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# FLOOD RISK ASSESSMENT REPORT FOR 19310 – HAWTHORNE FARM, CLITHEROE

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# 1 EXECUTIVE SUMMARY

EDGE have been instructed by Persimmon Homes & Charles Church Lancashire to prepare a Flood Risk Assessment to support a full planning application which seeks permission for the erection of 58 residential dwellings together with associated infrastructure on land north of Hawthorne place, off Waddington Road in Clitheroe.

The site is located on the northern border of the urban area of Clitheroe approximately 500m north of the town centre. The site is surrounded on its south, east and western borders by existing residential dwellings with greenfield agricultural farmland to the northern boundary.

The site area extends to 1.73 ha, is roughly square in shape and is greenfield land. A copy of the architects site layout outlining the development proposals can be found in Appendix C.

The purpose of this report is to assess the risk of flooding to the site from fluvial, tidal, pluvial (overland) surface water and ground water sources as well as from reservoirs, canals and adjacent sewers.

The topographic survey, a copy of which can be found in Appendix B, shows that the site falls from north to south by approximately 3.3 metres and west to east by approximately 3.3 metres.

Levels on the northern corner of the site are shown at 82.50m AOD with levels at the southern corner at 79.20m AOD. The western extents of the site are at 82.60m AOD and the eastern side of the site is shown to be at 79.30m AOD.

The site is located wholly within flood zone 1.

Surface water must discharge from the site in the most sustainable manor and drainage proposals should adhere to the SUDs hierarchy.

New drainage proposals consist of traditional gravity sewers for both foul and surface water.

The surface water discharge rate is proposed to mimic the greenfield run off rate, in accordance with Lancashire County Council guidelines. Attenuation is required within the on-site drainage network.

An attenuation pond is proposed to store all surface water volumes up to and including the 1 in 30-year storm events in line with United Utilities requirements with overflow to private tanks required to store the 1 in 100 year + climate change storm events.

An existing ordinary watercourse runs through the site from north to south and a connection to this watercourse is preferred should discharge of surface water via infiltration not be viable.

An existing combined public sewer bisects the site and connection to this is preferred for the proposed foul sewers. United Utilities sewer maps are shown in Appendix D

All sewers, will be offered to United Utilities for adoption under a section 104 agreement and drainage proposals are shown in Appendix E.

## 2 INTRODUCTION

EDGE Consulting Engineers have undertaken a Flood Risk Assessment in line with National Planning Policy framework and the main aims of this report are:

- To determine whether the proposed development is likely to be affected by current or future flooding from any source;
- To determine whether it will increase flood risk elsewhere;
- To determine whether the measures proposed to deal with these effects and risks are appropriate
- To assess under SUDS Guidance the best way of reducing the flow rates from site to an acceptable rate of discharge.

The proposed development area is classed as an undeveloped greenfield site. The site and surrounding boundary conditions are shown on the Aerial Image in Figure 2.1.

Falling head permeability tests have been undertaken on the site to determine if infiltration to the ground would be a viable option for surface water discharge.

GEOL Consultants phase 2 ground investigation report GEOL19-9988 states "*The results have identified very low permeability classifications, with poor & practically impervious drainage characteristics, and as such the ground conditions are considered unsuitable for the use of traditional soakaways"*

The results of the tests and borehole location plan can be found in Appendix H

The outcome of the SUDs evaluation is that ground conditions show soakaway of surface water via infiltration will not be viable.

There is an unnamed culverted ordinary watercourse also running through the site from north to south. The culvert is roughly 600mm x 600mm made from stone flags.

Surface water will connect to the culverted watercourse running through the site.

United Utilities sewer records have been provided, which can be found in Appendix D and they indicate a 300mm diameter combined sewer which is situated in the middle of the site running north to south.

FIGURE 2.1 – SITE LOCATION


## 3 NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

The National Planning Policy Framework (NPPF) clearly identifies flood risk as a specific material consideration in the Planning Process and in the allocation and release of sites for development or re-development.

NPPF seeks to further strengthen the co-ordination between land use planning and development planning and the operational delivery of flood and coastal defence strategy. NPPF encourages local planning authorities to use their existing powers to guide, regulate and control development in relation to flooding and flood risk. The framework expects local authorities to adopt a risk-based approach at all levels of planning, through the application of the Sequential Test detailed in Table 1 and 2, of the Technical Guidance to NPPF document, a copy of which is attached in Appendix A.

The aim of the sequential test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Strategic Flood Risk Assessment (SFRA) will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.

The Water Resources Act 1991 [Section 105] also requires the Environment Agency to exercise a general supervision over all flood defence matters, including flood plains and wash lands which accommodate waters during periods of flood. In discharging their functions, the Agency from time to time carries out comprehensive surveys and flood studies, largely of 'main rivers' within its jurisdiction.

A Section 105 Study involves the Agency topographically surveying the subject watercourse (or parts of it) and obtaining details of the flow mechanics within the watercourse. This data then enables them to generate a comprehensive hydraulic computer model for the watercourse.

From this hydraulic model the EA can define the approximate extent of fluvial flood-plain associated with the 1 in 100-year (1% annual probability) flooding event or the extent of tidal floodplain associated with the 1 in 200-year (0.5% annual probability) flooding event.

The extents of the modelled floodplain are then provided to Local Planning Authorities, to enable them to make more informed decisions when considering proposed development in flood susceptible areas. If development is proposed in a flood susceptible area, or in an area where there is a history of flooding, the EA, as a statutory consultee in the Planning Process, will generally recommend that the risk of flooding be formally assessed, in accordance with the NPPF, and that a Flood Risk Assessment report be produced to support the Planning Application.

The broader modelled flood extents are also indicated on the EA's Flood Zone Maps, available through their website (Figure 5.1).

# 4 STRATEGIC FLOOD RISK ASSESSMENT

Local planning authorities are required to produce local development frameworks, which are a portfolio of local development documents [LDDs] that collectively deliver the spatial planning strategy for the authority area. The LDD's undergo a sustainability appraisal which assists planning authorities in ensuring their policies fulfil the principles of sustainability.

Strategic Flood Risk Assessments [SFRA] are one of the documents to be used as the evidence base for planning decisions and are a component of the Sustainability Appraisal process. Therefore, SFRAs should be used in the review or production of LDD's.

To assist Local Planning Authorities in their strategic land-use planning, SFRA's should present enough information to enable Local Authorities to apply the Sequential Test to their proposed development sites:

"*Decision makers should use the SFRA to inform their knowledge of flooding, refine the information on the Flood Map and determine the variations in flood risk from all sources of flooding across and from their area. These should form the basis for preparing appropriate policies for flood risk management for these areas.*"

In May 2010 Ribble Valley borough council produced a level 1 Strategic Flood Risk Assessment.

The SFRA along with the EA flood risk maps indicate that the proposed development site lies predominantly within Flood Zone 1 (less than 1 in 1000 probability of flooding from river or sea) and therefore is unlikely to be at risk of fluvial flooding.

The SFRA has been developed with the assistance of the Environment Agency, United Utilities and key landowners to provide a robust assessment of current and future levels of flood risk, ensuring that future development takes full account of flood risk and sustainability at the outset.

In the application of the sequential test the strategic flood risk assessment has identified flood risk zones within the boroughs (1, 2 and 3) and has assessed the potential of the various possible development sites which have been identified by the councils. This has created a hierarchy of preferred development sites in line with the sequential approach required by the NPPF.

The SFRA refers to the Ribble Valley Catchment Flood Management Plan which contains high level "policies to manage flood risks in the whole River Ribble catchment which includes the Ribble Velley Borough Council area over the next 50 to 100 years and an action plan laying out how its policies can be achieved. These policies

consider the likely future impact of changes in climate and the effects of land management. The CFMP has been a significant source of information for the Ribble Valley Borough Council SFRA.

Appendix 4 of the Ribble Valley Borough Councils SFRA shows that, in Clitheroe, the policy unit is P5 which is to take further action to reduce flood risk in the area. Justification behind this policy selection is quoted below:

*"This very small policy unit (4km2) is entirely urban but set within a much larger rural catchment with considerable landscape, cultural and environmental interests. About 260 properties are at risk of flooding (1% AEP event), at a cost of £38M worth of damage, with a further 230 properties at risk in 100 years with a 'do nothing' scenario.*

*In addition, 3 schools and 1 hospital are currently at risk in a 1% event, which is not forecast to increase in the future. Flood risk management activities in the town include the maintenance of screens on the inlet and outlet of culverted watercourses, general maintenance of banks of open watercourses, and the provision of formal flood warnings to the Clitheroe and Low Moor areas. Further action is 52 needed to reduce the predicted effects of climate change and further urban development in and around Clitheroe.*

*Culverted stretches of Mearley Brook pose a high flood risk to the town, and work is required to reduce this risk. Whilst the projected damages in this unit are not as high as other policy units where P5 is proposed, this level of damage in such a small area indicates the action is needed to reduce the flood risk and therefore a proactive P5 policy is recommended, rather than any policy which would provide a lower level of flood risk management now and into the future. Being a wholly urban policy unit means that, by implications, opportunities for a policy P6 policy are extremely limited, although there is potential for flood storage upstream of the town. Work in this policy unit is likely to get priority on a national scale, with work programmed in Clitheroe to address flood risk.*

*Implementing flood resilience measures within existing and future properties may also help to reduce flood risk."* A copy of the SFRA is available from the Ribble Valley Borough Council's website.

## 5 FINDINGS OF A FLOOD RISK ASSESSMENT

EDGE Consulting Engineers have carried out a flood risk assessment in line with National Planning Policy Framework.

The Environment Agency's flood zone maps, now available on the GOV.uk website, indicate that the site is located within Flood Zone 1 (Ref Figure 5.1).

