit Number: **SA1** |
|---|---|---|

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Excavated Trial Pits | 1.30m x 0.35m | | Canton Ltd | P20-164 |
| | **Location** | **Dates** 17/06/2020-19/06/2020 | **Engineer** MC | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.35) | Crops onto dark brown grey slightly sandy slightly gravelly clayey loamy SILT with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.30 | C | | | | 0.35 | | | |
| | | | | | | Stiff pale to orange brown gravelly CLAY with roots to 1.10m depth. Gravel of fine to coarse rounded to sub-angular flint. (WEATHERED LOWESTOFT FORMATION) ...from 0.60m depth, becoming dark orange brown to grey brown. | | |
| 0.80 | D | | | | | | | |
| | | | | | (1.55) | | | |
| 1.30 | D | | | | | | | |
| 1.80 | D | | | | | | | |
| | | | | | 1.90 | Complete at 1.90m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.
Infiltration testing undertaken.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.SA1 |

| PADDOCK GEO ENGINEERING | Site | Trial Pit Number |
|---|---|---|
| | Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | SA2 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Ecavated Trial Pits | 1.30m x 0.35m | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020-19/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.20) 0.20 | Crops onto dark brown grey slightly sandy slightly gravelly clayey loamy SILT with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.40 | D | | | | (0.60) | Stiff grey to orange brown slightly gravelly silty CLAY with rootlets to 0.50m depth. Gravel of fine to medium rounded to sub-angular flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.60 | SV 89kPa | | | | 0.80 | | | |
| 1.00 | SV 96kPa | | | | (0.70) | Stiff orange brown mottled grey slightly gravelly silty CLAY. Gravel of fine to medium rounded to sub-angular flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 1.00 | D | | | | 1.50 | | | |
| | | | | | | Complete at 1.50m | | |

**Remarks**

Infiltration testing undertaken.
Trial pit sides remained stable upon completion.
No groundwater encountered.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.SA2 |

| | | | |
|---|---|---|---|
| PADDOCK GEO ENGINEERING | | **Site**<br>Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | **Trial Pit Number**<br>**SA3** |
| **Excavation Method**<br>Machine Excavated Trial Pits | **Dimensions**<br>1.30m x 0.35m | **Ground Level (mOD)** | **Client**<br>Canton Ltd | **Job Number**<br>P20-164 |
| | **Location** | **Dates**<br>17/06/2020-19/06/2020 | **Engineer**<br>MC | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.40) | Crops onto dark brown grey slightly sandy slightly gravelly clayey loamy SILT with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.30 | C | | | | | | | |
| | | | | | 0.40 | Firm to stiff orange brown mottled grey slightly gravelly to gravelly silty CLAY with rootlets to 0.60m depth. Gravel of fine to medium sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.70 | SV 93kPa | | | | | | | |
| 0.70 | D | | | | | | | |
| | | | | | (1.10) | | | |
| 1.20 | SV 102kPa | | | | | | | |
| 1.40 | D | | | | | | | |
| | | | | | 1.50 | Complete at 1.50m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.
Infiltration testing undertaken.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.SA3 |

| Site | Trial Pit Number |
|---|---|
| Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | **SA4** |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Machine Excavated Trial Pits | 1.30m x 0.35m | | Canton Ltd | P20-164 |
| | **Location** | **Dates** | **Engineer** | **Sheet** |
| | | 17/06/2020-19/06/2020 | MC | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.70) | Crops onto dark brown grey slightly sandy slightly gravelly clayey loamy SILT with frequent roots and rootlets to 0.50m depth. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.50 | D | | | | | | | |
| | | | | | 0.70 | Stiff grey to orange brown slightly gravelly silty CLAY. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 1.00 | D | | | | | | | |
| 1.30 | SV 78kPa | | | | (1.30) | ...from 1.20m depth, becoming orange brown occasionally grey. | | |
| 1.80 | SV 78kPa | | | | | | | |
| 1.80 | D | | | | | | | |
| | | | | | 2.00 | Complete at 2.00m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.
Infiltration testing undertaken.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.SA4 |

| PADDOCK GEO ENGINEERING | | | Site | Trial Pit Number |
|---|---|---|---|---|
| | | | Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | **SA5** |
| **Excavation Method**<br>Machine Excavated Trial Pits | **Dimensions**<br>1.30m x 0.35m | **Ground Level (mOD)** | **Client**<br>Canton Ltd | **Job Number**<br>P20-164 |
| | **Location** | **Dates**<br>17/06/2020-19/06/2020 | **Engineer**<br>MC | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.45) | Crops onto dark brown grey slightly sandy slightly gravelly clayey loamy SILT with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.40 | C | | | | 0.45 | | | |
| | | | | | | Firm orange brown to grey slightly gravelly silty CLAY with occasional fine to medium gravel sized pockets of sand. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 0.90 | D | | | | | | | |
| 1.00 | SV 52kPa | | | | (1.05) | | | |
| | | | | | 1.50 | Complete at 1.50m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.
Infiltration testing undertaken.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.SA5 |

| PADDOCK GEO ENGINEERING | | | Site<br>Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | Trial Pit Number<br>**SA6** |
|---|---|---|---|---|
| **Excavation Method**<br>Machine Excavated Trial Pits | **Dimensions**<br>1.30m x 0.35m | **Ground Level (mOD)** | **Client**<br>Canton Ltd | **Job Number**<br>P20-164 |
| | **Location** | **Dates**<br>17/06/2020-19/06/2020 | **Engineer**<br>MC | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.40) | Crops onto dark brown grey slightly sandy slightly gravelly clayey loamy SILT with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| 0.30 | D | | | | | | | |
| | | | | | 0.40 | Firm grey slightly sandy slightly gravelly silty CLAY. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| | | | | | (0.50) | | | |
| 0.70 | D | | | | | | | |
| | | | | | 0.90 | Firm to stiff orange brown slightly gravelly silty CLAY with occasional gravel sized pockets of sand. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| | | | | | (1.10) | | | |
| 1.50 | D | | | | | | | |
| | | | | | 2.00 | Complete at 2.00m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.
Infiltration testing undertaken.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.SA6 |

| PADDOCK GEO ENGINEERING | | | Site | Trial Pit Number |
|---|---|---|---|---|
| | | | Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ | **SA7** |
| **Excavation Method**<br>Machine Excavated Trial Pits | **Dimensions**<br>1.30m x 0.35m | **Ground Level (mOD)** | **Client**<br>Canton Ltd | **Job Number**<br>P20-164 |
| | **Location** | **Dates**<br>17/06/2020-19/06/2020 | **Engineer**<br>MC | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.50) | Crops onto dark brown grey slightly sandy slightly gravelly clayey loamy SILT with frequent roots and rootlets. Gravel of fine to coarse angular to sub-rounded flint. (TOPSOIL) | | |
| | | | | | 0.50 | Firm to stiff orange brown mottled grey slightly sandy slightly gravelly silty CLAY. Gravel of fine to coarse sub-angular to rounded flint. (WEATHERED LOWESTOFT FORMATION) | | |
| 1.00 | SV 106kPa | | | | (1.00) | | | |
| 1.40 | SV 117kPa | | | | | | | |
| | | | | | 1.50 | Complete at 1.50m | | |

**Remarks**

No groundwater encountered.
Trial pit sides remained stable upon completion.
Infiltration testing undertaken.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:25 | MC | P20-164.SA7 |

## Infiltration Test to BRE365 - SA1 TEST 1

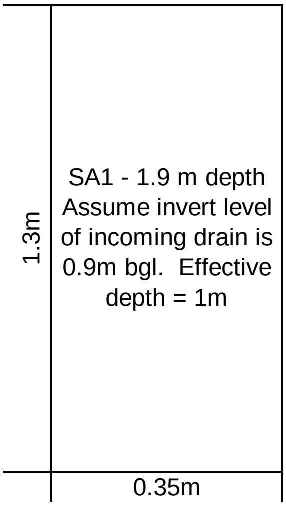
### Field Data

| Time | Time Elapsed (min) | Time Elapsed (sec) | Depth of Water below GL (m) |
|---|---|---|---|
| 10:35 | 0.0 | 0 | 0.90 |
| 10:38 | 3.0 | 180 | 0.90 |
| 10:48 | 13.0 | 780 | 0.90 |
| 11:20 | 45.0 | 2700 | 0.90 |
| 11:28 | 53.0 | 3180 | 0.90 |
| 13:46 | 191.0 | 11460 | 0.90 |

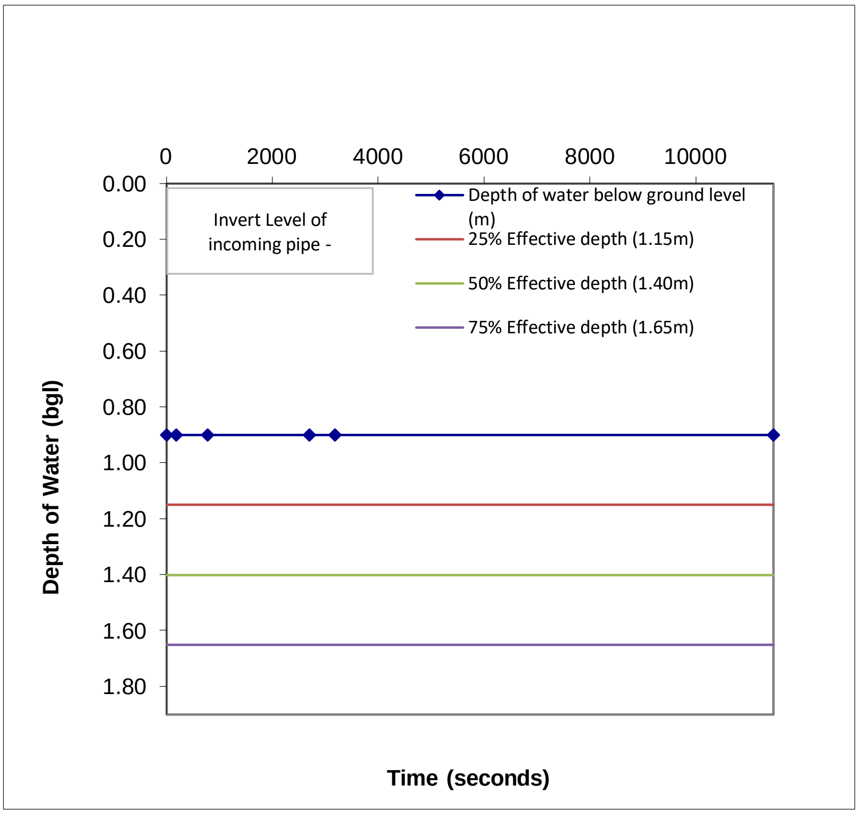
Linear extrapolated values for calculation

**Location:** SA1 **TEST 1**
**Weather:** Overcast
**Engineer:** MC
**Date:** 17/06/2020

**Strata Tested** Weathered Lowestoft Formation




**Pit Depths (m bgl)**
**Length**
1.3
**Width**
0.35
**Depth**
1.9
**25% Effective Depth**
1.15
**75% Effective Depth**
1.65
**Inlet Depth**
0.9




**CALCULATION:**

Soil Infiltration Rate(f) =
Vp75-25 / (ap50 x tp75-25)

Where:
Vp75-25 = effective storage volume between 75% and 25% effective depth
1.3x0.35x(1.65-1.15)
= **0.2275**

ap50 = internal area of TP upto 50% effective depth + base of TP
2(1.3 x ) + 2(0.35 x ) + (1.3 x 0.35)
**= 2.105**

Tp75-25 = the time for water level to fall from 75% - 25% effective depth
= **>>>>** secs

f= **N/A** m/s

**Comment**
Insufficient infiltration over three hours - Soakaway Failed

PADDOCK GEO ENGINEERING

**Client:** Canton Ltd
**Project No:** P20-164
**Project:** Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ

# Infiltration Test to BRE365 - SA2 TEST 1

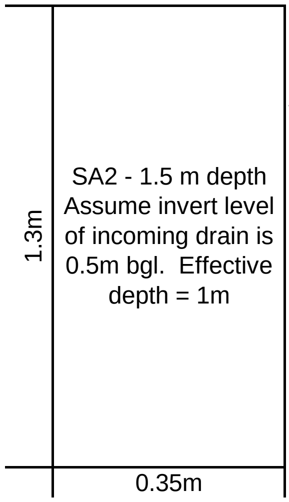
## Field Data

| Time | Time Elapsed (min) | Time Elapsed (sec) | Depth of Water below GL (m) |
|---|---|---|---|
| 11:20 | 0.0 | 0 | 0.50 |
| 11:26 | 6.0 | 360 | 0.50 |
| 12:10 | 50.0 | 3000 | 0.52 |
| 14:20 | 180.0 | 10800 | 0.56 |

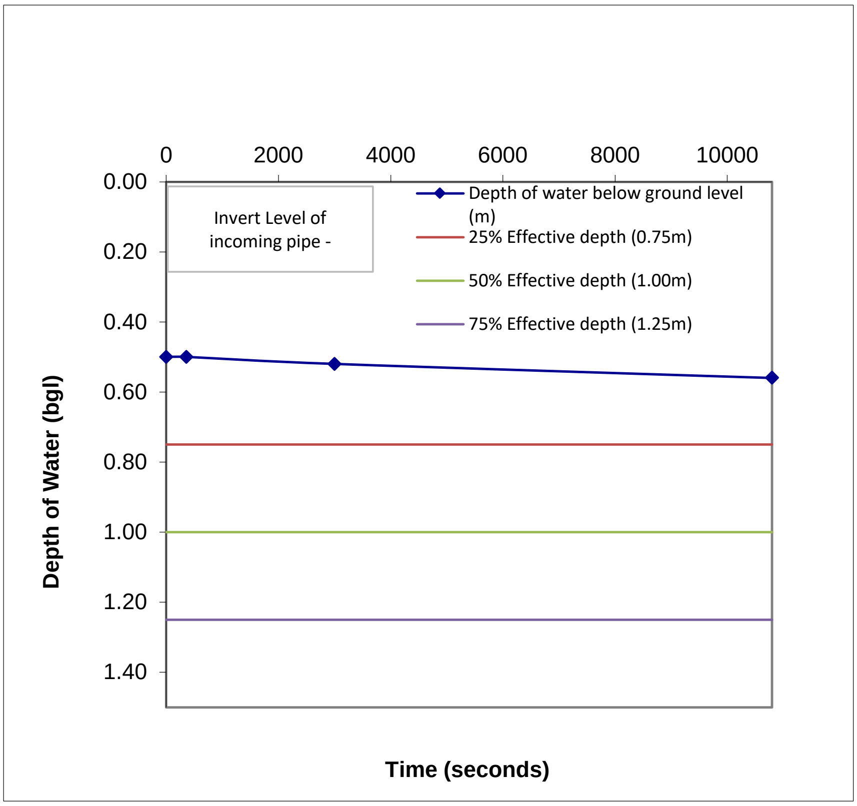
Linear extrapolated values for calculation

**Location:** **SA2** **TEST 1**
**Weather:** Overcast
**Engineer:** MC
**Date:** 17/06/2020

**Strata Tested** Weathered Lowestoft Formation




**Pit Depths (m bgl)**
**Length**
1.3
**Width**
0.35
**Depth**
1.5
**25% Effective Depth**
0.75
**75% Effective Depth**
1.25
**Inlet Depth**
0.5




**CALCULATION:**

Soil Infiltration Rate(f) =
Vp75-25 / (ap50 x tp75-25)