Flood Zone 1 indicates that there is a low risk of flooding from fluvial or tidal sources and current EA guidance indicates that all proposed developments in zone 1, larger than 1 hectare, should be accompanied by a flood risk assessment. The flood risk assessment should contain:

- Information about the surface water disposal measures already in place and their state of maintenance;
- An assessment of the volume of surface water run-off likely to be generated from the proposed development;
- Information on how that surface water run-off will be disposed of (from the new development);
- Estimates of how climate change could affect the probability and intensity of flooding events in the future;

FIGURE 5.1 – FLOOD ZONE MAP (RIVERS AND SEAS)


DRAINAGE STRATEGY

Existing Foul Drainage

There is a 300mm diameter existing public combined sewer running through the middle of the site from north to south. United Utilities asset search maps are shown in Appendix D. The appropriate easements should be provided/ maintained or diversion proposals, under a section 185 agreement be submitted to United Utilities for approval.

Proposed Foul Drainage

It is proposed that the foul flows generated from the development will utilise a traditional gravity system and connect to the existing combined sewer via new manholes which will be in accordance with consent being obtained from United Utilities. The depth of the existing sewer should be confirmed prior to detailed design works commencing to ensure its suitability for a gravity connection.

The proposed foul water drainage network will be offered to United Utilities for adoption under a section 104 agreement and will be designed in accordance with industry standard Sewers for Adoption and United Utilities guidelines and standard details. Foul water drainage proposals are shown in Appendix E.

Existing Storm Water Drainage

There is an unnamed culverted ordinary watercourse running through the site from north to south. The culvert is roughly 600mm x 600mm made from stone flags.

United Utilities sewer maps don't show surface water sewers in the vicinity of the site. The nearest surface water sewer is shown beyond existing residential dwellings running below Park Avenue to the south across 3rd party land.

The greenfield runoff rate for the site has been calculated using the ICP SUDS element of Micro drainage Source Control software. The output generated from Micro drainage shows that the QBAR greenfield run off rate is 11.7 litres per second. A pdf of the output can be found in Appendix F Drainage calculations.

Proposed Strom Water Drainage

Due to the cohesive nature of the underlying strata, as described in section 7 SUDs evaluation part of this report and in line with the grounds drainage characteristics and test findings provided in GEOL Consulting's phase 2 ground investigation report GEOL19-9988, discharging surface water flows via infiltration is not viable.

An existing ordinary watercourse runs through the site from north to south and a connection in the southern corner of the site is preferred. The line, depth and condition of the existing watercourse should be confirmed prior to construction works and proposed levels should be reviewed to ensure a gravity connection will be possible.

DEFRAs non statutory technical standards for sustainable drainage systems states that proposed developments on greenfield sites should control their peak flow as follows:

- *For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1-year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event.*

The construction of the proposed development will result in an increase of impermeable areas and therefore a corresponding increase in surface water run-off. To ensure that the site poses no flood risk to proposed or existing properties a restriction of surface water run-off is required.

It is proposed to restrict surface water run off to the Greenfield QBAR rate 11.7 litres per second. Greenfield calculations are shown in Appendix F.

The restriction of surface water run will result in volumes of storage being required. An attenuation pond is proposed to hold surface water within the site for all return periods up to the 30-year storm event. 30-year storage estimations are shown in Appendix G.

Private storage tanks will be used to store volumes above the 30 year up to and including the 1 in 100-year climate change storm events. 100-year storage calculations are shown in appendix G.

The proposed surface water drainage network is proposed to connect to the existing watercourse via a new manhole constructed on the culvert. Proposed sewers up to the outfall point will be offered to United Utilities for adoption under a section 104 agreement.

The proposed surface water network will be designed in accordance with industry standard Sewers for Adoption and United Utilities guidelines and standard details.

The existing 600mm x 600mm stone flagged culvert condition is unknown. It currently provides a cross sectional area of 0.36 square metres for upstream flows to pass through.

The development proposals allow for the opening and "daylighting" of a 55-metre section of the watercourse through the landscaped public open space area to the north. The open section of watercourse will provide a larger cross-sectional area for upstream flows to pass through or be stored in more extreme events.

The culvert will then be diverted away from its current course to navigate around the residential plots to the south.

The culvert diversion proposals include provision of a new culvert pipe. A 750mm concrete culvert pipe will provide a cross sectional area of 0.442 square meters and provision of the new pipe will enhance the efficiency of the culvert running through the site.

The surface water drainage design and culvert "daylighting" and diversion proposals are shown within Appendix E.

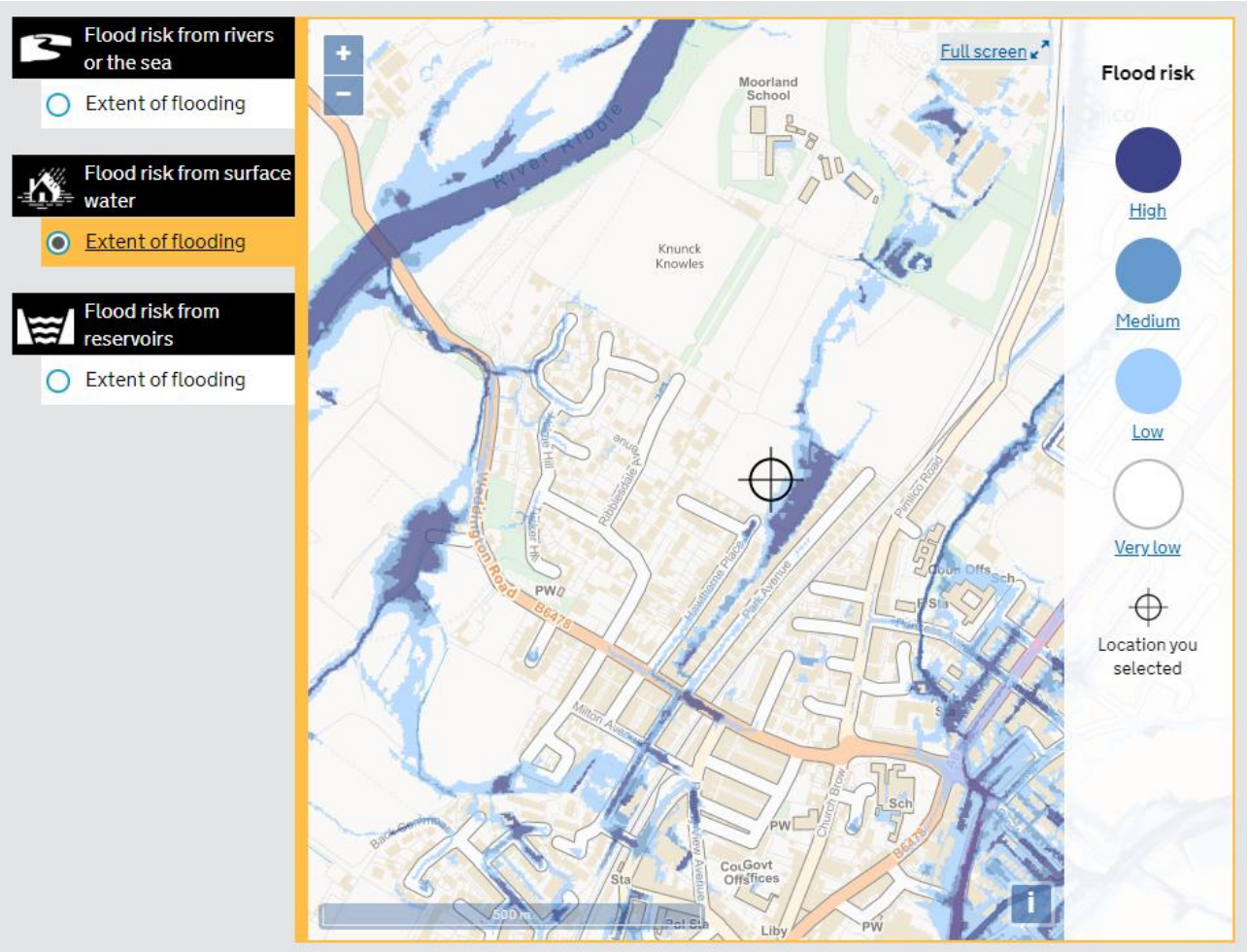
Flood Risk

- Fluvial – As mentioned in previous sections of this report the site is located within flood zone 1 and as such has a low probability of flooding from fluvial sources. An ordinary watercourse runs through the site and is not thought to pose a flood risk to the existing site, furthermore it is proposed to be opened and improved throughout its path within the development.

- Tidal – The site is located far enough inland to be considered at very low risk of flooding from the sea. Climate change is not thought to provide an increased risk to the site from tidal flooding during the lifetime of the development and so tidal flood risk is deemed to be low.

- Surface Water – Surface water flooding may occur when intense rainfall causes the ground to be saturated and its capacity is exceeded. Excess surface water flows from the site are believed to drain naturally to the low point in the south and to the watercourse itself by overland flow. The surface water flood map available on the EAs website (Figure 5.2 below) shows that the site is predominantly at low risk of flooding from pluvial sources. The southern border of the site does show a medium to high risk of pluvial flooding. The flood risk appears to follow the line of the existing watercourse and it is expected that some surcharging in extreme events is the source of the pluvial flooding indicated in these areas. Development proposals include opening the watercourse and providing a new culvert pipe to convey flows through the site improving the efficiency and enhancing the watercourses capacity within the development boundary. This will reduce the risk of flooding in the areas indicated as medium and high risk in the mapping below. Finished floor levels of proposed dwellings should be set a minimum of 150mm above surrounding ground levels to minimise the risk of flooding from overland flows. The introduction of impermeable areas will divert potential overland flows away from houses to soft landscaped areas and to gullies and drainage channels in the adoptable and private roads. On site flow paths should, where possible, be maintained to ensure that flood risk is not increased because of the development.

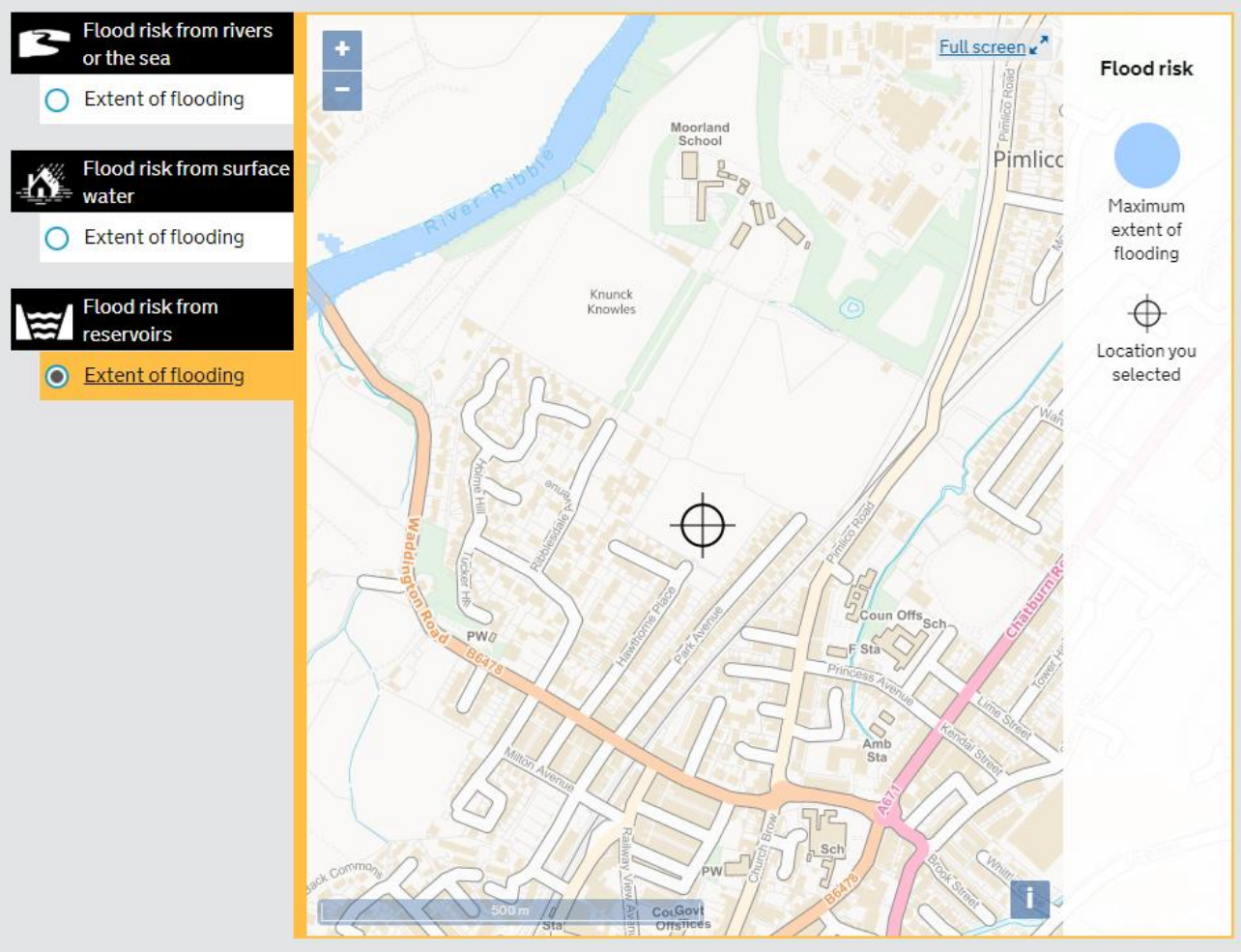
FIGURE 5.2 – FLOOD MAP (SURFACE WATER)




- Ground water – Gas and groundwater monitoring was undertaken by GEOL Consultants and the monitoring information can be found in their report GEOL19-9988. The report states: "*All the monitoring wells were recorded to be dry on the first monitoring visit, however water levels were noted to have risen significantly by the second visit to depths of between 0.30m and 1.17m below current ground levels, which coincided with periods of heavy rainfall. All the boreholes were purged of the standing water so that the response zones were no longer flooded. The increase in water levels is felt to be attributable to the ingress of surface water infiltration rather than representing a continuous groundwater surface, particularly when considering the nature of the drift deposits.*" As well as the permeability testing, mentioned in section 7 of this report, which was undertaken at depths up to 3m below ground level and indicating no water strikes, a total of 15 boreholes were percussion drilled at depths between 1m and 4.0m. Groundwater strikes were not indicated within any of the boreholes. The observations within the ground water monitoring coincide with the data on surface water flood risk of the site, during rainfall events, which is discussed above. It is assumed, that flooding from ground water sources is low.

- Reservoirs, canals – Flooding can occur from the release of large volumes of water from reservoirs and canals. The image below (Figure 5.3) is taken from the Environment Agencies flood risk section of the website indicating the extent of flooding from reservoirs. The risk is considered to be low. There are no canals in the vicinity of the site and so flooding from this source is also considered to be low.

FIGURE 5.3 – FLOOD MAP (RESERVOIRS)




- Adjacent sewers – There is an existing combined public sewer within the site and the only risk of flooding from this would be failure or surcharge during periods of high flow. Assuming the existing public sewers have sufficient capacity for the catchments they are serving, and they are regularly maintained and inspected the risk of flooding from sewers is low.
- Proposed sewers – Drainage infrastructure is designed to ensure that rainwater drains off site at a restricted rate. Attenuation pond and storage tanks will hold all volumes up to and including the 1 in 100 year + climate change storm events. This will minimise the risk of flooding from proposed surface water sources. The proposed drainage system is shown in Appendix E.

## 6 RESIDUAL RISKS

The table below outlines the initial qualitative assessment of risk posed by each potential source of flooding, the mechanisms for flooding and the likely consequences. The Table also includes a review of possible mitigation measures and what effect, if any, the mitigation measures are likely to have on the residual risk posed by each potential flood source. Categories of risk have been qualitatively defined as:

- High Risk: Flooding is likely to result in significant damage to property and pose a significant risk to life;
- Medium Risk: Flooding is likely to result in possible minor damage to property, but flood progress would allow adequate time for residents to be warned and safely evacuated to higher ground or appropriate places of safety;
- Low' Risk: Flooding is unlikely to result in any damage to property and pose little or no risk to life.

| Source | Flood Mechanism & Consequences | Assessment of Risk | Recommended Mitigation Measures | Residual Risk |
|---|---|---|---|---|
| Fluvial flooding | Risk of fluvial flooding at the site from adjacent Watercourses, Drains and other Water Bodies. | **Low** | • Fluvial flooding of the site is not expected during the 1 in 100-year event + climate change. | **Low** |
| Pluvial flooding | Risk of flooding from overland flows in extreme events. Ponding of surface water due to ground being saturated and capacity being exceeded. | **Medium** | • Upgrading of watercourse and culvert through the site.<br>• FFLs to be set 150mm above surrounding levels.<br>• Flow paths should be maintained to ensure that flood risk is not increased. | **Low** |
| Surcharging of artificial drainage systems | Drainage systems operating above design capacity, resulting in:<br>• surcharging of manholes / drainage systems;<br>• over-land flow through development;<br>• ponding in low-lying areas of site;<br>• no over-land flow route for flood waters accumulating in low-lying areas. | **Low** | • Appropriate design of SW drainage system to provide sufficient storage;<br>• Provision of overland flood flow routes through proposed development. | **Low** |
| Infrastructure failure | Water main burst resulting in:<br>• Possible over-land flows through / adjacent to the site and possible inundation of property;<br>• Possible ponding in low-lying areas; | **Low** | • Safe access/egress available to adjacent highway.<br>• Flood flow route through development. | **Low** |

## 7 SUDs EVALUATION

Development of the site will result in an increase of impermeable areas and therefore a corresponding increase in run-off volumes. The use of SUDs techniques to discharge the additional surface water will be evaluated in this section of the report.

The storm water drainage system for the proposed development will be designed in accordance with 'Sewers for Adoption', which requires that any surface water drainage system, should not surcharge during the 1 in 2 year storm event, and should not flood during a 1 in 30 year storm event (i.e. all run-off contained wholly within the sewerage system during the 1 in 30 year event).

Whilst Sewers for Adoption requires there be no surface flooding during the 1 in 30-year storm event. It is generally accepted that a degree of surface flooding can be permitted during extreme storm events i.e. 1 in 100 year + climate change. This will be subject to specific areas being designated as flood susceptible and subject to flooding of these areas posing little or no risk to human life and damage to property. Examples of surface areas which might be permitted to flood in such events are:

- Agricultural land
- Recreational land (playing fields etc.)
- Landscaped areas
- Highways
- Car parks
- Other non-inhabited, designated areas

In all cases where surface flooding might be permitted or designed in to a scheme, due diligence needs to be given to the NPPF and the need to make potential users of such areas aware of their functionality and purpose, and the requirement to maintain safe egress and access at all times.

The Building Regulations Approved Document H (2002) outlines a hierarchy of potential methods of disposing surface water from a site:

- A soakaway; or where that is not practicable
- A watercourse or river; or where that is not practicable,
- A sewer.

The viability of each has been assessed below:

- Soakaway: Regarding the consideration of soakaway infiltration methods for the disposal of surface water, variable head (falling) permeability tests were undertaken on the 30th August 2019 by GEOL Consultants Ltd within BH02, BH06 and BH15, in general accordance with BS EN ISO 22282-2:2012 using the Hvorslev Method, to determine the coefficient of permeability (k) for the underlying natural deposits, in order to assess their suitability for the use of soakaways. A borehole location plan can be found along with the test results in Appendix H. The below bullet points provide an overview of the testing at each location:
    - BH02 at 3.0m below ground level shown that the grounds drainage characteristics were *"Poor/ practically impervious"* and the permeability classification was *"Very Low".* Testing in borehole BH02 shown that the water level remained consistent (only dropping 50mm) during the test period (60 minutes).
    - BH06 at 3.0m below ground level shown that the grounds drainage characteristics were *"Poor"* and the permeability classification was "*Very Low".* Testing in borehole BH06 shown that the water level dropped by a total of 100mm in the first 30 minutes and a further 50mm by the end of the test period (60 minutes).

- BH15 at 2.72m below ground level shown that the grounds drainage characteristics were *"Poor/ practically impervious"* and the permeability classification was *"Very Low".* Testing in borehole BH15 shown that the water level remained consistent (only dropping 50mm) during the test period (60 minutes).