Where:
Vp75-25 = effective storage volume between 75% and 25% effective depth
1.3x0.35x(1.25-0.75)
= **0.2275**

ap50 = internal area of TP upto 50% effective depth + base of TP
2(1.3 x ) + 2(0.35 x ) + (1.3 x 0.35)
**= 2.105**

Tp75-25 = the time for water level to fall from 75% - 25% effective depth
= **>>>>** secs

f= **N/A** m/s

**Comment**
Insufficient infiltration over three hours - Soakaway Failed

PADDOCK GEO ENGINEERING

**Client:** Canton Ltd
**Project No:** P20-164
**Project:** Land off Fellows Lane,
Colney Heath, Hertfordshire,
AL4 0QQ

# Infiltration Test to BRE365 - SA3 TEST 1

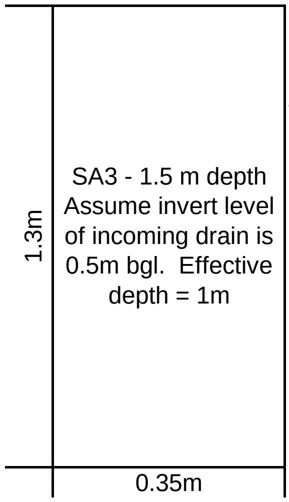
## Field Data

| Time | Time Elapsed (min) | Time Elapsed (sec) | Depth of Water below GL (m) |
|---|---|---|---|
| 12:00 | 0.0 | 0 | 0.50 |
| 12:06 | 6.0 | 360 | 0.50 |
| 12:10 | 10.0 | 600 | 0.50 |
| 12:31 | 31.0 | 1860 | 0.50 |
| 13:00 | 60.0 | 3600 | 0.50 |
| 14:20 | 140.0 | 8400 | 0.50 |
| 15:00 | 180.0 | 10800 | 0.50 |

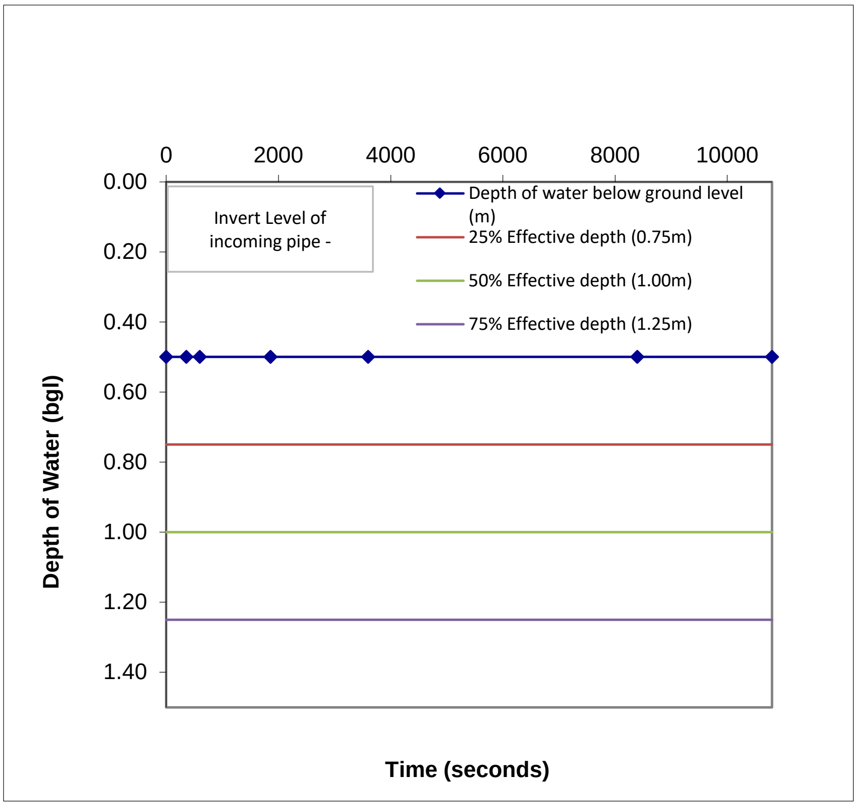
Linear extrapolated values for calculation

**Location:** SA3 **TEST 1**
**Weather:** Overcast
**Engineer:** MC
**Date:** 17/06/2020

**Strata Tested** Weathered Lowestoft Formation




**Pit Depths (m bgl)**
**Length**
1.3
**Width**
0.35
**Depth**
1.5
**25% Effective Depth**
0.75
**75% Effective Depth**
1.25
**Inlet Depth**
0.5




**CALCULATION:**

Soil Infiltration Rate(f) =
Vp75-25 / (ap50 x tp75-25)

Where:
Vp75-25 = effective storage volume between 75% and 25% effective depth
1.3x0.35x(1.25-0.75)
= **0.2275**

ap50 = internal area of TP upto 50% effective depth + base of TP
2(1.3 x ) + 2(0.35 x ) + (1.3 x 0.35)
**= 2.105**

Tp75-25 = the time for water level to fall from 75% - 25% effective depth
= **>>>>** secs

f= **N/A** m/s

**Comment**
Insufficient infiltration three hours - Soakaway Failed

PADDOCK GEO ENGINEERING

**Client:** Canton Ltd
**Project No:** P20-164
**Project:** Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ

# Infiltration Test to BRE365 - SA4 TEST 1

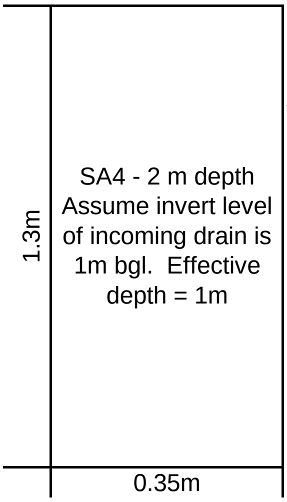
## Field Data

| Time | Time Elapsed (min) | Time Elapsed (sec) | Depth of Water below GL (m) |
|---|---|---|---|
| 13:00 | 0.0 | 0 | 1.00 |
| 13:01 | 1.0 | 60 | 1.00 |
| 13:05 | 5.0 | 300 | 1.00 |
| 13:10 | 10.0 | 600 | 1.00 |
| 13:25 | 25.0 | 1500 | 1.00 |
| 13:48 | 48.0 | 2880 | 1.00 |
| 14:22 | 82.0 | 4920 | 1.01 |
| 15:05 | 125.0 | 7500 | 1.02 |

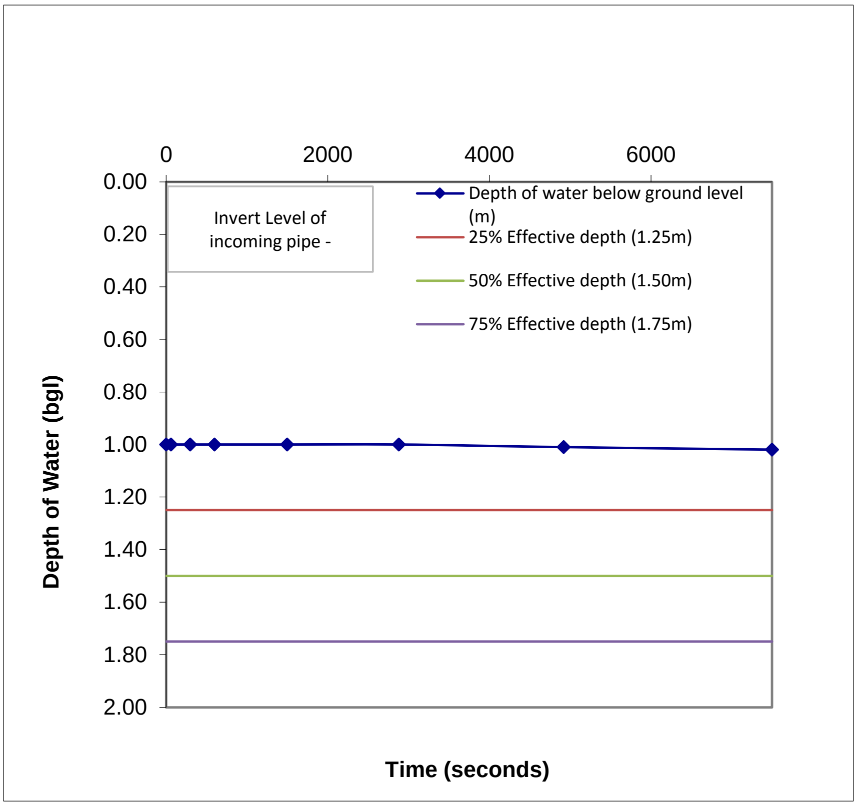
Linear extrapolated values for calculation

**Location:** SA4 **TEST 1**
**Weather:** Overcast
**Engineer:** MC
**Date:** 17/06/2020

**Strata Tested** Weathered Lowestoft Formation




**Pit Depths (m bgl)**
**Length**
1.3
**Width**
0.35
**Depth**
2.0
**25% Effective Depth**
1.25
**75% Effective Depth**
1.75
**Inlet Depth**
1




**CALCULATION:**

Soil Infiltration Rate(f) =
Vp75-25 / (ap50 x tp75-25)

Where:
Vp75-25 = effective storage volume between 75% and 25% effective depth
1.3x0.35x(1.75-1.25)
= **0.2275**

ap50 = internal area of TP upto 50% effective depth + base of TP
2(1.3 x ) + 2(0.35 x ) + (1.3 x 0.35)
**= 2.105**

Tp75-25 = the time for water level to fall from 75% - 25% effective depth
= **>>>>** secs

f= **N/A** m/s

**Comment**
Insufficient infiltration over two hours - Soakaway Failed

PADDOCK GEO ENGINEERING

**Client:** Canton Ltd
**Project No:** P20-164
**Project:** Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ

# Infiltration Test to BRE365 - SA5 TEST 1

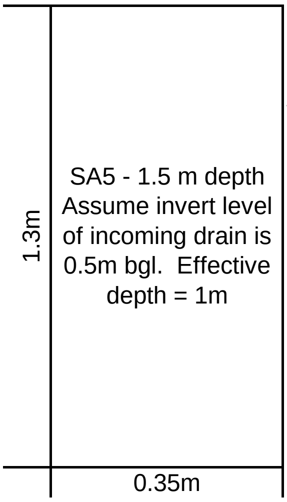
## Field Data

| Time | Time Elapsed (min) | Time Elapsed (sec) | Depth of Water below GL (m) |
|---|---|---|---|
| 13:05 | 0.0 | 0 | 0.50 |
| 13:10 | 5.0 | 300 | 0.52 |
| 13:25 | 20.0 | 1200 | 0.54 |
| 14:25 | 80.0 | 4800 | 0.55 |
| 15:10 | 125.0 | 7500 | 0.55 |

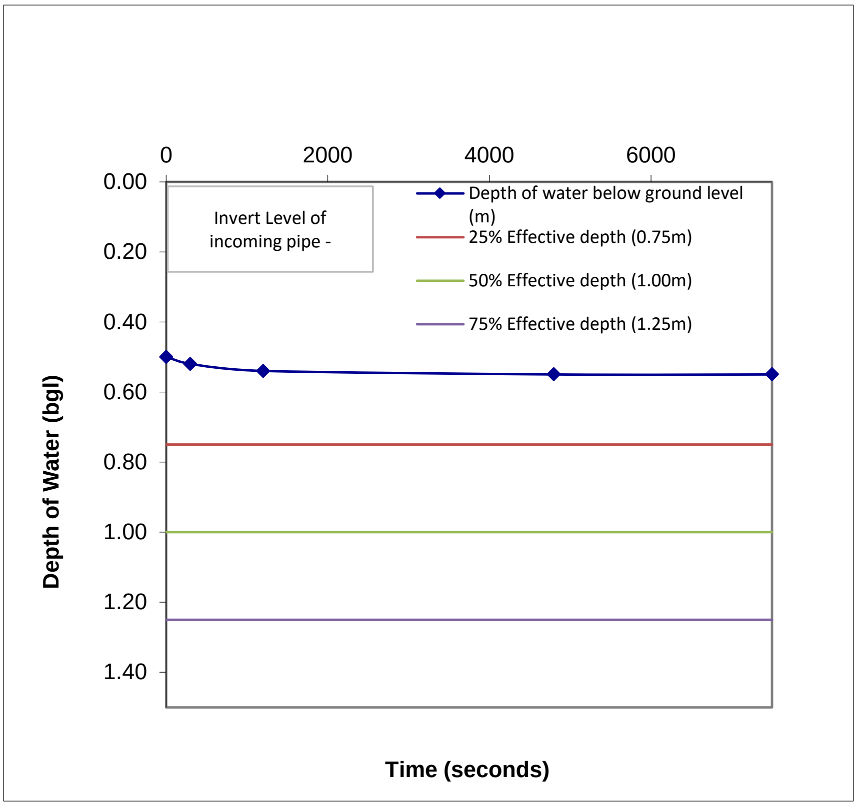
Linear extrapolated values for calculation

**Location:** SA5 **TEST 1**
**Weather:** Overcast
**Engineer:** MC
**Date:** 17/06/2020

**Strata Tested** Weathered Lowestoft Formation




**Pit Depths (m bgl)**
**Length**
1.3
**Width**
0.35
**Depth**
1.5
**25% Effective Depth**
0.75
**75% Effective Depth**
1.25
**Inlet Depth**
0.5




**CALCULATION:**

Soil Infiltration Rate(f) =
Vp75-25 / (ap50 x tp75-25)

Where:
Vp75-25 = effective storage volume between 75% and 25% effective depth
1.3x0.35x(1.25-0.75)
= **0.2275**

ap50 = internal area of TP upto 50% effective depth + base of TP
2(1.3 x ) + 2(0.35 x ) + (1.3 x 0.35)
**= 2.105**

Tp75-25 = the time for water level to fall from 75% - 25% effective depth
= **>>>>** secs

f= **N/A** m/s

**Comment**
Insufficient infiltration over two hours - Soakaway Failed

PADDOCK GEO ENGINEERING

**Client:** Canton Ltd
**Project No:** P20-164
**Project:** Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ

# Infiltration Test to BRE365 - SA6 TEST 1

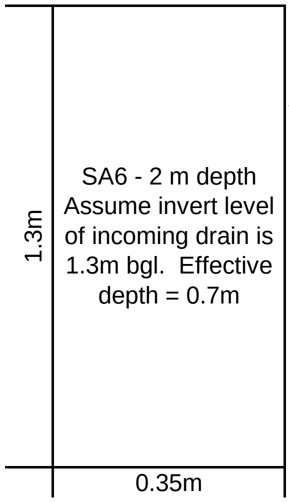
## Field Data

| Time | Time Elapsed (min) | Time Elapsed (sec) | Depth of Water below GL (m) |
|---|---|---|---|
| 13:22 | 0.0 | 0 | 1.30 |
| 13:25 | 3.0 | 180 | 1.30 |
| 13:30 | 8.0 | 480 | 1.30 |
| 13:45 | 23.0 | 1380 | 1.30 |
| 13:55 | 33.0 | 1980 | 1.30 |
| 14:26 | 64.0 | 3840 | 1.30 |
| 15:22 | 120.0 | 7200 | 1.30 |
| 16:24 | 182.0 | 10920 | 1.30 |