Based on the results of the GEOL Consulting testing, discharge of surface water via infiltration has been discounted.

- Watercourses waterbodies: An unnamed ordinary watercourse runs through the site from north to south. Connection to the watercourse in the low portion of the site is the preferred method of discharge. Runoff rates should be restricted to mimic the greenfield run off rate.

- Sewers: A United Utilities combined sewer is located within the site. United Utilities will not allow surface water to discharge to the sewer if a connection higher up the SUDs hierarchy is viable.

## 8 CONCLUSIONS AND RECOMMENDATIONS

- EDGE have been instructed by Persimmon Homes & Charles Church Lancashire to prepare a Flood risk assessment which will support a full planning application seeking permission for the construction of 58 residential dwellings together with associated infrastructure.
- The site is located 500m north of the town centre of Clitheroe.
- The site area is 1.73 hectares and is almost square in shape. It is greenfield land.
- There is an existing culverted watercourse running north to south through the site.
- There is an existing combined public sewer within the site flowing from north to south.
- EDGE Consulting Engineers have been instructed to formally assess the risk of flooding through a flood risk assessment.
- The site lies within Flood Zone 1 and is therefore unlikely to be affected by fluvial flooding.
- Pluvial flood risk is mitigated by "daylighting" a section of the culvert, providing a new culvert pipe through the site and raising finished floor levels 150mm above surrounding ground levels.
- The development of the site will result in an increase in impermeable area resulting in a corresponding increase in surface water run-off.
- Surface water flows will be restricted to a greenfield run off rate calculated as 11.7 litres per second.
- Surface water volumes will be stored within a pond and storage tanks.
- Climate change has been factored into the drainage calculations.
- Construction of the proposed development will not increase flood risk on or off the site.
- No mitigation measures are considered necessary to mitigate the risk from infrastructure failure.
- A drainage design (Appendix E) has been submitted in support of this flood risk assessment.
- Development of the site will not increase the flood risk to any other property.
- Based on the information provided to EDGE Consulting Engineers in support of this flood risk assessment, the development of the site would be considered sustainable in terms of flood risk, subject to the various recommendations in line with National and Local Planning Policy.

## APPENDICES

### Appendix A – Extract from chapter 14 of NPPF February 2019

# 14. Meeting the challenge of climate change, flooding and coastal change

148. The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

## Planning for climate change

149. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures[48]. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

150. New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and

b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

151. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

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[48] In line with the objectives and provisions of the Climate Change Act 2008.

152. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

153. In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

154. When determining planning applications for renewable and low carbon development, local planning authorities should:

a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

b) approve the application if its impacts are (or can be made) acceptable[49]. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

# Planning and flood risk

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

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

157. All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change

[49] Except for applications for the repowering of existing wind turbines, a proposed wind energy development involving one or more turbines should not be considered acceptable unless it is in an area identified as suitable for wind energy development in the development plan; and, following consultation, it can be demonstrated that the planning impacts identified by the affected local community have been fully addressed and the proposal has their backing.

– so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

a) applying the sequential test and then, if necessary, the exception test as set out below;

b) safeguarding land from development that is required, or likely to be required, for current or future flood management;

c) using opportunities provided by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques); and

d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.

158. The aim of the sequential test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.

159. If it is not possible for development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in national planning guidance.

160. The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

161. Both elements of the exception test should be satisfied for development to be allocated or permitted.

162. Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the plan-making stage, or if more recent information about existing or potential flood risk should be taken into account.

163. When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment[50]. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b) the development is appropriately flood resistant and resilient;

c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

164. Applications for some minor development and changes of use[51] should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 50.

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

a) take account of advice from the lead local flood authority;

b) have appropriate proposed minimum operational standards;

c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

d) where possible, provide multifunctional benefits.

# Coastal change

166. In coastal areas, planning policies and decisions should take account of the UK Marine Policy Statement and marine plans. Integrated Coastal Zone Management should be pursued across local authority and land/sea boundaries, to ensure effective alignment of the terrestrial and marine planning regimes.

---

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

[51] This includes householder development, small non-residential extensions (with a footprint of less than 250m$^2$) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate.

167. Plans should reduce risk from coastal change by avoiding inappropriate development in vulnerable areas and not exacerbating the impacts of physical changes to the coast. They should identify as a Coastal Change Management Area any area likely to be affected by physical changes to the coast, and:

a) be clear as to what development will be appropriate in such areas and in what circumstances; and

b) make provision for development and infrastructure that needs to be relocated away from Coastal Change Management Areas.

168. Development in a Coastal Change Management Area will be appropriate only where it is demonstrated that:

a) it will be safe over its planned lifetime and not have an unacceptable impact on coastal change;

b) the character of the coast including designations is not compromised;

c) the development provides wider sustainability benefits; and

d) the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast[52].

169. Local planning authorities should limit the planned lifetime of development in a Coastal Change Management Area through temporary permission and restoration conditions, where this is necessary to reduce a potentially unacceptable level of future risk to people and the development.

[52] As required by the Marine and Coastal Access Act 2009.

## Appendix B – Topographic survey

N

W E

S

COORDINATED STATIONS

| STATION | EASTING | NORTHING | LEVEL (m) |
|---|---|---|---|
| A | 374219.913 | 442280.128 | 77.856 |
| B | 374304.950 | 442383.677 | 79.179 |
| C | 374354.825 | 442457.499 | 80.116 |

ABBREVIATIONS

| | |
|---|---|
| AV | AIR VALVE/VENT |
| BOL | BOLLARD |
| BB | BELISHA BEACON |
| BM | BENCH MARK |
| BL | BED LEVEL |
| BS | BUS STOP |
| BT | BRITISH TELECOM |
| CL | COVER LEVEL |
| Dil | DILAPIDATED |
| Dis | DISUSED |
| EL | EAVES LEVEL |
| ELE | ELEC JUNCT. BOX |
| EP | ELECTRICITY POLE |
| FH | FIRE HYDRANT |
| FL | FLOOR LEVEL |
| FOS | FULL OF SEDIMENT |
| FP | FLAG POLE |
| G | GULLY |
| GM | GAS METER |
| GV | GAS VALVE |
| IC | INSPECT CHAMBER |
| IL | INVERT LEVEL |
| JKW | JAPANESE KNOTT WEED |
| LH | LAMP HOLE |
| LP | LAMP POST |
| NP | NAME PLATE |
| MH | MANHOLE |
| PS | POST/SIGN POST |
| PB | POST BOX |
| PX | UNKNOWN SERVICE |
| RE | ROODING EYE |
| RL | RIDGE LEVEL |
| RS | ROAD SIGN |
| ST | STOP TAP |
| TH | TRIAL HOLE |
| TL | TRAFFIC LIGHT |
| TP | TELEGRAPH POLE |
| TV | CABLE TV BOX |
| Utl | UNABLE TO LIFT |
| WM | WATER METER |

SYMBOLS

| | |
|---|---|
| SURVEY STATION | TREE |
| E O\H ELEC CABLE | BENCH MARK |
| T O\H PHONE LINE | TRIAL PIT |
| CANOPY\HEDGE | BOREHOLE |

NOTES

A) ONLY MANHOLES AND SERVICES VISIBLE AT TIME OF SURVEY SHOWN

B) O/S USED AND ORIENTATED TO TRUE NORTH

C) LEVELS IN METRES RELATED TO G.P.S.

D) DRAINAGE INFORMATION TAKEN FROM LOCAL AUTHORITY RECORDS. INFORMATION MUST BE CHECKED PRIOR TO WORK COMMENCING

| Rev | Description | Date |
|---|---|---|

# PROPOSED DEVELOPMENT AT HAWTHORNE PLACE, CLITHEROE

## PERSIMMON HOMES

## TOPOGRAPHICAL SURVEY

(SHEET 2 OF 5)

PH252/T00

| | |
|---|---|
| Drawn | S. FAIRHURST |
| Date | AUGUST 2018 |
| Scale | 1:500 @ A1 |


RJP Surveying Consultants Ltd

LAND SURVEYORS & SITE ENGINEERS

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TEL: 01257 251554
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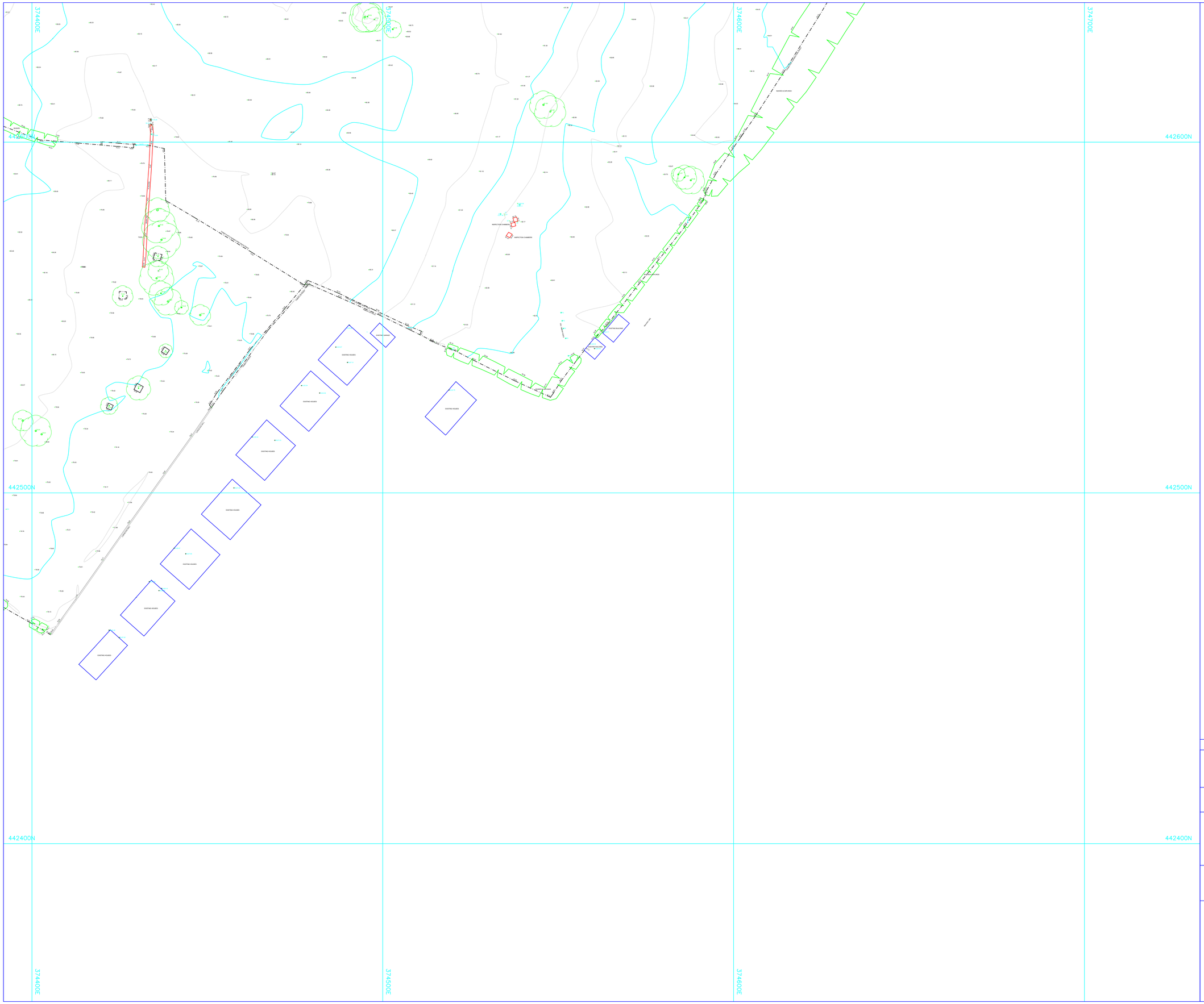
WEBSITE : www.rjpsurveyors.co.uk
E-MAIL: mail@rjpsurveyors.co.uk


374100E 374200E 374300E

442700N 442600N 442500N




N

W RJP E

S

COORDINATED STATIONS

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|---|---|---|---|
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| B | 374304.950 | 442383.677 | 79.179 |
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## ABBREVIATIONS

| | | | |
|---|---|---|---|
| AV | AIR VALVE/VENT | IC | INSPECT CHAMBER |
| BOL | BOLLARD | IL | INVERT LEVEL |
| BB | BELISHA BEACON | JKW | JAPANESE KNOTT WEED |
| BM | BENCH MARK | LH | LAMP HOLE |
| BL | BED LEVEL | LP | LAMP POST |
| BS | BUS STOP | NP | NAME PLATE |
| BT | BRITISH TELECOM | MH | MANHOLE |
| CL | COVER LEVEL | PS | POST/SIGN POST |
| DI | DILAPIDATED | PB | POST BOX |
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| FOS | FULL OF SEDIMENT | TL | TRAFFIC LIGHT |
| FP | FLAG POLE | TP | TELEGRAPH POLE |
| G | GULLY | TV | CABLE TV BOX |
| GM | GAS METER | Uti | UNABLE TO LIFT |
| GV | GAS VALVE | WM | WATER METER |

## SYMBOLS

| | | | |
|---|---|---|---|
| | SURVEY STATION | | TREE |
| — E — | O\H ELEC CABLE | | BENCH MARK |
| — T — | O\H PHONE LINE | | TRIAL PIT |
| | CANOPY\HEDGE | | BOREHOLE |

## NOTES

A) ONLY MANHOLES AND SERVICES VISIBLE AT TIME OF SURVEY SHOWN

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| Rev | Description | Date |
|---|---|---|

# PROPOSED DEVELOPMENT AT HAWTHORNE PLACE, CLITHEROE

## PERSIMMON HOMES

## TOPOGRAPHICAL SURVEY

(SHEET 5 OF 5)

PH252/T00

| | |
|---|---|
| Drawn | S. FAIRHURST |
| Date | AUGUST 2018 |
| Scale | 1:500 @ A1 |

RJP Surveying Consultants Ltd
LAND SURVEYORS & SITE ENGINEERS

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WEBSITE : www.rjpsurveyors.co.uk
E-MAIL: mail@rjpsurveyors.co.uk

## Appendix C – Architects layout


**MIX SCHEDULE**

| | | | |
|---|---|---|---|
| **SITE AREA** | **Acres** | Gross | 4.275 |
| | | Net | 3.674 |
| | **Hectares** | Gross | 1.730 |
| | | Net | 1.487 |
| | **P.O.S. & Buffer** | Acres | 0.315 |
| | **Non Dev** | Acres | 0.286 |

**Private**

| HOUSE TYPE | SQ.FT | NO | TOTAL SQ.FT |
|---|---|---|---|
| Danbury E | 811 | 2 | 1622 |
| Danbury M | 811 | 1 | 811 |
| Danbury S | 811 | 2 | 1622 |
| Buttermere S | 870 | 6 | 5220 |
| Grasmere | 921 | 4 | 3684 |
| Lockwood Cr | 999 | 2 | 1998 |
| Hornsea | 1096 | 8 | 8768 |
| Coniston | 1222 | 4 | 4888 |
| Belmont | 1277 | 4 | 5108 |
| Tiverton | 1398 | 4 | 5592 |
| Holywell | 1414 | 4 | 5656 |
| | | **41** | **44969** |

**Affordable**

| HOUSE TYPE | SQ.FT | NO | TOTAL SQ.FT |
|---|---|---|---|
| Alnmouth E | 643 | 2 | 1286 |
| Alnmouth M | 643 | 2 | 1286 |
| Barton E | 761 | 6 | 4566 |
| Barton M | 761 | 3 | 2283 |
| Barton S | 761 | 4 | 3044 |
| | | **17** | **12465** |

| | | |
|---|---|---|
| **TOTAL** | **58** | **57434** |

| | | |
|---|---|---|
| **FOOTAGE (NET)** | Per Acre | 15,633 |
| | Per Hectare | 38,630 |
| **UNITS (NET)** | Per Acre | 16 |
| | Per Hectare | 39 |

| Revision | Date | Amendment | Initials |
|---|---|---|---|
| A | 14.08.19 | Layout revised to accommodate additional land to NE corner. | SDH |

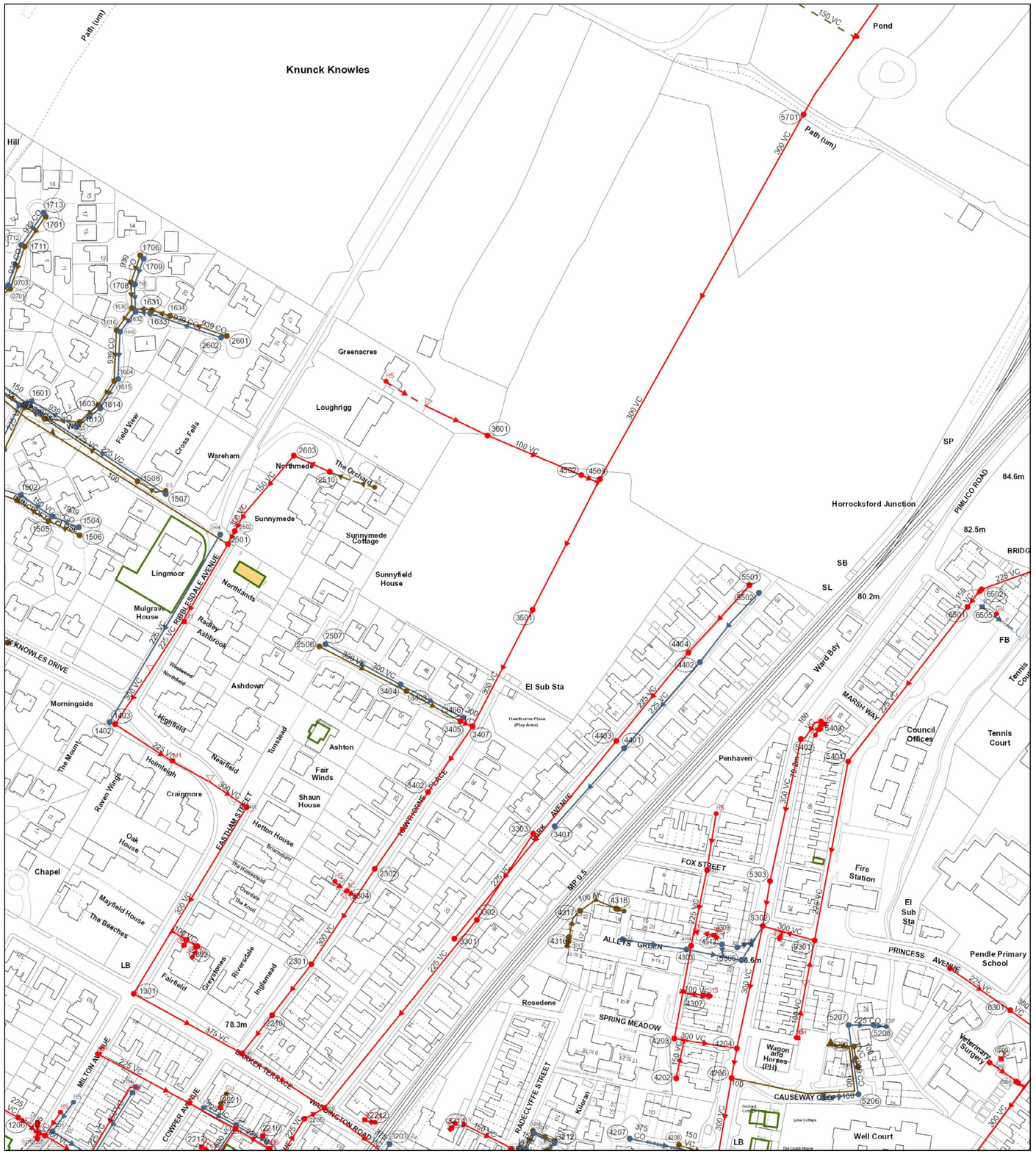
| | | | |
|---|---|---|---|
| Development | Hawthorne Farm | | |
| Location | Clitheroe | | |
| Marketing Name | | | |
| Drawing Title | Sketch Layout | | |
| Drawing Number | HTF.SK01 | | |
| Revision | A | Scale @ A2 | 1:500 |
| Drawn By | SDH | Date Started | Oct 2018 |
| Checked by | | | Date |