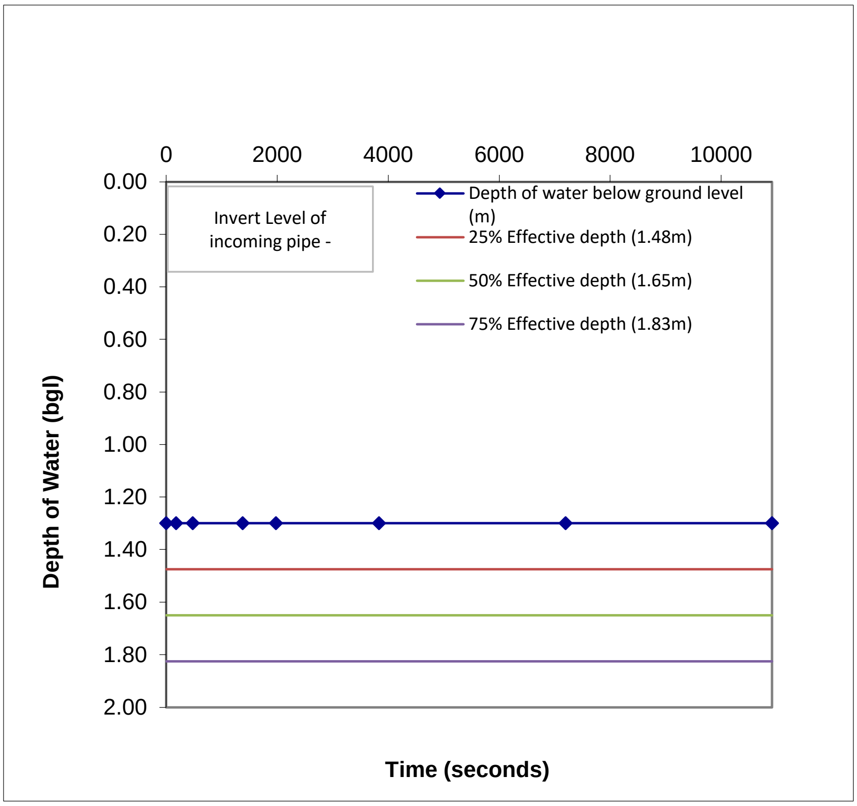
Linear extrapolated values for calculation

**Location:** SA6 **TEST 1**
**Weather:** Overcast
**Engineer:** MC
**Date:** 17/06/2020

**Strata Tested** Weathered Lowestoft Formation




**Pit Depths (m bgl)**
**Length**
1.3
**Width**
0.35
**Depth**
2.0
**25% Effective Depth**
1.48
**75% Effective Depth**
1.83
**Inlet Depth**
1.3




**CALCULATION:**

Soil Infiltration Rate(f) =
Vp75-25 / (ap50 x tp75-25)

Where:
Vp75-25 = effective storage volume between 75% and 25% effective depth
1.3x0.35x(1.825-1.475)
= **0.15925**

ap50 = internal area of TP upto 50% effective depth + base of TP
2(1.3 x ) + 2(0.35 x ) + (1.3 x 0.35)
**= 1.61**

Tp75-25 = the time for water level to fall from 75% - 25% effective depth
= **>>>>** secs

f= **N/A** m/s

**Comment**
Insufficient infiltration over three hours - Soakaway Failed

**Client:** Canton Ltd
**Project No:** P20-164
**Project:** Land off Fellows Lane, Colney Heath, Hertfordshire, AL4 0QQ

# Infiltration Test to BRE365 - SA7 TEST 1

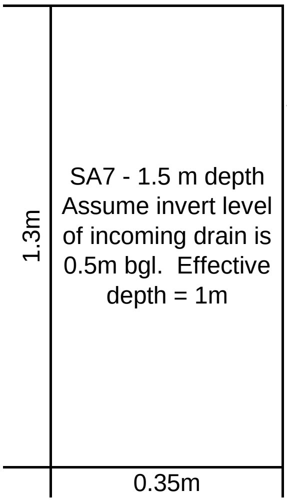
## Field Data

| Time | Time Elapsed (min) | Time Elapsed (sec) | Depth of Water below GL (m) |
|---|---|---|---|
| 14:15 | 0.0 | 0 | 0.50 |
| 14:16 | 1.0 | 60 | 0.50 |
| 14:18 | 3.0 | 180 | 0.50 |
| 14:25 | 10.0 | 600 | 0.50 |
| 14:35 | 20.0 | 1200 | 0.50 |
| 14:58 | 43.0 | 2580 | 0.50 |
| 15:27 | 72.0 | 4320 | 0.50 |
| 16:18 | 123.0 | 7380 | 0.50 |

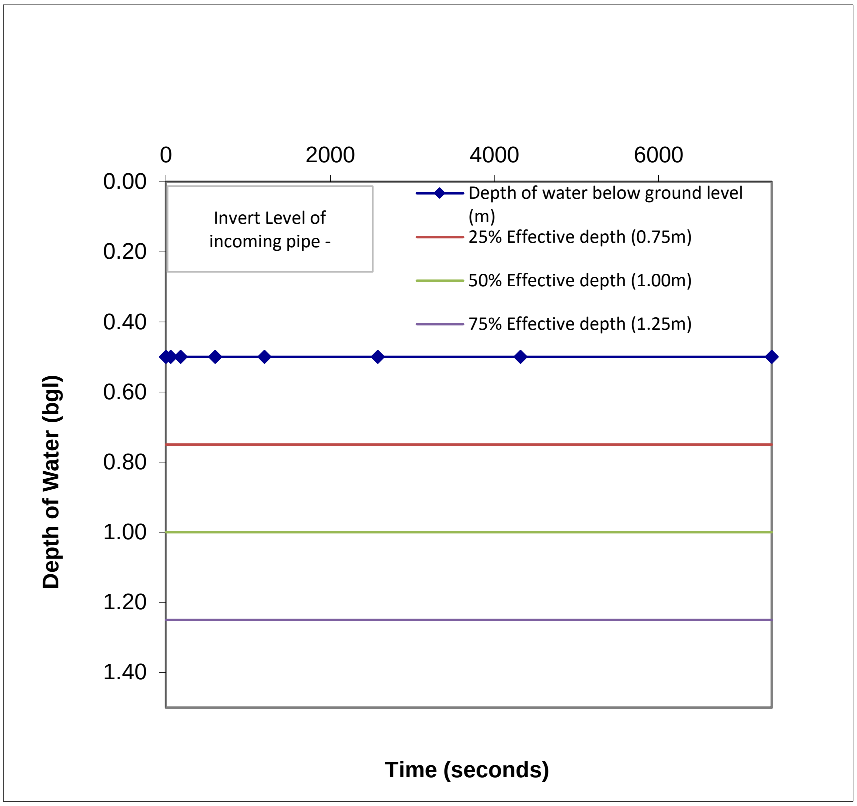
Linear extrapolated values for calculation

**Location:** SA7 **TEST 1**
**Weather:** Overcast
**Engineer:** MC
**Date:** 17/06/2020

**Strata Tested** Weathered Lowestoft Formation




**Pit Depths (m bgl)**
**Length**
1.3
**Width**
0.35
**Depth**
1.5
**25% Effective Depth**
0.75
**75% Effective Depth**
1.25
**Inlet Depth**
0.5




**CALCULATION:**

Soil Infiltration Rate(f) =
Vp75-25 / (ap50 x tp75-25)

Where:
Vp75-25 = effective storage volume between 75% and 25% effective depth
1.3x0.35x(1.25-0.75)
= **0.2275**

ap50 = internal area of TP upto 50% effective depth + base of TP
2(1.3 x ) + 2(0.35 x ) + (1.3 x 0.35)
**= 2.105**

Tp75-25 = the time for water level to fall from 75% - 25% effective depth
= **>>>>** secs

f= **N/A** m/s

**Comment**
Insufficient infiltration over two hours - Soakaway Failed

PADDOCK GEO ENGINEERING

**Client:** Canton Ltd
**Project No:** P20-164
**Project:** Land off Fellows Lane,
Colney Heath, Hertfordshire,
AL4 0QQ

# Appendix H

## Thames Water – Wastewater Plan and Manhole Records

Woods Hardwick
Architecture | Engineering | Planning | Surveying

# Asset location search

Thames Water Property Searches

Woods Hardwick Ltd
BEDFORD
MK40 3NH

| | |
|---|---|
| **Search address supplied** | Roundhouse Farm<br>Bullen's Green Lane<br>North Mymms<br>Welwyn Hatfield<br>Hertfordshire<br>AL4 0QT |
| **Your reference** | 18770_Colney Heath |
| **Our reference** | ALS/ALS Standard/2020_4193250 |
| **Search date** | 12 June 2020 |



Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

**Search address supplied:** Roundhouse Farm, Bullen's Green Lane, North Mymms, Welwyn Hatfield, Hertfordshire, AL4 0QT

Dear Sir / Madam

**An Asset Location Search is recommended when undertaking a site development.**It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

**Contact Us**

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

## Waste Water Services

**Please provide a copy extract from the public sewer map.**

The following quartiles have been printed as they fall within Thames' sewerage area:

TL2006SE
TL2105NW
TL2106SW
TL2005NE

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

## Clean Water Services

**Please provide a copy extract from the public water main map.**

Following examination of our statutory maps, Thames Water has been unable to find any plans of water mains within this area. If you require a connection to the public water supply system, please write to:

New Connections / Diversions
Thames Water
Network Services Business Centre
Brentford
Middlesex
TW8 0EE

Tel: 0845 850 2777
Fax: 0207 713 3858
Email: developer.services@thameswater.co.uk

The following quartiles have not been printed as they are out of Thames' water catchment area. For details of the assets requested please contact the water company indicated below:

| | |
|---|---|
| TL2006SE | Affinity Water |
| TL2105NW | Affinity Water |
| TL2106SW | Affinity Water |
| TL2005NE | Affinity Water |

Affinity Water Ltd
Tamblin Way
Hatfield
AL10 9EZ

Tel: 0345 3572401

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

**Payment for this Search**

A charge will be added to your suppliers account.

## Further contacts:

### Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

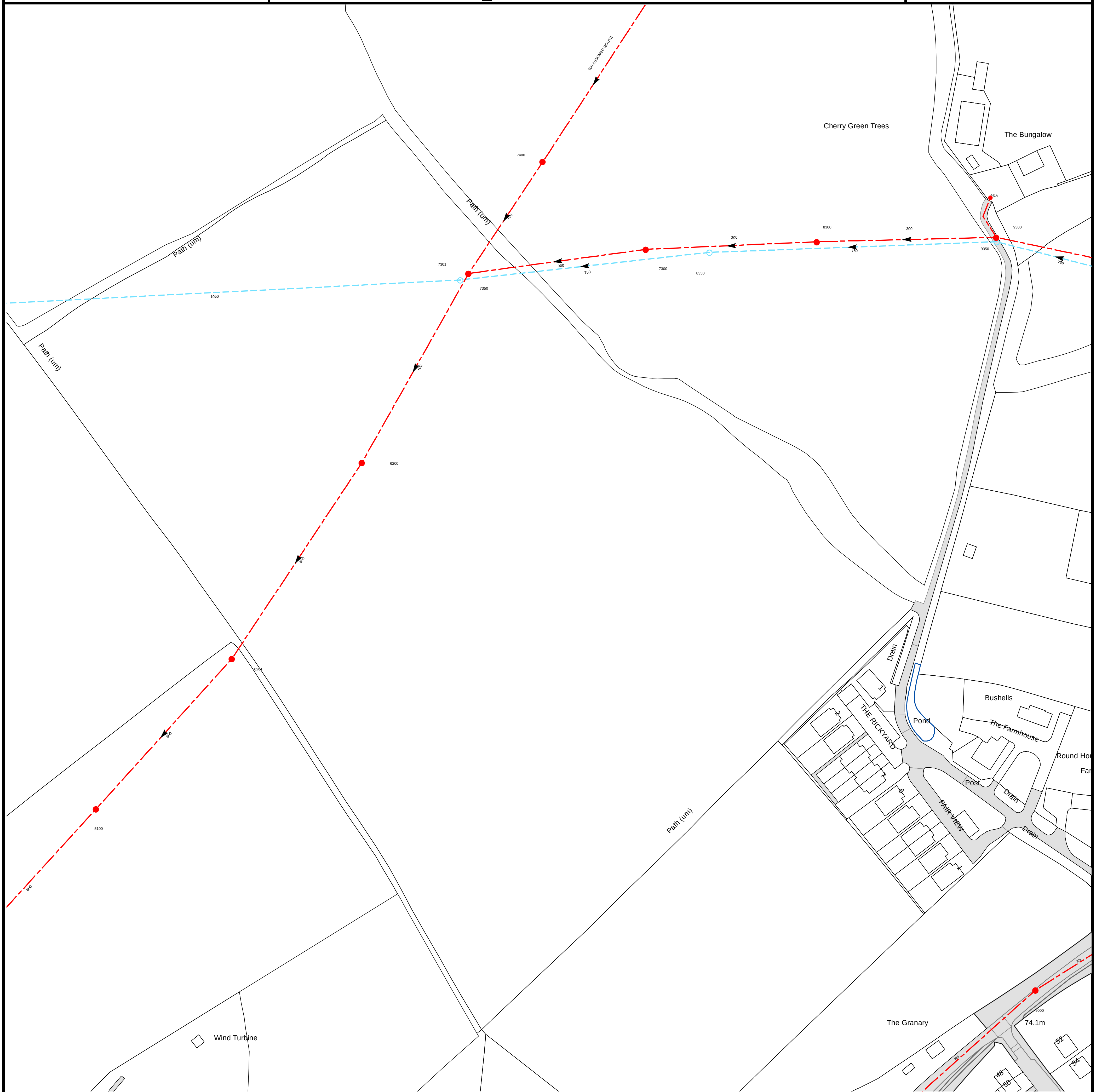
### Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

| Asset Location Search Sewer Map - ALS/ALS Standard/2020_4193250 | TL2006SE |
|---|---|




The width of the displayed area is 500m and the centre of the map is located at OS coordinates 520750,206250

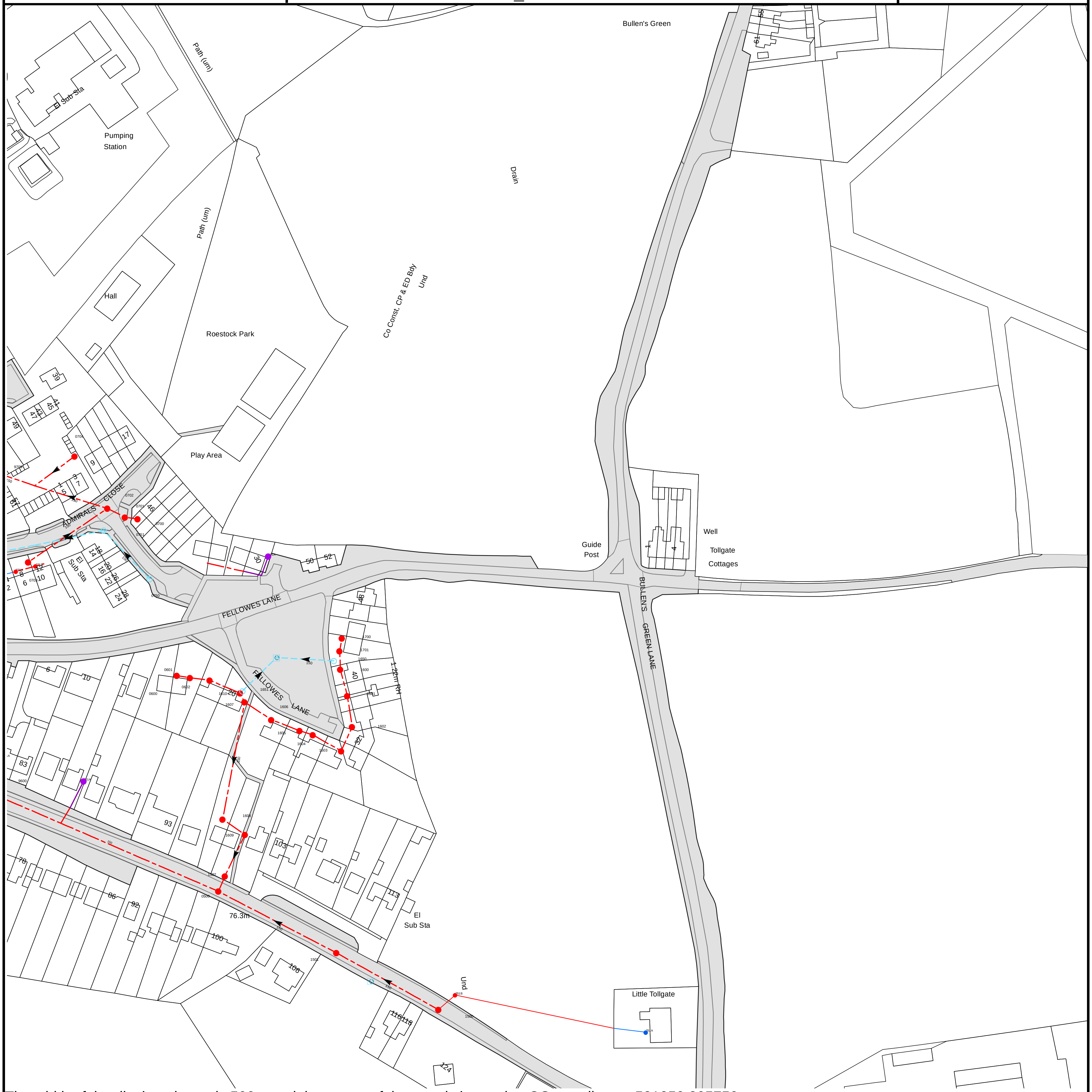
**The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual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

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 9000 | 74.2 | 72.1 |
| 5100 | 75.01 | 69.58 |
| 6201 | 74.89 | 69.67 |
| 6200 | 73.74 | 69.83 |
| 7350 | 72.31 | 69.18 |
| 7301 | 72.28 | 69.92 |
| 8350 | 72.84 | 70.16 |
| 7300 | 72.33 | 70.51 |
| 8300 | 74.18 | 70.94 |
| 9350 | 74.61 | 71.14 |
| 9300 | 74.6 | 71.35 |
| 941A | n/a | n/a |
| 7400 | 71.96 | 69.99 |

**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.**

| Asset Location Search Sewer Map - ALS/ALS Standard/2020_4193250 | TL2105NW |
|---|---|




The width of the displayed area is 500m and the centre of the map is located at OS coordinates 521250,205750

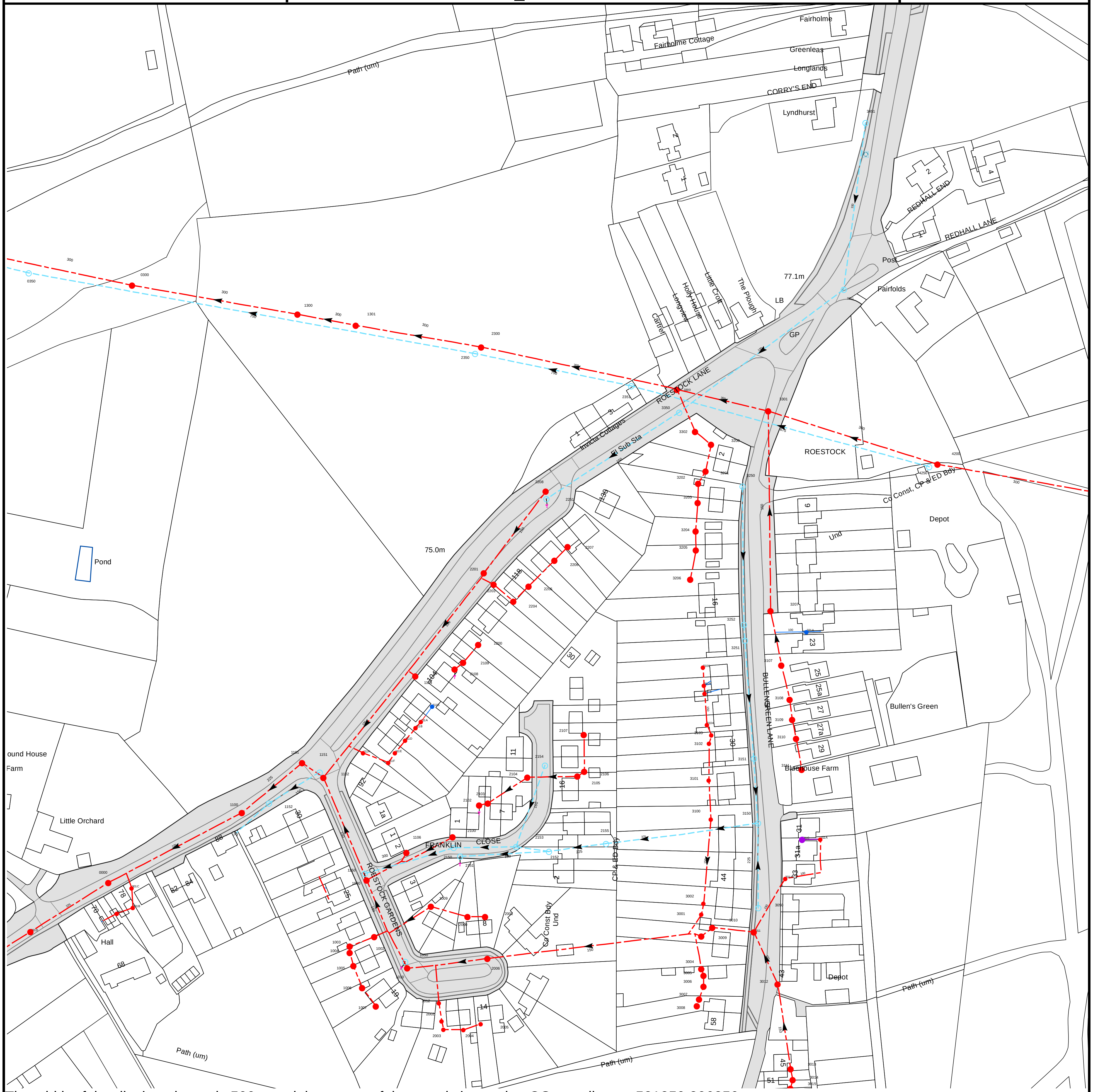
**The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual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

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 251A | n/a | n/a |
| 1500 | 76.88 | 75.03 |
| 251B | n/a | n/a |
| 1550 | n/a | 75.97 |
| 1501 | 76.54 | 74.59 |
| 1603 | 75.93 | 75.06 |
| 1602 | 75.74 | 75.14 |
| 1601 | 75.78 | 75.24 |
| 1600 | 75.77 | 75.27 |
| 1650 | 75.9 | 74.9 |
| 1701 | 75.88 | 75.33 |
| 1700 | 75.88 | 75.38 |
| 171A | n/a | n/a |
| 0751 | 75.82 | 74.47 |
| 0700 | 76.01 | 74.56 |
| 0701 | 75.89 | 74.44 |
| 0702 | 75.78 | 74.34 |
| 0704 | 75.99 | 74.98 |
| 071A | n/a | n/a |
| 0703 | 76.06 | 74.82 |
| 071B | n/a | n/a |
| 061A | n/a | n/a |
| 0750 | 76 | 74.98 |
| 0600 | 75.72 | 75.07 |
| 0601 | 75.73 | 74.99 |
| 0602 | 75.76 | 74.91 |
| 0500 | 76.37 | 74.31 |
| 1608 | 76.34 | 74.6 |
| 1502 | 76.31 | 74.41 |
| 1610 | 75.75 | 74.85 |
| 1651 | 75.72 | 74.82 |
| 1607 | 75.79 | 74.78 |
| 1609 | 76.42 | 74.52 |
| 1606 | 75.77 | 74.84 |
| 1652 | n/a | 74.54 |
| 1605 | 75.79 | 74.89 |
| 1604 | 75.89 | 74.94 |

**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.**

| Asset Location Search Sewer Map - ALS/ALS Standard/2020_4193250 | TL2106SW |
|---|---|




The width of the displayed area is 500m and the centre of the map is located at OS coordinates 521250,206250

**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.**

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 4200 | 79.57 | 76.7 |
| 2105 | 75.71 | 74.56 |
| 2107 | 75.83 | n/a |
| 2106 | 75.75 | 74.59 |
| 2155 | 76.02 | 75.26 |
| 3009 | 77 | 74.57 |
| 3001 | 76.71 | 74.69 |
| 3106 | 76.97 | 76.51 |
| 3002 | 76.7 | 74.8 |
| 3105 | 76.87 | 76.33 |
| 311B | n/a | n/a |
| 3104 | 76.76 | 75.93 |
| 3101 | 76.73 | 75.73 |
| 3102 | 76.88 | 75.88 |
| 3100 | 76.72 | 75.4 |
| 3103 | 76.79 | 75.9 |
| 3010 | 77.06 | 74.69 |
| 3151 | 77.12 | 76.07 |
| 3150 | 76.91 | 76.11 |
| 3050 | 77.1 | 76.32 |
| 3107 | 77.38 | 76.23 |
| 3108 | 77.35 | 76.4 |
| 3109 | 77.38 | 76.51 |
| 3110 | 77.5 | 76.57 |
| 3111 | 77.69 | 76.73 |
| 3251 | 77.07 | 76.21 |
| 321A | n/a | n/a |
| 3252 | 77.09 | 76.22 |
| 3207 | 77.42 | 75.82 |
| 2204 | 75.55 | 74.57 |
| 2205 | 75.56 | 74.73 |
| 2203 | 75.43 | 74.28 |
| 3206 | 77.26 | 76.65 |
| 2201 | 75.33 | 73.76 |
| 2206 | 75.78 | 75.01 |
| 3205 | 77.12 | 76.49 |
| 2207 | 76.63 | 75.87 |
| 3204 | 77.17 | 76.38 |
| 3203 | 77.02 | 76.17 |
| 2251 | 75.28 | n/a |
| 2208 | 76.55 | 75 |
| 3250 | 77.32 | 76.54 |
| 3202 | 77.04 | 76.04 |
| 3201 | 77.01 | 75.96 |
| 4250 | 79.32 | 76.61 |
| 3200 | 76.95 | 75.68 |
| 3302 | 76.74 | 75.51 |
| 3350 | 76.64 | 75.29 |
| 3301 | 76.83 | 74.63 |
| 3300 | 76.33 | 73.95 |
| 2351 | 76.5 | 73.85 |
| 2350 | 75.34 | 72.51 |
| 1301 | 75.57 | 72.52 |
| 2300 | n/a | n/a |
| 3351 | 77.28 | 75.38 |
| 3451 | 77.08 | 75.82 |
| 3450 | n/a | n/a |
| 3015 | 77.35 | 76.33 |
| 3014 | 77.37 | 76.15 |
| 3013 | 77.51 | 76.1 |
| 2004 | 75.09 | 74.27 |
| 2003 | 75 | 74.18 |
| 2005 | 75.16 | 74.39 |
| 2002 | 74.98 | 74.13 |
| 1007 | 75.57 | 74.83 |
| 3008 | 76.89 | 76.29 |
| 1012 | 74.83 | 73.94 |
| 3007 | 76.86 | 76.1 |
| 1006 | 74.68 | 73.9 |
| 3006 | 76.95 | 76.07 |
| 3012 | 77.14 | 75.24 |
| 3005 | 76.96 | 75.95 |
| 3004 | 76.96 | 75.92 |
| 1010 | 74.58 | 73.48 |
| 1005 | 74.55 | 73.85 |
| 1050 | 74.61 | 73.69 |
| 2006 | 74.93 | 73.78 |
| 1004 | 74.49 | 73.76 |
| 1003 | 74.39 | 73.74 |
| 1002 | 74.6 | 73.62 |
| 1102 | 74.06 | 72.68 |
| 111H | n/a | n/a |
| 1150 | 74.3 | 73.5 |
| 1000 | 74.35 | 73.05 |
| 111F | n/a | n/a |
| 111E | n/a | n/a |
| 111D | n/a | n/a |
| 1106 | 74.57 | 73.75 |
| 1104 | 74.83 | 73.5 |
| 111B | n/a | n/a |

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 111A | n/a | n/a |
| 1009 | 75.01 | 73.96 |
| 111G | n/a | n/a |
| 2100 | 74.88 | 73.92 |
| 2150 | 74.78 | 73.98 |
| 2108 | 74.93 | 74.15 |
| 2151 | 75 | 74.21 |
| 2109 | 75.21 | 74.16 |
| 2000 | 75.15 | 74.25 |
| 2200 | 75.3 | 74.33 |
| 2102 | 75.02 | 74.15 |
| 2001 | 75.18 | 74.4 |
| 2103 | 75.08 | 74.15 |
| 2153 | 75.24 | 74.24 |
| 2104 | 75.51 | 74.41 |
| 2154 | 75.5 | 74.82 |
| 2152 | 75.69 | 74.86 |
| 001D | n/a | n/a |
| 001A | n/a | n/a |
| 001B | n/a | n/a |
| 001C | n/a | n/a |
| 0000 | 74.08 | 72.36 |
| 1100 | 73.96 | 72.56 |
| 1152 | n/a | n/a |
| 1151 | 74.08 | 73.28 |
| 1101 | n/a | n/a |
| 1300 | 75.3 | 72.4 |
| 0300 | 74.32 | 71.87 |
| 0350 | 73.65 | 71.45 |
| 3011 | 76.94 | 74.97 |
| 301A | n/a | n/a |
| 311C | n/a | n/a |
| 311A | n/a | n/a |