PERSIMMON

**Persimmon Homes Lancashire**

Persimmon House, Lancaster Business Park, Caton Road, Lancaster, LA13RQ
Tel: 01524 542 000 Fax: 01524 542 001 Web: www.persimmonhomes.com

## Appendix D – United Utilities asset search maps




The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.



| Refno | Cover | Func | Invert | Size x | Size y | Shape | Matl | Length | Grad |
|---|---|---|---|---|---|---|---|---|---|
| 3407 | | CO | 0 | 300 | | | VC | 43,93365 | |
| 5501 | 81,63 | CO | 80,05 | 225 | | | VC | 50,53084 | 1 in 112 |
| 3501 | | CO | | 300 | | | VC | 73,1277 | |
| 2602 | | SW | 0 | 939 | | | CO | 41,79082 | |
| 6301 | 76,72 | CO | 75,14 | 300 | | | VC | 31,8042 | 1 in 68 |
| 5206 | | SW | 0 | 939 | | | CO | 39,00126 | |
| 1616 | | FO | 0 | 939 | | | CO | 28,21596 | |
| 1211 | 78,81 | SW | 77,29 | 225 | | | VC | 26,19195 | 1 in 131 |
| 0506 | | FO | 0 | 939 | | | CO | 15,63918 | |
| 3403 | | FO | 0 | 300 | | | VC | 34,40399 | |
| 3402 | 79,98 | CO | 77,28 | 300 | | | VC | 51,9828 | 1 in 306 |
| 5502 | 81,65 | SW | 80,51 | 225 | | | VC | 50,62241 | 1 in 73 |
| 1709 | | SW | 0 | 939 | | | CO | 15,13005 | |
| 4301 | 79,62 | CO | 76,48 | 225 | | | VC | 42,99156 | |
| 4316 | | FO | | 100 | | | AK | 16,33193 | |
| 1504 | | SW | 0 | 939 | | | CO | 15,72715 | |
| 1634 | | FO | 0 | 939 | | | CO | 10,46296 | |
| 3406 | | SW | 0 | 300 | | | VC | 2,436001 | |
| 5701 | | CO | 0 | 300 | | | VC | 103,9835 | |
| 4503 | | CO | 0 | 300 | | | VC | 81,52834 | |
| 1208 | | CO | 0 | 300 | | | VC | 5,244206 | |
| 6502 | 79,68 | CO | 78,01 | 225 | | | VC | 5,296386 | 1 in 530 |
| 4315 | | FO | | 100 | | | AK | 2,387086 | |
| 4204 | 79,02 | CO | 76,53 | 300 | | | VC | 18,81705 | |
| 1206 | 79,19 | GO | 76,8 | 225 | | | VC | 7,276434 | |
| 4302 | | SW | 0 | 225 | | | VC | 36,02388 | |
| 1204 | 78,69 | CO | 76,99 | 225 | | | VC | 51,02184 | |
| 3207 | | FO | | 150 | | | VC | 13,29272 | |
| 1508 | 78,45 | FO | 76,95 | 225 | | | VC | 62,08035 | 1 in 18 |
| 2205 | 77,03 | CO | 75,88 | 225 | | | VC | 12,51706 | 1 in 78 |
| 5302 | 78,66 | CO | 76,58 | 300 | | | VC | 69,39209 | 1 in 2313 |
| 2504 | | SW | 0 | 225 | | | VC | 121,0435 | |
| 2510 | | CO | | 150 | | | VC | 21,72715 | |
| 1614 | | FO | 0 | 939 | | | CO | 14,0557 | |
| 1631 | | FO | 0 | 939 | | | CO | 11,3017 | |
| 5401 | 78,69 | CO | 77,24 | 225 | | | VC | 101,207 | 1 in 202 |
| 2601 | | FO | 0 | 939 | | | CO | 33,36135 | |
| 4304 | | CO | 0 | 225 | | | VC | 52,34993 | |
| 1712 | | SW | 0 | 939 | | | CO | 23,5498 | |
| 4208 | 79,92 | FO | 77,91 | 150 | | | VC | 22,67588 | |
| 1615 | | FO | 0 | 939 | | | CO | 16,15303 | |
| 1701 | | FO | 0 | 939 | | | CO | 20,43419 | |
| 2507 | | SW | 0 | 300 | | | VC | 47,34771 | |
| 4206 | | CO | 0 | 300 | | | VC | 44,08069 | |
| 4318 | | FO | | 100 | | | AK | 4,676182 | |
| 2501 | 82,77 | CO | 0 | 225 | | | VC | 83,40821 | |
| 3206 | | FO | | 150 | | | VC | 12,25528 | |
| 2301 | 78,42 | CO | 76,8 | 300 | | | VC | 35,59674 | 1 in 81 |
| 2401 | 82,07 | CO | 79,66 | 300 | | | VC | 121,2811 | 1 in 47 |
| 1210 | | CO | 0 | 300 | | | VC | 3,100258 | |
| 1713 | | SW | 0 | 939 | | | CO | 21,77798 | |
| 2603 | | CO | | 150 | | | VC | 41,87473 | |
| 3303 | 80,17 | CO | 0 | 225 | | | VC | 57,26549 | |
| 1603 | | SW | 0 | 939 | | | CO | 16,70435 | |
| 5403 | | CO | | 100 | | | VC | 15,85951 | |
| 5203 | | FO | 0 | 100 | | | PVC | 12,92955 | |
| 2302 | 79,05 | CO | 77,09 | 300 | | | VC | 63,57977 | 1 in 235 |
| 1612 | 75,26 | FO | 73,55 | 225 | | | VC | 13,03804 | |
| 5402 | 79,74 | CO | 77,15 | 300 | | | VC | 80,74579 | 1 in 188 |
| 1705 | | FO | 0 | 939 | | | CO | 14,42641 | |
| 1711 | | FO | 0 | 939 | | | CO | 24,69285 | |
| 1627 | | SW | 0 | 150 | | | VC | 26,05719 | |
| 0510 | | FO | 0 | 150 | | | VC | 18,46241 | |
| 2506 | | FO | 0 | 300 | | | VC | 54,27273 | |
| 4404 | 81,15 | CO | 79,58 | 225 | | | VC | 63,28629 | 1 in 83 |
| 1633 | | SW | 0 | 939 | | | CO | 8,067323 | |
| 1207 | 78,82 | CO | 76,57 | 300 | | | VC | 29,24769 | |
| 6501 | 79,67 | CO | 77,98 | 225 | | | VC | 106,5072 | 1 in 151 |
| 4317 | | FO | | 100 | | | AK | 23,09936 | |
| 4402 | 81,08 | SW | 79,8 | 225 | | | VC | 63,72642 | 1 in 108 |
| 3302 | 78,08 | CO | 77,44 | 225 | | | VC | 134,5455 | 1 in 78 |
| 1602 | 75,25 | SW | 73,62 | 225 | | | VC | 74,62141 | |
| 4401 | 80,54 | SW | 79,19 | 225 | | | VC | 57,91006 | 1 in 121 |
| 3203 | | SW | 0 | 225 | | | VC | 205,9861 | |
| 4403 | 80,6 | CO | 78,8 | 225 | | | VC | 142,1689 | 1 in 134 |
| 1632 | | SW | 0 | 939 | | | CO | 14,15265 | |
| 0701 | | FO | 0 | 939 | | | CO | 30,41257 | |
| 1402 | 83,46 | CO | 80,62 | 225 | | | VC | 61,88216 | 1 in 91 |
| 1505 | | FO | 0 | 150 | | | VC | 20,79617 | |
| 2209 | 77,78 | CO | 75,98 | 375 | | | VC | 54,85156 | 1 in 196 |
| 5208 | | SW | 0 | 225 | | | CO | 7,003371 | |
| 5303 | 78,8 | CO | 76,7 | 300 | | | VC | 25,53235 | 1 in 253 |
| 0703 | | SW | 0 | 939 | | | CO | 28,56633 | |
| 5301 | 78,19 | CO | 76,73 | 300 | | | VC | 29,83857 | 1 in 230 |
| 3404 | | SW | 0 | 300 | | | VC | 39,33428 | |
| 4207 | 80,12 | SW | 78,24 | 375 | | | CO | 40,99031 | 1 in 111 |
| 1601 | | SW | 0 | 939 | | | CO | 6,776821 | |
| 1502 | | SW | 0 | 150 | | | VC | 23,59704 | |
| 1613 | | FO | 0 | 225 | | | CO | 19,32862 | |
| 3601 | | CO | | 100 | | | VC | 56,59791 | |
| 3212 | | SW | | 150 | | | VC | 12,67379 | |
| 3211 | | SW | | 150 | | | VC | 10,25076 | |
| 6302 | 77,01 | CO | 75,97 | 225 | | | VC | 40,68728 | 1 in 59 |
| 5205 | | SW | 0 | 939 | | | CO | 19,6644 | |
| 4303 | | SW | 0 | 225 | | | VC | 31,09815 | |
| 1604 | | SW | 0 | 939 | | | CO | 19,04681 | |
| 5204 | | FO | 0 | 100 | | | PVC | 11,45173 | |
| 2210 | 78,09 | CO | 76,34 | 300 | | | VC | 27,15046 | 1 in 80 |
| 6206 | | CO | | 150 | | | VC | 18,28668 | |
| 1708 | | SW | 0 | 939 | | | CO | 15,09154 | |
| 1630 | | FO | 0 | 939 | | | CO | 14,83806 | |
| 5701 | | CO | 0 | 300 | | | VC | 232,1514 | |
| 2208 | 77,45 | CO | 76,2 | 300 | | | VC | 54,74615 | 1 in 152 |
| 1503 | | SW | 0 | 150 | | | VC | 21,30053 | |
| 1506 | | FO | 0 | 939 | | | CO | 19,07764 | |
| 1706 | | FO | 0 | 939 | | | CO | 15,87492 | |
| 2206 | 76,94 | CO | 75,69 | 375 | | | VC | 57,12059 | 1 in 168 |
| 6208 | | CO | | 150 | | | VC | 5,384523 | |
| 3217 | | CO | | 150 | | | VC | 31,69613 | |
| 2502 | 82,79 | CO | 81,21 | 300 | | | VC | 8,211194 | |
| 1628 | | FO | 0 | 225 | | | VC | 18,7342 | |
| 1605 | | SW | 0 | 939 | | | CO | 26,27518 | |
| 5305 | | SW | 0 | 300 | | | VC | 22,37574 | |
| 4307 | | CO | | 100 | | | VC | 11,28512 | |
| 1507 | 80,13 | SW | 78,31 | 225 | | | VC | 84,52764 | 1 in 18 |
| 4502 | | CO | | 100 | | | VC | 10,15951 | |
| 1301 | 79,91 | CO | 77,06 | 375 | | | VC | 68,75974 | 1 in 65 |
| 3405 | | CO | 0 | 300 | | | VC | 7,28309 | |
| 1626 | | SW | 0 | 939 | | | CO | 28,99725 | |
| 4203 | 79,25 | CO | 77,07 | 300 | | | VC | 35,12064 | 1 in 76 |
| 2215 | 77,43 | SW | 75,28 | 600 | | | VC | 166,2697 | 1 in 406 |
| 4202 | 79,51 | CO | 78,04 | 150 | | | VC | 21,71918 | |