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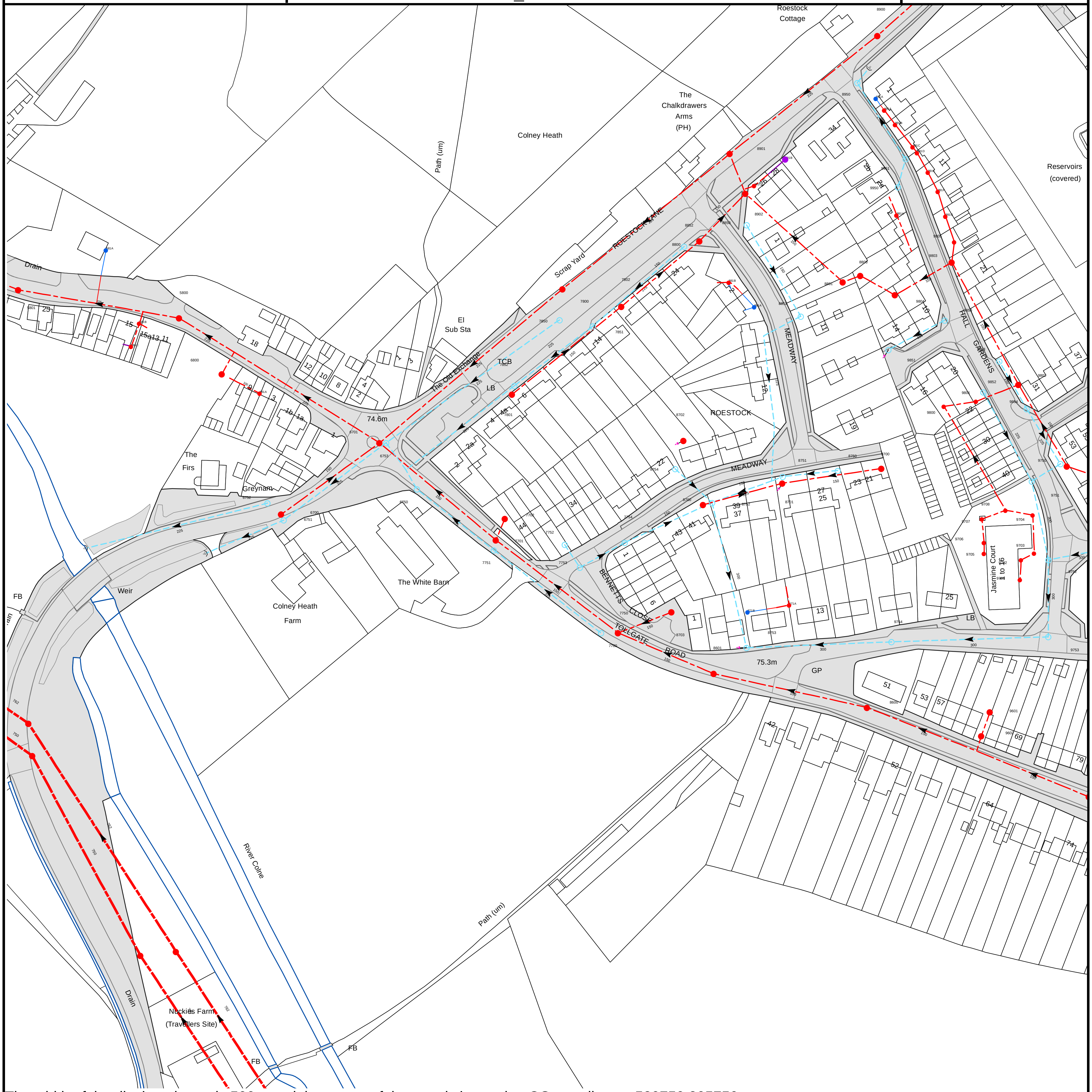
| Asset Location Search Sewer Map - ALS/ALS Standard/2020_4193250 | TL2005NE |
|---|---|




The width of the displayed area is 500m and the centre of the map is located at OS coordinates 520750,205750

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 8950 | 74.46 | 73.94 |
| 8900 | 74.18 | 71.81 |
| 9853 | 75.48 | 74.54 |
| 9851 | 75.62 | 74.06 |
| 9850 | 75.35 | 74.31 |
| 8851 | 75.46 | 73.87 |
| 881A | n/a | n/a |
| 9804 | 75.33 | 73.16 |
| 881B | n/a | n/a |
| 8801 | 75.4 | 73.05 |
| 8803 | n/a | n/a |
| 9803 | 75.19 | 73.36 |
| 9805 | 75.26 | 73.86 |
| 8850 | 75.29 | 74.2 |
| 991G | n/a | n/a |
| 991H | n/a | n/a |
| 8902 | 75.13 | 72.02 |
| 991F | n/a | n/a |
| 9950 | 74.85 | 74.24 |
| 891C | n/a | n/a |
| 991E | n/a | n/a |
| 891B | n/a | n/a |
| 9951 | 74.72 | 74.06 |
| 8901 | 74.85 | 71.65 |
| 991D | n/a | n/a |
| 991C | n/a | n/a |
| 991B | n/a | n/a |
| 991A | n/a | n/a |
| 891A | n/a | n/a |
| 5801 | 73.08 | 70.25 |
| 581A | n/a | n/a |
| 5800 | 73.35 | 70.56 |
| 6800 | 73.62 | 72.26 |
| 681A | n/a | n/a |
| 6752 | 73.82 | 72.22 |
| 6700 | 74.03 | 71.37 |
| 6751 | 74.09 | 72.14 |
| 6701 | 74.66 | 70.94 |
| 6753 | n/a | n/a |
| 6750 | 74.75 | 73.27 |
| 7751 | 74.99 | 73.74 |
| 7701 | 74.92 | 72.07 |
| 7702 | 75.25 | 73.5 |
| 7801 | 75.1 | 73.9 |
| 7852 | 75.24 | 74.18 |
| 7850 | 74.97 | 74.12 |
| 7800 | 75 | 71.29 |
| 7752 | 74.98 | 74.45 |
| 7851 | 75.42 | 74.4 |
| 7802 | 75.47 | 73.41 |
| 7754 | 75.11 | 73.58 |
| 8754 | 75.31 | 73.79 |
| 8702 | 75.41 | 73.71 |
| 8852 | n/a | n/a |
| 8800 | 75.42 | 72.78 |
| 9702 | 76.1 | 75.04 |
| 9705 | 76.05 | 74.91 |
| 9703 | 76.07 | 74.93 |
| 9706 | 76.06 | 74.81 |
| 9707 | 76.06 | 74.59 |
| 9704 | 76.04 | 74.64 |
| 9708 | 75.91 | 74.24 |
| 8700 | 75.56 | 74.36 |
| 8752 | 75.38 | 73.18 |
| 8701 | 75.56 | 74.04 |
| 9751 | 76 | 74.02 |
| 8751 | 75.54 | 73.48 |
| 8750 | 75.69 | 73.74 |
| 9700 | 75.61 | 74.42 |
| 9709 | 75.85 | 73.77 |
| 9750 | 75.9 | 74.18 |
| 9854 | 75.78 | 74.38 |
| 9800 | 75.88 | 73.93 |
| 9801 | 75.73 | 73.64 |
| 9852 | 75.57 | 74.26 |
| 9802 | 75.69 | 73.6 |
| C123 | 70.64 | 67.13 |
| CC123 | 71.73 | 67.17 |
| CC124 | 71.65 | 67.29 |
| C124 | 71.61 | 67.27 |
| 7753 | 75.08 | 74.06 |
| 7750 | 75.56 | 74.3 |
| 7700 | 75.42 | 72.42 |
| 8703 | 75.35 | 73.85 |
| 8601 | 74.49 | 72.63 |
| 8753 | 75.46 | 72.98 |
| 871B | n/a | n/a |
| 871A | n/a | n/a |
| 8600 | 75.64 | 72.97 |
| 9754 | 75.54 | 73.4 |

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|---|---|---|
| 9602 | 75.84 | 74.67 |
| 9601 | 75.99 | 75.06 |
| 9701 | 76.07 | 75.27 |
| 9753 | 75.8 | 73.83 |
| 9752 | 76.05 | 73.86 |
| 9600 | 76.25 | 73.65 |
| 961A | n/a | n/a |
| 581C | n/a | n/a |
| 581B | n/a | n/a |

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# ALS Sewer Map Key

## Public Sewer Types (Operated & Maintained by Thames Water)

**Foul:** A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

**Surface Water:** A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

**Combined:** A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Trunk Surface Water
- Trunk Foul
- Storm Relief
- Trunk Combined
- Vent Pipe
- Bio-solids (Sludge)
- Proposed Thames Surface Water Sewer
- Proposed Thames Water Foul Sewer
- Gallery
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Sludge Rising Main
- Proposed Thames Water Rising Main
- Vacuum

## Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Dam Chase
- Fitting
- Meter
- Vent Column

## Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Control Valve
- Drop Pipe
- Ancillary
- Weir

## End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Outfall
- Undefined End
- Inlet

## Other Symbols

Symbols used on maps which do not fall under other general categories

- Public/Private Pumping Station
- Change of characteristic indicator (C.O.C.I.)
- Invert Level
- Summit

**Areas**

Lines denoting areas of underground surveys, etc.

- Agreement
- Operational Site
- Chamber
- Tunnel
- Conduit Bridge

## Other Sewer Types (Not Operated or Maintained by Thames Water)

- Foul Sewer
- Surface Water Sewer
- Combined Sewer
- Gulley
- Culverted Watercourse
- Proposed
- Abandoned Sewer

**Notes:**

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

## Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

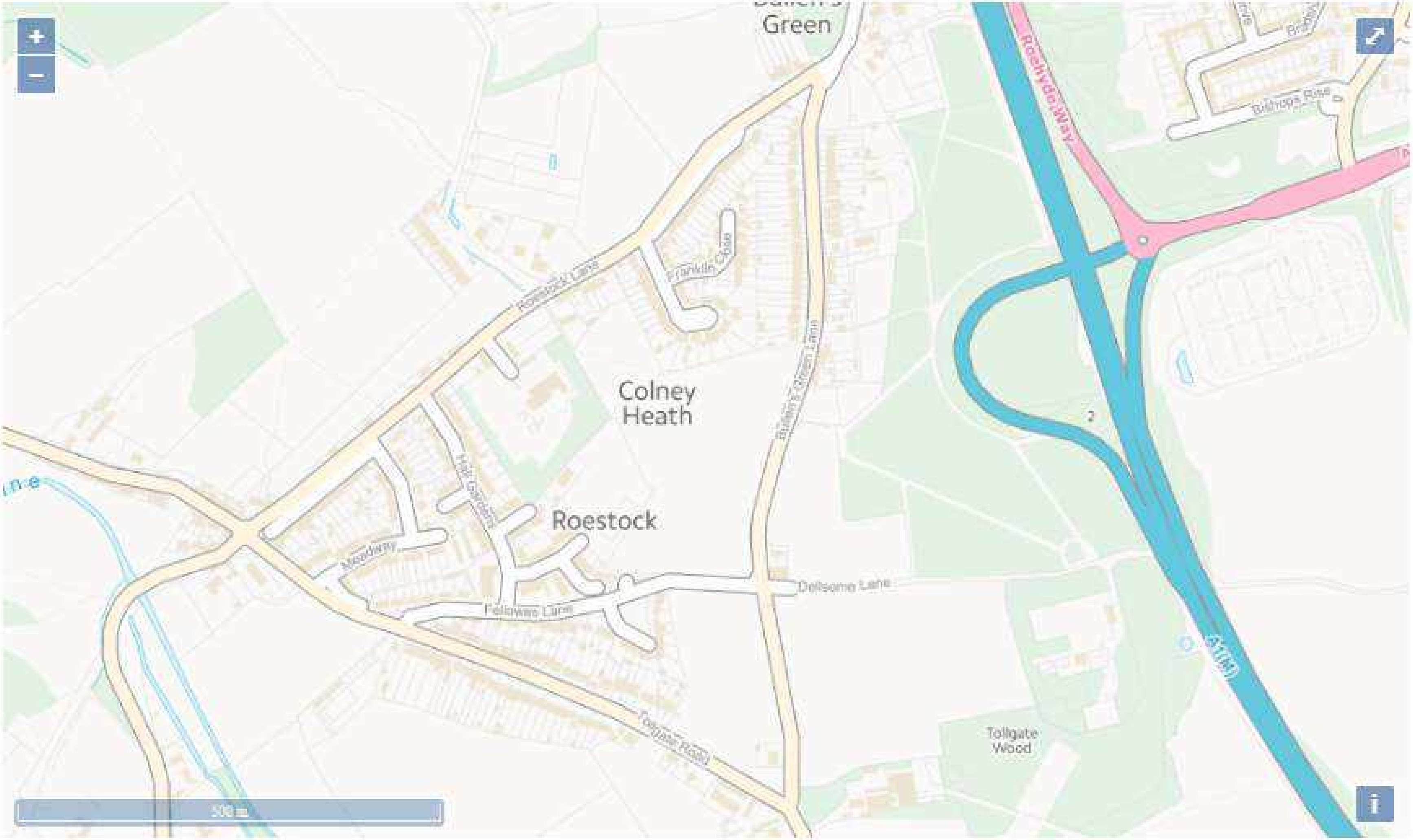
### Ways to pay your bill

| **Credit Card** | **BACS Payment** | **Telephone Banking** | **Cheque** |
|---|---|---|---|
| Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS | Account number **90478703**<br>Sort code **60-00-01**<br>A remittance advice must be sent to:<br>**Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.**<br>or email<br>**ps.billing@thameswater.co.uk** | By calling your bank and quoting:<br>Account number **90478703**<br>Sort code **60-00-01**<br>and your invoice number | Made payable to '**Thames Water Utilities Ltd**'<br>Write your Thames Water account number on the back.<br>Send to:<br>**Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW**<br>or by DX to **151280 Slough 13** |

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

# Appendix I

## Environment Agency – Reservoir Flood Map




Extent of flooding from reservoirs

Maximum extent of flooding

# Appendix J

## Thames Water Correspondence

Woods Hardwick
Architecture | Engineering | Planning | Surveying

Miss Jasmine Katsoulis
Woods Hardwick
15-17 Goldington Road
Bedford
MK40 3NH

Wastewater pre-planning
Our ref DS6075257

20 Aug. 20

## Pre-planning enquiry: Confirmation of sufficient capacity

Dear Miss Katsoulis

Thank you for providing information on your development: **Roundhouse Farm, Colney Heath, Bullen's Green Lane, North Mymms, Welwyn Hatfield, Hertfordshire, AL4 0QT.**

***Residential development comprising 100 units. Foul water to be pumped into MH3011 at 2.31l/s. Surface water to be attenuated to the greenfield rate 9.3l/s and discharged into MH1150***.

We're pleased to confirm that there will be sufficient foul and surface water capacity in our sewerage network to serve your development, so long as your phasing follows the timescale you've suggested.

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.

### Source Protection Zone

The development site boundary falls within a Source Protection Zone for groundwater abstraction. These zones may be at particular risk from polluting activities on or below the land surface. To prevent pollution, the Environment Agency and Thames Water (or other local water undertaker) will use a tiered, risk-based approach to regulate activities that may impact groundwater resources, this may potentially affect your drainage or surface water strategies where infiltration systems are proposed. The applicant is encouraged to read the Environment Agency's approach to groundwater protection (available at https://www.gov.uk/government/publications/ groundwater-protection-position-statements) and may wish to discuss the full implications for their development with a suitably qualified environmental consultant.

**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 0203 577 8082.

Yours sincerely

Artur Jaroma

Thames Water

## Yolanda Kwaramba

| | |
|---|---|
| **From:** | Yolanda Kwaramba |
| **Sent:** | 20 August 2020 10:42 |
| **To:** | 'DEVELOPER.SERVICES@THAMESWATER.CO.U' |
| **Cc:** | John Freeman |
| **Subject:** | FW: RE: RE: RE: RE: RE: FW: Thames Water Pre-Planning Enquiry Request. TW ref. DS6075257 [Filed 20 Aug 2020 14:20] |
| **Attachments:** | DS6075257 PDEV AL4 0QT Roundhouse Farm.pdf; 18.08.2020 Greenfield Calculation.PNG |

Artur,

Further to our telephone conversation, please could you revise your response taking into account the following;

1. Preferred surface water point of connection – MH3010 in Bullens Green Lane.
2. The QBAR rate is 9.6l/s based on a site area of 5.25ha – see attached calculation.

I look forward to hearing from you soon.

Many thanks.

---

**From:** DEVELOPER.SERVICES@THAMESWATER.CO.U <DEVELOPER.SERVICES@THAMESWATER.CO.UK>
**Sent:** 20 August 2020 09:50
**To:** Jasmine Katsoulis <j.katsoulis@WoodsHardwick.com>
**Subject:** RE: RE: RE: RE: RE: RE: FW: Thames Water Pre-Planning Enquiry Request. TW ref. DS6075257

Dear Sir/Madam

Following your Pre-Planning Enquiry for the above site, please find our formal response enclosed.

Please note, Thames Water do not envisage any capacity concerns to the waste water infrastructure at this stage of your development.

Should you have any further queries, please do not hesitate to contact me again.

Kind Regards

Artur Jaroma
Developer Services – Sewer Adoptions Engineer
Office: 0800 009 3921
Mobile: 077476 47276

**Get advice on making your sewer connection correctly at connectright.org.uk**

Clearwater Court, Vastern Road, Reading, RG1 8DB
Find us online at developers.thameswater.co.uk

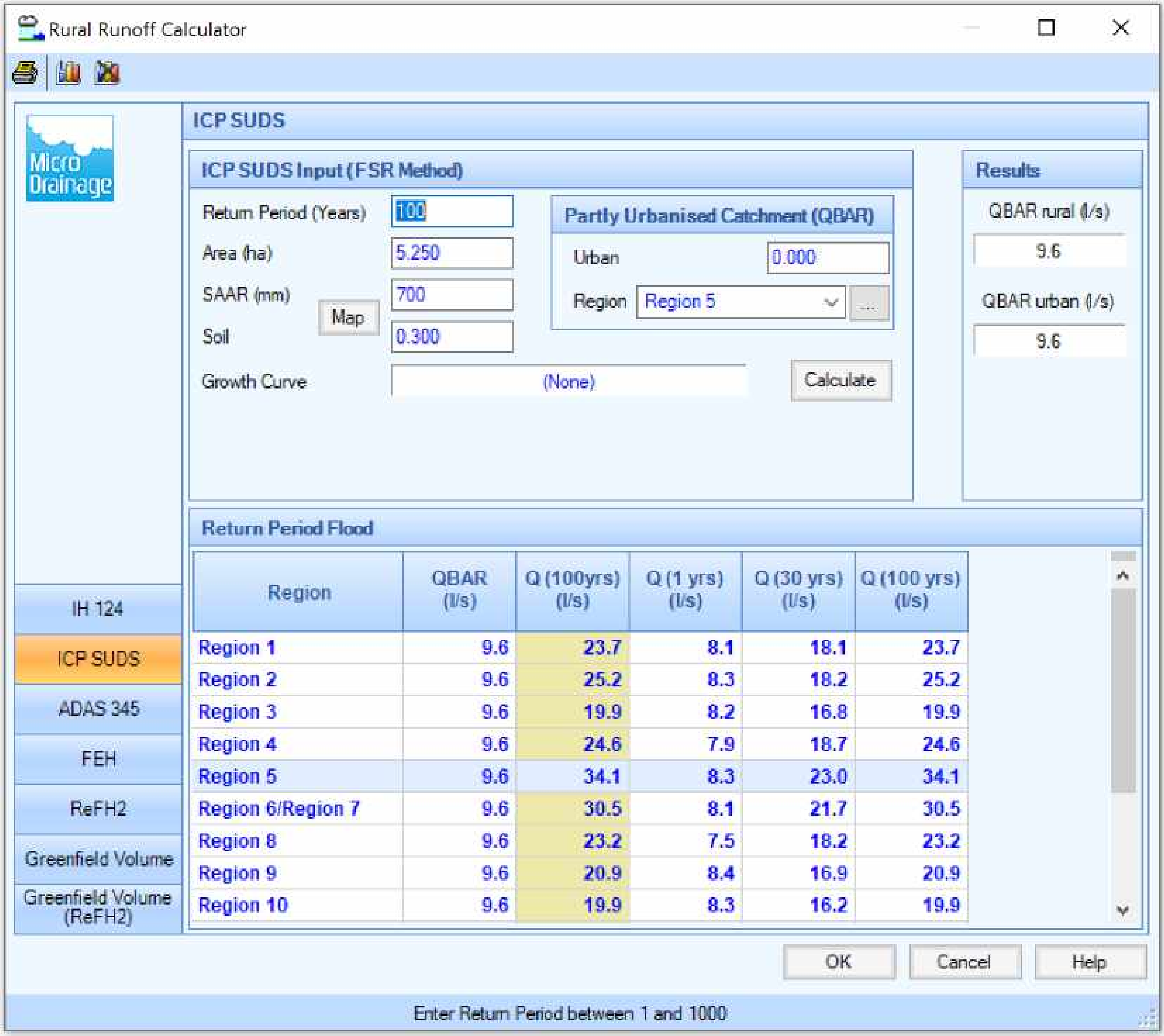
Original Text

# Appendix K

## Greenfield Calculations

Woods Hardwick

Architecture | Engineering | Planning | Surveying




| Region | QBAR (l/s) | Q (100yrs) (l/s) | Q (1 yrs) (l/s) | Q (30 yrs) (l/s) | Q (100 yrs) (l/s) |
|---|---|---|---|---|---|
| Region 1 | 9.6 | 23.7 | 8.1 | 18.1 | 23.7 |
| Region 2 | 9.6 | 25.2 | 8.3 | 18.2 | 25.2 |
| Region 3 | 9.6 | 19.9 | 8.2 | 16.8 | 19.9 |
| Region 4 | 9.6 | 24.6 | 7.9 | 18.7 | 24.6 |
| Region 5 | 9.6 | 34.1 | 8.3 | 23.0 | 34.1 |
| Region 6/Region 7 | 9.6 | 30.5 | 8.1 | 21.7 | 30.5 |
| Region 8 | 9.6 | 23.2 | 7.5 | 18.2 | 23.2 |
| Region 9 | 9.6 | 20.9 | 8.4 | 16.9 | 20.9 |
| Region 10 | 9.6 | 19.9 | 8.3 | 16.2 | 19.9 |

# Appendix L

**Proposed Drainage Strategy**


## NOTES

1. Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be reported to the Architect or Engineer before proceeding.


2. Reproduced from OS Sitemap ® by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. 

3. Until technical approval has been obtained from the relevant authorities, all drawings are issued as preliminary and not for construction. Should the Contractor commence site work prior to approval being given it is entirely at his own risk.

## SAFETY, HEALTH AND ENVIRONMENTAL

In addition to the hazards, risks normally associated with the type of work detailed on this drawing, note the following significant risks and information.

Construction:

1. There is an existing HV cable which crosses the site.

For information relating to end use, maintenance, demolition, see the health and safety file.

It is assumed that all works will be carried out by a competent Contractor, where appropriate, to an approved method statement.

Site Boundary
Proposed Surface Water Network
Proposed Foul Water Network
Proposed Permeable Paving
Proposed Swale

| REV | DESCRIPTION | DRN | CHD | DATE |
|---|---|---|---|---|
| | | | | |

☒ PRELIMINARY ☐ INFORMATION ☐ TENDER
☐ CONSTRUCTION ☐ AS BUILT

| | | | |
|---|---|---|---|
| SCALE | 1:500 @ A1 | DATE | 20.08.2020 |
| DRAWN | YK | CHK | JGF |
| DRAWING NO. | 18770-FELL-5-201 | REV | - |

TITLE
Land North of Fellows Lane
Colney Heath

DETAILS
Proposed Drainage Strategy
Sheet 1 of 2


Woods Hardwick
Architecture | Engineering | Planning | Surveying

BEDFORD : HEAD OFFICE
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BIRMINGHAM
Fort Dunlop, Fort Parkway
Birmingham B24 9FE
T: +44 (0) 121 6297784

ONLINE: mail@woodshardwick.com | woodshardwick.com


**NOTES**

1. Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be reported to the Architect or Engineer before proceeding.
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3. Until technical approval has been obtained from the relevant authorities, all drawings are issued as preliminary and not for construction. Should the Contractor commence site work prior to approval being given it is entirely at his own risk.

**SAFETY, HEALTH AND ENVIRONMENTAL**

In addition to the hazards, risks normally associated with the type of work detailed on this drawing, note the following significant risks and information.

Construction:

1. There is an existing HV cable which crosses the site.

For information relating to end use, maintenance, demolition, see the health and safety file.

It is assumed that all works will be carried out by a competent Contractor, where appropriate, to an approved method statement.

- Site Boundary
- Proposed Surface Water Network
- Proposed Foul Water Network
- Proposed Permeable Paving
- Proposed Swale

| REV | DESCRIPTION | DRN | CHD | DATE |
|---|---|---|---|---|

☒ PRELIMINARY ☐ INFORMATION ☐ TENDER
☐ CONSTRUCTION ☐ AS BUILT

| | | | |
|---|---|---|---|
| SCALE | 1:500 @ A2 | DATE | 20.08.2020 |
| DRAWN | YK | CHK | JGF |
| DRAWING NO. | 18770-FELL-5-202 | REV | - |

TITLE
Land North of Fellows Lane
Colney Heath

DETAILS
Proposed Drainage Strategy
Sheet 2 of 2

Woods Hardwick
Architecture | Engineering | Planning | Surveying


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ONLINE: mail@woodshardwick.com | woodshardwick.com


PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS DRAWING

# Appendix M

## Drainage Calculations

## Design Settings

| | |
|---|---|
| Rainfall Methodology | FEH-99 |
| Return Period (years) | 100 |
| Additional Flow (%) | 40 |
| C (1km) | -0.029 |
| D1 (1km) | 0.300 |
| D2 (1km) | 0.302 |
| D3 (1km) | 0.294 |
| E (1km) | 0.324 |
| F (1km) | 2.454 |
| CV | 0.750 |

| | |
|---|---|
| Time of Entry (mins) | 6.00 |
| Maximum Time of Concentration (mins) | 30.00 |
| Maximum Rainfall (mm/hr) | 50.0 |
| Minimum Velocity (m/s) | 1.00 |
| Connection Type | Level Soffits |
| Minimum Backdrop Height (m) | 0.200 |
| Preferred Cover Depth (m) | 1.200 |
| Include Intermediate Ground | ✓ |
| Enforce best practice design rules | ✓ |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| 1 | 0.102 | 6.00 | 75.500 | 1200 | 521186.287 | 205760.078 | 1.500 |
| 2 | 0.000 | | 75.500 | 1200 | 521194.056 | 205764.144 | 1.552 |
| 3 | 0.100 | 6.00 | 75.492 | 1350 | 521199.897 | 205765.339 | 1.729 |
| 18 | 0.133 | 6.00 | 75.276 | 1350 | 521160.812 | 205822.575 | 1.575 |
| 19 | 0.000 | | 75.698 | 1350 | 521192.336 | 205812.006 | 2.195 |
| 4 | 0.191 | 6.00 | 75.809 | 1500 | 521199.897 | 205810.705 | 2.577 |
| 20 | 0.102 | 6.00 | 75.800 | 1200 | 521262.129 | 205837.776 | 1.425 |
| 21 | 0.095 | 6.00 | 75.797 | 1200 | 521266.210 | 205850.397 | 1.501 |
| 5 | 0.066 | 6.00 | 75.236 | 1500 | 521217.365 | 205866.193 | 2.273 |
| 6 | 0.000 | | 75.000 | 1500 | 521224.373 | 205888.455 | 2.089 |
| 7 | 0.043 | 6.00 | 75.000 | 1800 | 521223.408 | 205901.064 | 2.192 |
| 22 | 0.278 | 6.00 | 75.504 | 1350 | 521166.496 | 205895.913 | 1.575 |
| 8 | 0.000 | | 74.944 | 1800 | 521214.333 | 205919.481 | 2.182 |
| 9 | 0.018 | 6.00 | 75.018 | 1800 | 521212.514 | 205926.227 | 2.270 |
| 23 | 0.089 | 6.00 | 76.000 | 1200 | 521290.517 | 205922.086 | 1.500 |
| 24 | 0.094 | 6.00 | 75.980 | 1350 | 521294.862 | 205935.646 | 1.640 |
| 25 | 0.000 | | 75.583 | 1350 | 521256.954 | 205947.794 | 1.575 |
| 26 | 0.000 | | 75.467 | 1350 | 521246.550 | 205948.409 | 1.575 |
| 27 | 0.128 | 6.00 | 75.342 | 1350 | 521234.203 | 205945.549 | 1.650 |
| 28 | 0.023 | 6.00 | 75.208 | 1350 | 521222.068 | 205939.864 | 1.650 |
| 10 | 0.000 | | 75.107 | 1800 | 521214.321 | 205933.750 | 2.374 |
| 11 | 0.064 | 6.00 | 74.845 | 1800 | 521199.220 | 205944.285 | 2.149 |
| 12 | 0.000 | | 74.800 | 1800 | 521190.659 | 205962.357 | 2.144 |
| 29 | 0.000 | 6.00 | 74.500 | 1800 | 521139.727 | 205976.078 | 1.500 |
| 30 | 0.103 | 6.00 | 74.700 | 1800 | 521153.158 | 205964.357 | 1.800 |
| 31 | 0.040 | 6.00 | 74.700 | 1800 | 521165.217 | 205973.998 | 1.831 |
| 13 | 0.000 | | 74.800 | 1800 | 521189.355 | 205972.213 | 2.365 |
| 14 | 0.000 | | 74.809 | 1800 | 521194.505 | 205981.642 | 2.395 |
| 15 | 0.047 | 6.00 | 74.911 | 1800 | 521201.709 | 205984.839 | 2.513 |
| 32 | 0.157 | 6.00 | 75.300 | 1200 | 521247.550 | 205994.839 | 1.500 |
| 16 | 0.000 | | 75.151 | 1800 | 521220.488 | 205988.936 | 2.791 |
| 17 | 0.000 | | 75.200 | 1800 | 521222.762 | 205978.513 | 2.861 |