| Refno | Cover | Func | Invert | Size x | Size y | Shape | Matl | Length | Grad |
|---|---|---|---|---|---|---|---|---|---|

## LEGEND

Abandoned | Foul | Surface Water | Combined

- Public Sewer
- Private Sewer
- Section 104
- Rising Main
- Sludge Main
- Overflow
- Water Course
- Highway Drain

All point assets follow the standard colour convention:
red - combined  blue - surface water
brown - foul  purple - overflow

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Washout Chamber
- Valve
- Air Valve
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- Change of Characteristic

**MANHOLE FUNCTION**

| | |
|---|---|
| FO | Foul |
| SW | Surface Water |
| CO | Combined |
| OV | Overflow |

**SEWER SHAPE**

| | | | |
|---|---|---|---|
| CI | Circular | TR | Trapezoidal |
| EG | Egg | AR | Arch |
| OV | Oval | BA | Barrel |
| FT | Flat Top | HO | HorseShoe |
| RE | Rectangular | UN | Unspecified |
| SQ | Scuare | | |

**SEWER MATERIAL**

| | |
|---|---|
| AC | Asbestos Cement |
| BR | Brick |
| PE | Polyethylene |
| RP | Reinforced Plastic Matrix |
| CO | Concrete |
| CSB | Concrete Segment Bolted |
| CSU | Concrete Segment Unbolted |
| CC | Concrete Box Culverted |
| PSC | Plastic / Steel Composite |
| GRC | Glass Reinforced Plastic |
| DI | Ductile Iron |
| PVC | Polyvinyl Chloride |
| CI | Cast Iron |
| SI | Spun Iron |
| ST | Steel |
| VC | Vitrified Clay |
| PP | Polypropylene |
| PF | Pitch Fibre |
| MAC | Masonry, Coursed |
| MAR | Masonry, Random |
| U | Unspecified |

**Address or Site Reference:**

1 HAWTHORNE PLACE,
CLITHEROE,
BB7 2HU

**Scale:** 1:1250  **Date:** 08/02/2019

**Sheet:** 1 of 1

**Printed by:** Property Searches

**SEWER RECORDS**

United Utilities
helping life flow smoothly

## Appendix E – Proposed drainage layout


EXISTING WATERCOURSE TO BE OPENED UP AT NORTHERN EXTENTS OF THE SITE AND TAKEN THROUGH POS AREA
S9 Ø 1200 CL:80.80 IL:79.37
225Ø 1:67 L:32.10M
11.5M DEEP ONLINE ATTENUATION POND 370m³ REQUIRED FOR 1 IN 30 YEAR RETURN PERIODS.
OFFLINE PRIVATE TANK 0.66M DEEP 151.8M³ REQUIRED FOR 1 IN 100 YEAR +30% CC IL: 80.10
46M
S8 Ø 1500 CL:80.80 IL:78.60
HW1 IL:78.57
375Ø 1:300 L:9.02M
HW2 IL:78.57
225Ø 1:67 L:3.45M
EXHW3
5M
S10 Ø 1350 CL:80.69 IL:78.55
S11 HYDROBRAKE 11.7L/S Ø 1800 CL:80.80 IL:78.54
225Ø 1:7 L:9.34M
750Ø CULVERT
S12 Ø 1800 CL:80.80 IL:78.52
S7 Ø 1350 CL:80.80 IL:78.65
375Ø 1:300 L:16.32M
OFFLINE PRIVATE TANK 0.66M DEEP 63.4M³ REQUIRED FOR 1 IN 100 YEAR +30% CC IL: 80.10
20M
5M
S1 Ø 1350 CL:81.80 IL:79.49
225Ø 1:20 L:15.46M
F1 Ø 1200 CL:81.80 IL:79.15
225Ø 1:67 L:15.46M
S2 Ø 1350 CL:81.275 IL:79.40
150Ø 1:50 L:51.15M
225Ø 1:67 L:36.37M
CONNECTION TO EXISTING PUBLIC SEWER. LINE, LOCATION, DEPTH AND CONDITION TO BE CONFIRMED PRIOR TO DRAINAGE WORKS COMMENCING
F4 Ø 1200 CL:80.80 IL:79.4
150Ø 1:150 L:11.34M
F5 Ø 1350 CL:80.90 IL:79.55
750Ø CULVERT 1:400 L:8.30M
750Ø CULVERT 1:400 L:21.34M
Ø 1800 CL:80.50 IL:78.43
Ø 1800 CL:80.44 IL:78.49
CULVERT EASEMENT TO BE MAINTAINED
375Ø 1:300 L:35.00M
CONNECTION TO EXISTING PUBLIC SEWER. LINE, LOCATION, DEPTH AND CONDITION TO BE CONFIRMED PRIOR TO DRAINAGE WORKS COMMENCING
F2 Ø 1200 CL:81.80 IL:80.45
150Ø 1:150 L:58.76M
F3 Ø 1350 CL:80.80 IL:79.40
S5 Ø 1375 CL:80.81 IL:78.77
300Ø 1:230 L:34.16M
300Ø 1:230 L:24.30M
S3 Ø 1350 CL:81.80 IL:79.10
S4 Ø 1350 CL:80.91 IL:78.95
225Ø 1:67 L:10.02M
225Ø 1:67 L:24.35M
S6 Ø 1350 CL:80.80 IL:79.37
750Ø CULVERT 1:400 L:55.50M
Ø 1800 CL:80.80 IL:78.30
CONNECTION TO EXISTING CULVERT VIA NEW MANHOLE TO BE IN ACCORDANCE WITH LLFA CONSENT, LINE, LOCATION, DEPTH AND CONDITION TO BE CONFIRMED PRIOR TO DRAINAGE WORKS COMMENCING
KEY:
SW SEWER
FW SEWER
EXISTING COMBINED SEWER
EXISTING GAS MAIN
DIVERTED WATERCOURSE
3M EASEMENT (EXACT WIDTH TO BE CONFIRMED BY LLFA)
NOTES:
1 THIS DRAWING IS NOT FOR CONSTRUCTION AND THE INFORMATION PROVIDED IS FOR FEASIBILITY PURPOSES.
2 THE LINE, LOCATION AND DEPTH OF ALL EXISTING SERVICES SHOWN SHOULD BE CONFIRMED PRIOR TO ANY WORKS COMMENCING.
3 PROPOSED SEWERS SHOWN ARE INDICATIVE. ALL LENGTHS, SIZES AND PROPOSED LEVELS SHOWN ALONG WITH STORAGE VOLUMES QUOTED SHOULD BE CONFIRMED AT DETAILED DESIGN STAGE.
4 CONNECTION TO THE EXISTING PUBLIC SEWER TO BE IN STRICT ACCORDANCE WITH THE WATER AUTHORITIES CONSENT.
5 CONNECTION TO THE EXISTING WATERCOURSE TO BE IN STRICT ACCORDANCE WITH THE LLFA AND EA CONSENT WITH ALL RELEVANT PERMITS TO BE OBTAINED PRIOR TO WORKS COMMENCING.
6 ALL HIGHWAY WORKS TO BE IN STRICT ACCORDANCE WITH THE HIGHWAYS AUTHORITY APPROVAL.
7 DISCHARGE RATE TO THE EXISTING WATERCOURSE IS 11.7 LITRES PER SECOND. THIS MIMICS THE EXISTING QBAR GREENFIELD RUN OFF RATE.
P03 28.10.19 Updated to new layout. Large pipes removed. Levels revised. M.A. R.A
P02 09.10.19 Updated to new site layout F.A R.A
P01 13.05.19 Issued for APPROVAL J.C R.A
Rev Date Description By Chk
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DO NOT SCALE DRAWINGS. IF IN DOUBT, ASK!
Project Name
HAWTHORNE FARM
CLITHEROE
Client
PERSIMMON HOMES
Designed R.A
Drawn F.A
Checked R.A
Scale @ A1 1:250
Drawing Title
SCHEMATIC DRAINAGE AND LEVELS LAYOUT
Project No. 19310
PRELIMINARY NOT FOR CONSTRUCTION
Drawing No. C2091
Revision P03
PLOT DATE:
FILENAME:
0 mm 10 20 30 40 50