## Links (Input)

| Name | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 2 | 8.769 | 0.600 | 74.000 | 73.948 | 0.052 | 168.0 | 300 | 6.12 | 50.0 |
| 1.001 | 2 | 3 | 5.962 | 0.600 | 73.948 | 73.913 | 0.035 | 168.0 | 300 | 6.20 | 50.0 |
| 1.002 | 3 | 4 | 45.366 | 0.600 | 73.763 | 73.382 | 0.381 | 119.1 | 450 | 6.61 | 50.0 |
| 2.000 | 18 | 19 | 33.249 | 0.600 | 73.701 | 73.503 | 0.198 | 168.0 | 375 | 6.40 | 50.0 |
| 2.001 | 19 | 4 | 7.672 | 0.600 | 73.503 | 73.457 | 0.046 | 168.0 | 375 | 6.49 | 50.0 |
| 1.003 | 4 | 5 | 58.173 | 0.600 | 73.232 | 73.038 | 0.194 | 300.0 | 600 | 7.30 | 50.0 |
| 3.000 | 20 | 21 | 13.264 | 0.600 | 74.375 | 74.296 | 0.079 | 168.0 | 225 | 6.22 | 50.0 |
| 3.001 | 21 | 5 | 51.336 | 0.600 | 74.296 | 73.413 | 0.883 | 58.1 | 225 | 6.72 | 50.0 |
| 1.004 | 5 | 6 | 23.339 | 0.600 | 72.963 | 72.911 | 0.052 | 450.0 | 675 | 7.62 | 50.0 |
| 1.005 | 6 | 7 | 12.646 | 0.600 | 72.911 | 72.883 | 0.028 | 450.0 | 675 | 7.79 | 50.0 |
| 1.006 | 7 | 8 | 20.531 | 0.600 | 72.808 | 72.762 | 0.046 | 450.0 | 750 | 8.05 | 50.0 |
| 4.000 | 22 | 8 | 53.328 | 0.600 | 73.929 | 73.137 | 0.792 | 67.3 | 375 | 6.40 | 50.0 |
| 1.007 | 8 | 9 | 6.987 | 0.600 | 72.762 | 72.748 | 0.014 | 500.0 | 750 | 8.14 | 50.0 |
| 1.008 | 9 | 10 | 7.737 | 0.600 | 72.748 | 72.733 | 0.015 | 500.0 | 750 | 8.25 | 50.0 |
| 5.000 | 23 | 24 | 14.239 | 0.600 | 74.500 | 74.415 | 0.085 | 168.0 | 300 | 6.20 | 50.0 |
| 5.001 | 24 | 25 | 39.807 | 0.600 | 74.340 | 74.008 | 0.332 | 119.9 | 375 | 6.60 | 50.0 |
| 5.002 | 25 | 26 | 10.422 | 0.600 | 74.008 | 73.892 | 0.116 | 89.8 | 375 | 6.69 | 50.0 |
| 5.003 | 26 | 27 | 12.674 | 0.600 | 73.892 | 73.767 | 0.125 | 101.4 | 375 | 6.81 | 50.0 |
| 5.004 | 27 | 28 | 13.401 | 0.600 | 73.692 | 73.558 | 0.134 | 100.0 | 450 | 6.92 | 50.0 |
| 5.005 | 28 | 10 | 9.869 | 0.600 | 73.558 | 73.457 | 0.101 | 97.7 | 450 | 7.00 | 50.0 |
| 1.009 | 10 | 11 | 18.413 | 0.600 | 72.733 | 72.696 | 0.037 | 500.0 | 750 | 8.49 | 50.0 |
| 1.010 | 11 | 12 | 19.997 | 0.600 | 72.696 | 72.656 | 0.040 | 500.0 | 750 | 8.76 | 50.0 |
| 1.011 | 12 | 13 | 9.942 | 0.600 | 72.656 | 72.435 | 0.221 | 45.0 | 750 | 8.80 | 50.0 |
| 6.000 | 29 | 30 | 17.826 | 0.600 | 73.000 | 72.900 | 0.100 | 178.3 | 750 | 6.14 | 50.0 |
| 6.001 | 30 | 31 | 15.439 | 0.600 | 72.900 | 72.869 | 0.031 | 500.0 | 750 | 6.35 | 50.0 |
| 6.002 | 31 | 13 | 24.204 | 0.600 | 72.869 | 72.585 | 0.284 | 85.2 | 750 | 6.48 | 50.0 |
| 1.012 | 13 | 14 | 10.744 | 0.600 | 72.435 | 72.414 | 0.021 | 500.0 | 750 | 8.95 | 50.0 |
| 1.013 | 14 | 15 | 7.882 | 0.600 | 72.414 | 72.398 | 0.016 | 500.0 | 750 | 9.05 | 50.0 |
| 1.014 | 15 | 16 | 19.221 | 0.600 | 72.398 | 72.360 | 0.038 | 500.0 | 750 | 9.31 | 50.0 |
| 7.000 | 32 | 16 | 27.698 | 0.600 | 73.800 | 73.635 | 0.165 | 168.0 | 300 | 6.38 | 50.0 |
| 1.015 | 16 | 17 | 10.668 | 0.600 | 72.360 | 72.339 | 0.021 | 500.0 | 750 | 9.45 | 50.0 |

## Pipeline Schedule

| Link | Length (m) | Slope (1:X) | Dia (mm) | Link Type | US CL (m) | US IL (m) | US Depth (m) | DS CL (m) | DS IL (m) | DS Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 8.769 | 168.0 | 300 | Circular_Default Sewer Type | 75.500 | 74.000 | 1.200 | 75.500 | 73.948 | 1.252 |
| 1.001 | 5.962 | 168.0 | 300 | Circular_Default Sewer Type | 75.500 | 73.948 | 1.252 | 75.492 | 73.913 | 1.279 |
| 1.002 | 45.366 | 119.1 | 450 | Circular_Default Sewer Type | 75.492 | 73.763 | 1.279 | 75.809 | 73.382 | 1.977 |
| 2.000 | 33.249 | 168.0 | 375 | Circular_Default Sewer Type | 75.276 | 73.701 | 1.200 | 75.698 | 73.503 | 1.820 |
| 2.001 | 7.672 | 168.0 | 375 | Circular_Default Sewer Type | 75.698 | 73.503 | 1.820 | 75.809 | 73.457 | 1.977 |
| 1.003 | 58.173 | 300.0 | 600 | Circular_Default Sewer Type | 75.809 | 73.232 | 1.977 | 75.236 | 73.038 | 1.598 |
| 3.000 | 13.264 | 168.0 | 225 | Circular_Default Sewer Type | 75.800 | 74.375 | 1.200 | 75.797 | 74.296 | 1.276 |

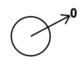
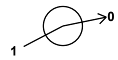
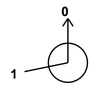
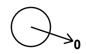
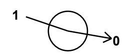
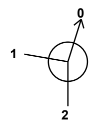
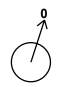
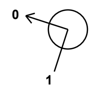
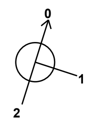
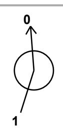
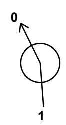
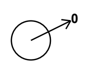
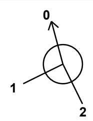
| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 1200 | Manhole | Adoptable | 2 | 1200 | Manhole | Adoptable |
| 1.001 | 2 | 1200 | Manhole | Adoptable | 3 | 1350 | Manhole | Adoptable |
| 1.002 | 3 | 1350 | Manhole | Adoptable | 4 | 1500 | Manhole | Adoptable |
| 2.000 | 18 | 1350 | Manhole | Adoptable | 19 | 1350 | Manhole | Adoptable |
| 2.001 | 19 | 1350 | Manhole | Adoptable | 4 | 1500 | Manhole | Adoptable |
| 1.003 | 4 | 1500 | Manhole | Adoptable | 5 | 1500 | Manhole | Adoptable |
| 3.000 | 20 | 1200 | Manhole | Adoptable | 21 | 1200 | Manhole | Adoptable |

## Pipeline Schedule

| Link | Length (m) | Slope (1:X) | Dia (mm) | Link Type | US CL (m) | US IL (m) | US Depth (m) | DS CL (m) | DS IL (m) | DS Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.001 | 51.336 | 58.1 | 225 | Circular_Default Sewer Type | 75.797 | 74.296 | 1.276 | 75.236 | 73.413 | 1.598 |
| 1.004 | 23.339 | 450.0 | 675 | Circular_Default Sewer Type | 75.236 | 72.963 | 1.598 | 75.000 | 72.911 | 1.414 |
| 1.005 | 12.646 | 450.0 | 675 | Circular_Default Sewer Type | 75.000 | 72.911 | 1.414 | 75.000 | 72.883 | 1.442 |
| 1.006 | 20.531 | 450.0 | 750 | Circular_Default Sewer Type | 75.000 | 72.808 | 1.442 | 74.944 | 72.762 | 1.432 |
| 4.000 | 53.328 | 67.3 | 375 | Circular_Default Sewer Type | 75.504 | 73.929 | 1.200 | 74.944 | 73.137 | 1.432 |
| 1.007 | 6.987 | 500.0 | 750 | Circular_Default Sewer Type | 74.944 | 72.762 | 1.432 | 75.018 | 72.748 | 1.520 |
| 1.008 | 7.737 | 500.0 | 750 | Circular_Default Sewer Type | 75.018 | 72.748 | 1.520 | 75.107 | 72.733 | 1.624 |
| 5.000 | 14.239 | 168.0 | 300 | Circular_Default Sewer Type | 76.000 | 74.500 | 1.200 | 75.980 | 74.415 | 1.265 |
| 5.001 | 39.807 | 119.9 | 375 | Circular_Default Sewer Type | 75.980 | 74.340 | 1.265 | 75.583 | 74.008 | 1.200 |
| 5.002 | 10.422 | 89.8 | 375 | Circular_Default Sewer Type | 75.583 | 74.008 | 1.200 | 75.467 | 73.892 | 1.200 |
| 5.003 | 12.674 | 101.4 | 375 | Circular_Default Sewer Type | 75.467 | 73.892 | 1.200 | 75.342 | 73.767 | 1.200 |
| 5.004 | 13.401 | 100.0 | 450 | Circular_Default Sewer Type | 75.342 | 73.692 | 1.200 | 75.208 | 73.558 | 1.200 |
| 5.005 | 9.869 | 97.7 | 450 | Circular_Default Sewer Type | 75.208 | 73.558 | 1.200 | 75.107 | 73.457 | 1.200 |
| 1.009 | 18.413 | 500.0 | 750 | Circular_Default Sewer Type | 75.107 | 72.733 | 1.624 | 74.845 | 72.696 | 1.399 |
| 1.010 | 19.997 | 500.0 | 750 | Circular_Default Sewer Type | 74.845 | 72.696 | 1.399 | 74.800 | 72.656 | 1.394 |
| 1.011 | 9.942 | 45.0 | 750 | Circular_Default Sewer Type | 74.800 | 72.656 | 1.394 | 74.800 | 72.435 | 1.615 |
| 6.000 | 17.826 | 178.3 | 750 | Circular_Default Sewer Type | 74.500 | 73.000 | 0.750 | 74.700 | 72.900 | 1.050 |
| 6.001 | 15.439 | 500.0 | 750 | Circular_Default Sewer Type | 74.700 | 72.900 | 1.050 | 74.700 | 72.869 | 1.081 |
| 6.002 | 24.204 | 85.2 | 750 | Circular_Default Sewer Type | 74.700 | 72.869 | 1.081 | 74.800 | 72.585 | 1.465 |
| 1.012 | 10.744 | 500.0 | 750 | Circular_Default Sewer Type | 74.800 | 72.435 | 1.615 | 74.809 | 72.414 | 1.645 |
| 1.013 | 7.882 | 500.0 | 750 | Circular_Default Sewer Type | 74.809 | 72.414 | 1.645 | 74.911 | 72.398 | 1.763 |
| 1.014 | 19.221 | 500.0 | 750 | Circular_Default Sewer Type | 74.911 | 72.398 | 1.763 | 75.151 | 72.360 | 2.041 |
| 7.000 | 27.698 | 168.0 | 300 | Circular_Default Sewer Type | 75.300 | 73.800 | 1.200 | 75.151 | 73.635 | 1.216 |
| 1.015 | 10.668 | 500.0 | 750 | Circular_Default Sewer Type | 75.151 | 72.360 | 2.041 | 75.200 | 72.339 | 2.111 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 3.001 | 21 | 1200 | Manhole | Adoptable | 5 | 1500 | Manhole | Adoptable |
| 1.004 | 5 | 1500 | Manhole | Adoptable | 6 | 1500 | Manhole | Adoptable |
| 1.005 | 6 | 1500 | Manhole | Adoptable | 7 | 1800 | Manhole | Adoptable |
| 1.006 | 7 | 1800 | Manhole | Adoptable | 8 | 1800 | Manhole | Adoptable |
| 4.000 | 22 | 1350 | Manhole | Adoptable | 8 | 1800 | Manhole | Adoptable |
| 1.007 | 8 | 1800 | Manhole | Adoptable | 9 | 1800 | Manhole | Adoptable |
| 1.008 | 9 | 1800 | Manhole | Adoptable | 10 | 1800 | Manhole | Adoptable |
| 5.000 | 23 | 1200 | Manhole | Adoptable | 24 | 1350 | Manhole | Adoptable |
| 5.001 | 24 | 1350 | Manhole | Adoptable | 25 | 1350 | Manhole | Adoptable |
| 5.002 | 25 | 1350 | Manhole | Adoptable | 26 | 1350 | Manhole | Adoptable |
| 5.003 | 26 | 1350 | Manhole | Adoptable | 27 | 1350 | Manhole | Adoptable |
| 5.004 | 27 | 1350 | Manhole | Adoptable | 28 | 1350 | Manhole | Adoptable |
| 5.005 | 28 | 1350 | Manhole | Adoptable | 10 | 1800 | Manhole | Adoptable |
| 1.009 | 10 | 1800 | Manhole | Adoptable | 11 | 1800 | Manhole | Adoptable |
| 1.010 | 11 | 1800 | Manhole | Adoptable | 12 | 1800 | Manhole | Adoptable |
| 1.011 | 12 | 1800 | Manhole | Adoptable | 13 | 1800 | Manhole | Adoptable |
| 6.000 | 29 | 1800 | Manhole | Adoptable | 30 | 1800 | Manhole | Adoptable |
| 6.001 | 30 | 1800 | Manhole | Adoptable | 31 | 1800 | Manhole | Adoptable |
| 6.002 | 31 | 1800 | Manhole | Adoptable | 13 | 1800 | Manhole | Adoptable |
| 1.012 | 13 | 1800 | Manhole | Adoptable | 14 | 1800 | Manhole | Adoptable |
| 1.013 | 14 | 1800 | Manhole | Adoptable | 15 | 1800 | Manhole | Adoptable |
| 1.014 | 15 | 1800 | Manhole | Adoptable | 16 | 1800 | Manhole | Adoptable |
| 7.000 | 32 | 1200 | Manhole | Adoptable | 16 | 1800 | Manhole | Adoptable |
| 1.015 | 16 | 1800 | Manhole | Adoptable | 17 | 1800 | Manhole | Adoptable |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 521186.287 | 205760.078 | 75.500 | 1.500 | 1200 |  | 0 | 1.000 | 74.000 | 300 |
| 2 | 521194.056 | 205764.144 | 75.500 | 1.552 | 1200 |  | 1 | 1.000 | 73.948 | 300 |
| | | | | | | | 0 | 1.001 | 73.948 | 300 |
| 3 | 521199.897 | 205765.339 | 75.492 | 1.729 | 1350 |  | 1 | 1.001 | 73.913 | 300 |
| | | | | | | | 0 | 1.002 | 73.763 | 450 |
| 18 | 521160.812 | 205822.575 | 75.276 | 1.575 | 1350 |  | 0 | 2.000 | 73.701 | 375 |
| 19 | 521192.336 | 205812.006 | 75.698 | 2.195 | 1350 |  | 1 | 2.000 | 73.503 | 375 |
| | | | | | | | 0 | 2.001 | 73.503 | 375 |
| 4 | 521199.897 | 205810.705 | 75.809 | 2.577 | 1500 |  | 1 | 2.001 | 73.457 | 375 |
| | | | | | | | 2 | 1.002 | 73.382 | 450 |
| | | | | | | | 0 | 1.003 | 73.232 | 600 |
| 20 | 521262.129 | 205837.776 | 75.800 | 1.425 | 1200 |  | 0 | 3.000 | 74.375 | 225 |
| 21 | 521266.210 | 205850.397 | 75.797 | 1.501 | 1200 |  | 1 | 3.000 | 74.296 | 225 |
| | | | | | | | 0 | 3.001 | 74.296 | 225 |
| 5 | 521217.365 | 205866.193 | 75.236 | 2.273 | 1500 |  | 1 | 3.001 | 73.413 | 225 |
| | | | | | | | 2 | 1.003 | 73.038 | 600 |
| | | | | | | | 0 | 1.004 | 72.963 | 675 |
| 6 | 521224.373 | 205888.455 | 75.000 | 2.089 | 1500 |  | 1 | 1.004 | 72.911 | 675 |
| | | | | | | | 0 | 1.005 | 72.911 | 675 |
| 7 | 521223.408 | 205901.064 | 75.000 | 2.192 | 1800 |  | 1 | 1.005 | 72.883 | 675 |
| | | | | | | | 0 | 1.006 | 72.808 | 750 |
| 22 | 521166.496 | 205895.913 | 75.504 | 1.575 | 1350 |  | 0 | 4.000 | 73.929 | 375 |
| 8 | 521214.333 | 205919.481 | 74.944 | 2.182 | 1800 |  | 1 | 4.000 | 73.137 | 375 |
| | | | | | | | 2 | 1.006 | 72.762 | 750 |
| | | | | | | | 0 | 1.007 | 72.762 | 750 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 9 | 521212.514 | 205926.227 | 75.018 | 2.270 | 1800 | 1 | 1.007 | 72.748 | 750 |
| | | | | | | 0 | 1.008 | 72.748 | 750 |
| 23 | 521290.517 | 205922.086 | 76.000 | 1.500 | 1200 | 0 | 5.000 | 74.500 | 300 |
| 24 | 521294.862 | 205935.646 | 75.980 | 1.640 | 1350 | 1 | 5.000 | 74.415 | 300 |
| | | | | | | 0 | 5.001 | 74.340 | 375 |
| 25 | 521256.954 | 205947.794 | 75.583 | 1.575 | 1350 | 1 | 5.001 | 74.008 | 375 |
| | | | | | | 0 | 5.002 | 74.008 | 375 |
| 26 | 521246.550 | 205948.409 | 75.467 | 1.575 | 1350 | 1 | 5.002 | 73.892 | 375 |
| | | | | | | 0 | 5.003 | 73.892 | 375 |
| 27 | 521234.203 | 205945.549 | 75.342 | 1.650 | 1350 | 1 | 5.003 | 73.767 | 375 |
| | | | | | | 0 | 5.004 | 73.692 | 450 |
| 28 | 521222.068 | 205939.864 | 75.208 | 1.650 | 1350 | 1 | 5.004 | 73.558 | 450 |
| | | | | | | 0 | 5.005 | 73.558 | 450 |
| 10 | 521214.321 | 205933.750 | 75.107 | 2.374 | 1800 | 1 | 5.005 | 73.457 | 450 |
| | | | | | | 2 | 1.008 | 72.733 | 750 |
| | | | | | | 0 | 1.009 | 72.733 | 750 |
| 11 | 521199.220 | 205944.285 | 74.845 | 2.149 | 1800 | 1 | 1.009 | 72.696 | 750 |
| | | | | | | 0 | 1.010 | 72.696 | 750 |
| 12 | 521190.659 | 205962.357 | 74.800 | 2.144 | 1800 | 1 | 1.010 | 72.656 | 750 |
| | | | | | | 0 | 1.011 | 72.656 | 750 |
| 29 | 521139.727 | 205976.078 | 74.500 | 1.500 | 1800 | 0 | 6.000 | 73.000 | 750 |
| 30 | 521153.158 | 205964.357 | 74.700 | 1.800 | 1800 | 1 | 6.000 | 72.900 | 750 |
| | | | | | | 0 | 6.001 | 72.900 | 750 |
| 31 | 521165.217 | 205973.998 | 74.700 | 1.831 | 1800 | 1 | 6.001 | 72.869 | 750 |
| | | | | | | 0 | 6.002 | 72.869 | 750 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 13 | 521189.355 | 205972.213 | 74.800 | 2.365 | 1800 | 1 | 6.002 | 72.585 | 750 |
| | | | | | | 2 | 1.011 | 72.435 | 750 |
| | | | | | | 0 | 1.012 | 72.435 | 750 |
| 14 | 521194.505 | 205981.642 | 74.809 | 2.395 | 1800 | 1 | 1.012 | 72.414 | 750 |
| | | | | | | 0 | 1.013 | 72.414 | 750 |
| 15 | 521201.709 | 205984.839 | 74.911 | 2.513 | 1800 | 1 | 1.013 | 72.398 | 750 |
| | | | | | | 0 | 1.014 | 72.398 | 750 |
| 32 | 521247.550 | 205994.839 | 75.300 | 1.500 | 1200 | 0 | 7.000 | 73.800 | 300 |
| 16 | 521220.488 | 205988.936 | 75.151 | 2.791 | 1800 | 1 | 7.000 | 73.635 | 300 |
| | | | | | | 2 | 1.014 | 72.360 | 750 |
| | | | | | | 0 | 1.015 | 72.360 | 750 |
| 17 | 521222.762 | 205978.513 | 75.200 | 2.861 | 1800 | 1 | 1.015 | 72.339 | 750 |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-99 | E (1km) | 0.324 | Skip Steady State | ✓ |
| C (1km) | -0.029 | F (1km) | 2.454 | Drain Down Time (mins) | 240 |
| D1 (1km) | 0.300 | Summer CV | 0.750 | Additional Storage (m³/ha) | 20.0 |
| D2 (1km) | 0.302 | Winter CV | 0.840 | Check Discharge Rate(s) | x |
| D3 (1km) | 0.294 | Analysis Speed | Normal | 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 %) |
|---|---|---|---|
| 100 | 40 | 0 | 0 |

## Node 17 Online Pump Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Design Depth (m) | 1.750 | Switch off depth (m) | 0.100 |
| Replaces Downstream Link | ✓ | Design Flow (l/s) | 5.0 | | |
| Invert Level (m) | 72.339 | Switch on depth (m) | 0.500 | | |

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|
| 0.001 | 5.000 | 2.800 | 5.000 |

## Node 29 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 73.000 |
| 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) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.000 | 671.0 | 0.0 | 0.900 | 1040.0 | 0.0 | 0.901 | 2035.0 | 0.0 | 1.500 | 2590.0 | 0.0 |

## Node 18 Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 74.436 | Slope (1:X) | 100.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 7 | Depth (m) | |
| Safety Factor | 2.0 | Width (m) | 10.000 | Inf Depth (m) | 0.600 |
| Porosity | 1.00 | Length (m) | 10.000 | | |

## Node 20 Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 74.960 | Slope (1:X) | 100.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 8 | Depth (m) | |
| Safety Factor | 2.0 | Width (m) | 10.000 | Inf Depth (m) | 0.600 |
| Porosity | 1.00 | Length (m) | 10.000 | | |

## Node 22 Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 74.664 | Slope (1:X) | 100.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 5 | Depth (m) | |
| Safety Factor | 2.0 | Width (m) | 10.000 | Inf Depth (m) | 0.600 |
| Porosity | 1.00 | Length (m) | 10.000 | | |

## Node 23 Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 75.160 | Slope (1:X) | 100.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 0 | Depth (m) | |
| Safety Factor | 2.0 | Width (m) | 10.000 | Inf Depth (m) | 0.600 |
| Porosity | 1.00 | Length (m) | 10.000 | | |

## Node 32 Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 74.460 | Slope (1:X) | 100.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 3 | Depth (m) | |
| Safety Factor | 2.0 | Width (m) | 10.000 | Inf Depth (m) | 0.600 |
| Porosity | 1.00 | Length (m) | 10.000 | | |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 56.80%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 1 | 10 | 75.500 | 1.500 | 97.2 | 3.7365 | 1.4148 | FLOOD |
| 15 minute winter | 2 | 10 | 75.405 | 1.457 | 90.2 | 1.6479 | 0.0000 | FLOOD RISK |
| 15 minute summer | 3 | 10 | 75.332 | 1.569 | 180.0 | 4.0615 | 0.0000 | FLOOD RISK |
| 15 minute winter | 18 | 14 | 75.168 | 1.467 | 307.1 | 72.7454 | 0.0000 | FLOOD RISK |
| 15 minute winter | 19 | 13 | 75.118 | 1.615 | 180.0 | 2.3113 | 0.0000 | SURCHARGED |
| 15 minute summer | 4 | 10 | 75.176 | 1.944 | 349.2 | 6.3168 | 0.0000 | SURCHARGED |
| 15 minute winter | 20 | 16 | 75.464 | 1.089 | 149.0 | 48.2323 | 0.0000 | SURCHARGED |
| 15 minute winter | 21 | 15 | 75.434 | 1.138 | 90.6 | 2.7278 | 0.0000 | SURCHARGED |
| 15 minute summer | 5 | 10 | 75.054 | 2.091 | 384.6 | 4.9095 | 0.0000 | FLOOD RISK |
| 15 minute winter | 6 | 10 | 75.000 | 2.089 | 352.0 | 3.6913 | 7.3093 | FLOOD |
| 15 minute summer | 7 | 10 | 74.974 | 2.166 | 345.0 | 6.3605 | 0.0000 | FLOOD RISK |
| 15 minute winter | 22 | 14 | 75.230 | 1.301 | 314.6 | 58.0977 | 0.0000 | FLOOD RISK |
| 15 minute winter | 8 | 11 | 74.944 | 2.182 | 546.3 | 5.5532 | 4.0423 | FLOOD |
| 15 minute summer | 9 | 11 | 74.930 | 2.182 | 536.2 | 5.8974 | 0.0000 | FLOOD RISK |
| 15 minute winter | 23 | 13 | 75.361 | 0.861 | 97.5 | 17.0819 | 0.0000 | SURCHARGED |
| 15 minute winter | 24 | 12 | 75.326 | 0.986 | 149.6 | 2.5419 | 0.0000 | SURCHARGED |
| 15 minute winter | 25 | 11 | 75.197 | 1.189 | 134.7 | 1.7020 | 0.0000 | SURCHARGED |
| 15 minute winter | 26 | 11 | 75.161 | 1.269 | 137.0 | 1.8163 | 0.0000 | SURCHARGED |
| 15 minute winter | 27 | 11 | 75.121 | 1.429 | 211.7 | 4.2612 | 0.0000 | FLOOD RISK |
| 15 minute winter | 28 | 11 | 75.017 | 1.459 | 232.7 | 2.4949 | 0.0000 | FLOOD RISK |
| 15 minute winter | 10 | 10 | 74.915 | 2.182 | 765.5 | 5.5536 | 0.0000 | FLOOD RISK |
| 15 minute summer | 11 | 10 | 74.845 | 2.149 | 770.8 | 6.7479 | 9.1366 | FLOOD |
| 15 minute summer | 12 | 10 | 74.792 | 2.136 | 778.8 | 5.4369 | 0.0000 | FLOOD RISK |
| 600 minute winter | 29 | 585 | 74.111 | 1.111 | 100.3 | 1221.0760 | 0.0000 | SURCHARGED |
| 15 minute summer | 30 | 10 | 74.651 | 1.751 | 1056.8 | 6.4579 | 0.0000 | FLOOD RISK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 1 | 1.000 | 2 | 90.2 | 1.282 | 1.055 | 0.6175 | |
| 15 minute winter | 2 | 1.001 | 3 | 90.6 | 1.287 | 1.060 | 0.4198 | |
| 15 minute summer | 3 | 1.002 | 4 | 180.9 | 1.438 | 0.611 | 7.1879 | |
| 15 minute winter | 18 | 2.000 | 19 | -180.3 | -1.635 | -1.170 | 3.6673 | |
| 15 minute winter | 19 | 2.001 | 4 | -180.0 | -1.632 | -1.168 | 0.8462 | |
| 15 minute summer | 4 | 1.003 | 5 | 262.2 | 1.228 | 0.662 | 16.3860 | |
| 15 minute winter | 20 | 3.000 | 21 | 70.0 | 1.760 | 1.751 | 0.5275 | |
| 15 minute winter | 21 | 3.001 | 5 | 72.0 | 1.851 | 1.053 | 2.0417 | |
| 15 minute summer | 5 | 1.004 | 6 | 329.6 | 1.029 | 0.750 | 8.3315 | |
| 15 minute winter | 6 | 1.005 | 7 | 355.2 | 0.997 | 0.808 | 4.5143 | |
| 15 minute summer | 7 | 1.006 | 8 | 350.7 | 0.797 | 0.605 | 9.0361 | |
| 15 minute winter | 22 | 4.000 | 8 | 192.3 | 2.170 | 0.788 | 5.8819 | |
| 15 minute winter | 8 | 1.007 | 9 | 550.5 | 1.251 | 1.001 | 3.0751 | |
| 15 minute summer | 9 | 1.008 | 10 | 541.2 | 1.230 | 0.985 | 3.4052 | |
| 15 minute winter | 23 | 5.000 | 24 | 116.2 | 1.650 | 1.359 | 1.0027 | |
| 15 minute winter | 24 | 5.001 | 25 | 134.7 | 1.597 | 0.737 | 4.3906 | |
| 15 minute winter | 25 | 5.002 | 26 | 137.0 | 1.490 | 0.649 | 1.1495 | |
| 15 minute winter | 26 | 5.003 | 27 | 139.3 | 1.436 | 0.701 | 1.3979 | |
| 15 minute winter | 27 | 5.004 | 28 | 212.7 | 1.532 | 0.658 | 2.1233 | |
| 15 minute winter | 28 | 5.005 | 10 | 233.9 | 1.777 | 0.715 | 1.5637 | |
| 15 minute winter | 10 | 1.009 | 11 | 769.4 | 1.748 | 1.399 | 8.1039 | |
| 15 minute summer | 11 | 1.010 | 12 | 778.8 | 1.770 | 1.417 | 8.8011 | |
| 15 minute summer | 12 | 1.011 | 13 | 785.1 | 1.784 | 0.425 | 4.3757 | |
| 600 minute winter | 29 | 6.000 | 30 | -100.3 | -0.413 | -0.108 | 7.8456 | |
| 15 minute summer | 30 | 6.001 | 31 | -987.6 | -2.244 | -1.796 | 6.7950 | |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 56.80%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 31 | 10 | 74.700 | 1.831 | 981.4 | 5.4600 | 8.9198 | FLOOD |
| 15 minute summer | 13 | 10 | 74.754 | 2.319 | 958.2 | 5.9021 | 0.0000 | FLOOD RISK |
| 15 minute summer | 14 | 10 | 74.754 | 2.340 | 191.4 | 5.9548 | 0.0000 | FLOOD RISK |
| 15 minute summer | 15 | 10 | 74.754 | 2.356 | 276.1 | 6.8764 | 0.0000 | FLOOD RISK |
| 15 minute winter | 32 | 13 | 74.813 | 1.013 | 214.6 | 33.5694 | 0.0000 | SURCHARGED |
| 15 minute summer | 16 | 10 | 74.753 | 2.393 | 140.6 | 6.0902 | 0.0000 | SURCHARGED |
| 15 minute summer | 17 | 10 | 74.755 | 2.416 | 64.8 | 6.1478 | 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 summer | 31 | 6.002 | 13 | -964.2 | -2.191 | -0.720 | 10.6527 | |
| 15 minute summer | 13 | 1.012 | 14 | 185.3 | 0.759 | 0.337 | 4.7287 | |
| 15 minute summer | 14 | 1.013 | 15 | 239.3 | 0.618 | 0.435 | 3.4690 | |
| 15 minute summer | 15 | 1.014 | 16 | -141.5 | 0.367 | -0.257 | 8.4596 | |
| 15 minute winter | 32 | 7.000 | 16 | 137.3 | 1.950 | 1.605 | 1.9505 | |
| 15 minute summer | 16 | 1.015 | 17 | 64.8 | 0.545 | 0.118 | 4.6952 | |
| 15 minute summer | 17 | Pump | | 5.0 | | | | 74.6 |

Woods Hardwick

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