## Appendix F – Greenfield runoff calculations

## ICP SUDS Mean Annual Flood

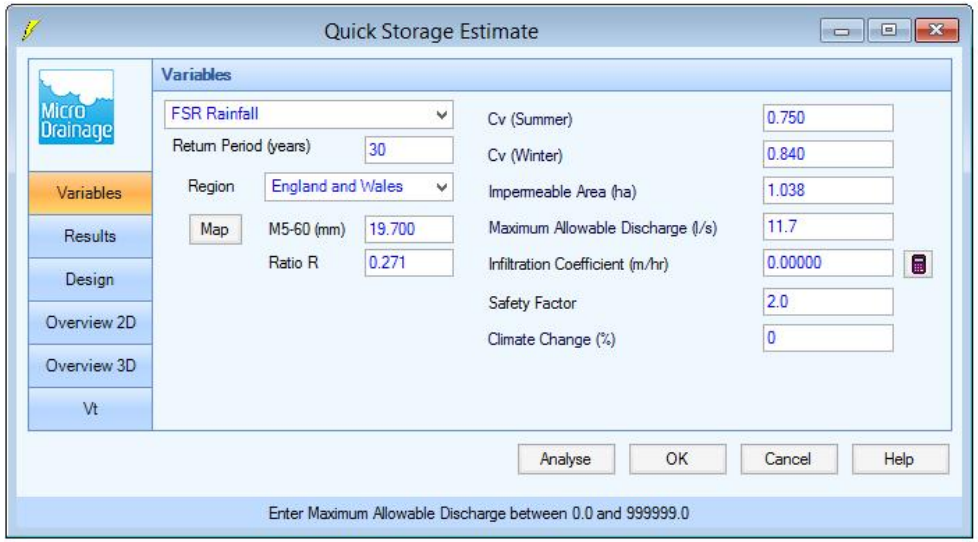
Input

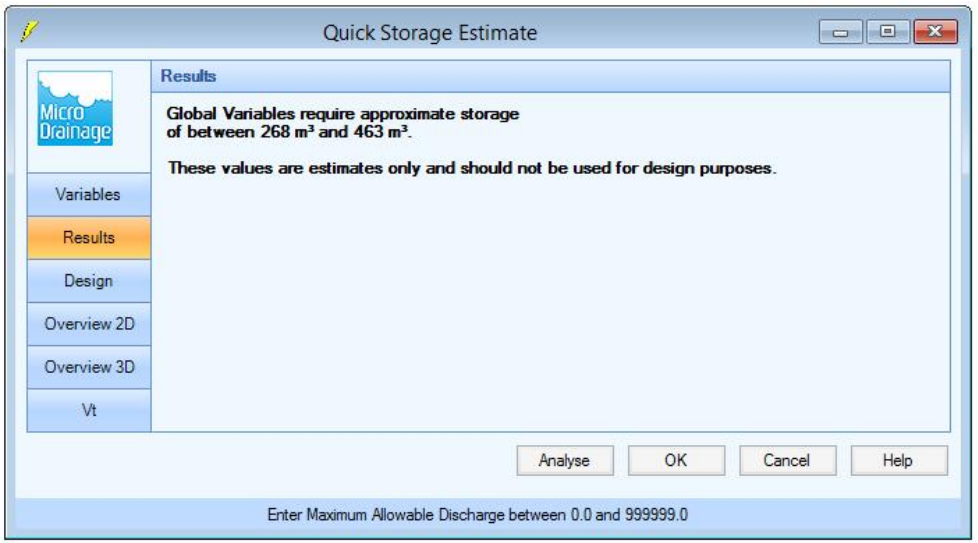
| | | | |
|---|---|---|---|
| Return Period (years) | 30 | Soil | 0.450 |
| Area (ha) | 1.730 | Urban | 0.000 |
| SAAR (mm) | 1010 | Region Number | Region 10 |

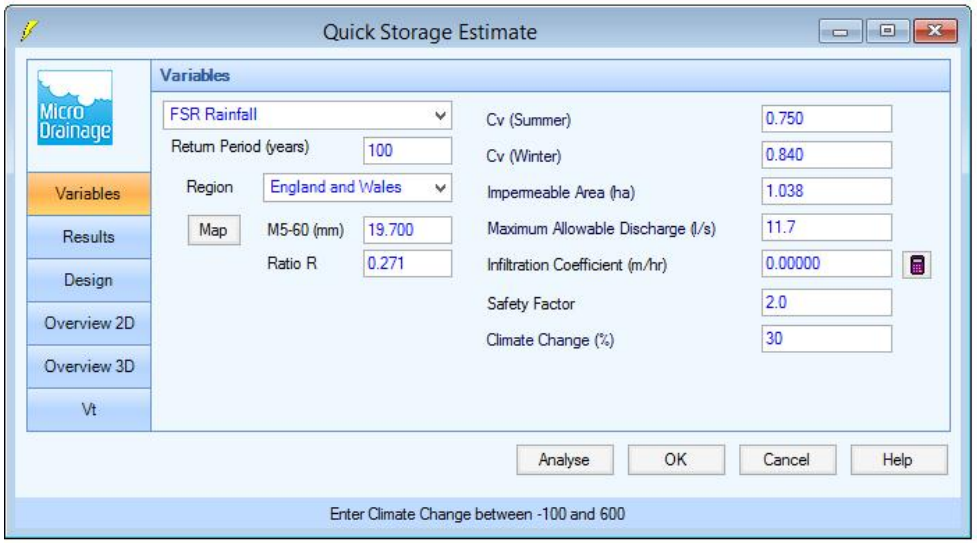
**Results l/s**

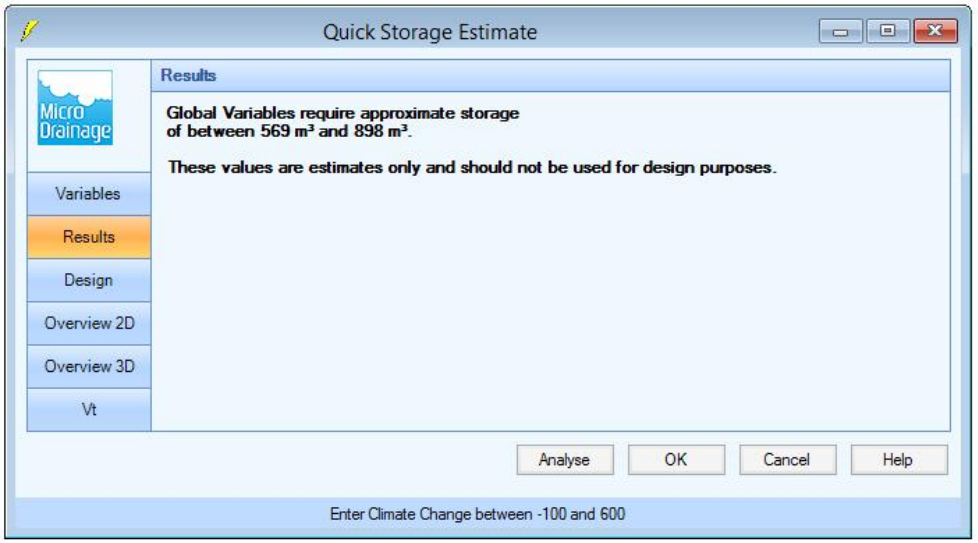
| | |
|---|---|
| QBAR Rural | 11.7 |
| QBAR Urban | 11.7 |
| Q30 years | 19.8 |
| Q1 year | 10.2 |
| Q30 years | 19.8 |
| Q100 years | 24.3 |

## Appendix G – Storage calculations


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FSR Rainfall
Return Period (years) 30
Region England and Wales
Map
M5-60 (mm) 19.700
Ratio R 0.271
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 1.038
Maximum Allowable Discharge (l/s) 11.7
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 0
Analyse
OK
Cancel
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage of between 268 m³ and 463 m³.
These values are estimates only and should not be used for design purposes.
Analyse
OK
Cancel
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FSR Rainfall
Return Period (years) 100
Region England and Wales
Map
M5-60 (mm) 19.700
Ratio R 0.271
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 1.038
Maximum Allowable Discharge (l/s) 11.7
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 30
Analyse
OK
Cancel
Help
Enter Climate Change between -100 and 600


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage of between 569 m³ and 898 m³.
These values are estimates only and should not be used for design purposes.
Analyse
OK
Cancel
Help
Enter Climate Change between -100 and 600

## Appendix H – GEOL Consulting ground permeability tests and borehole location plan


442600N
442550N
442500N
374300E
374350E
374400E
374450E
82.26
BH3
80.58
BH8
81.15
BH5
82.31
BH2
79.64
BH11
80.66
BH7
82.34
BH1
81.43
BH4
79.29
BH15
79.64
BH13
79.80
BH10
80.72
BH6
79.13
BH14
79.29
BH12
79.56
BH9
existing gas mains & associated easement
landscaped buffer strip
existing play area
POS
POS
Cottage

# Geol Consultants Limited

## VARIABLE HEAD (FALLING) PERMEABILITY TEST

SITE DETAILS: Land at Hawthorne Farm, Hawthorne Place, Clitheroe  BOREHOLE: BH02 at 3.00mBGL

| | | |
|---|---|---|
| Bottom of Borehole | 3.00 | mBGL |
| Base of casing | 1.00 | mBGL |
| Diameter of casing | 50.00 | mm |
| Height of casing | 0.00 | mAGL |
| Elevation of Borehole | | mAOD |
| Groundwater Level | 3.00 | mBGL |

| | | |
|---|---|---|
| Operator | RS | |
| Date | 30/08/2019 | |
| Time | 11.00 | |
| Weather | Dry | |
| Input volume of water | c.8 | litres |
| Test Zone | 2.00 | m |

### TEST CALCULATION

Intake Factor (F)

$$F = \frac{2\pi L}{\text{Log}_e\left[(L/D) + \sqrt{\{1+(L/D)^2\}}\right]} \quad \text{(i)}$$

(From BS 5930:2015 for standpipes)

L=length of test zone
D=diameter of standpipe

Permeability (k)

$$k = \frac{A}{F(t_2 - t_1)} \times \text{Log}_e\,(H_1/H_2) \quad \text{(ii)}$$

or

$$k = \frac{A}{FT} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor corresponding to an H/Ho value of 0.37

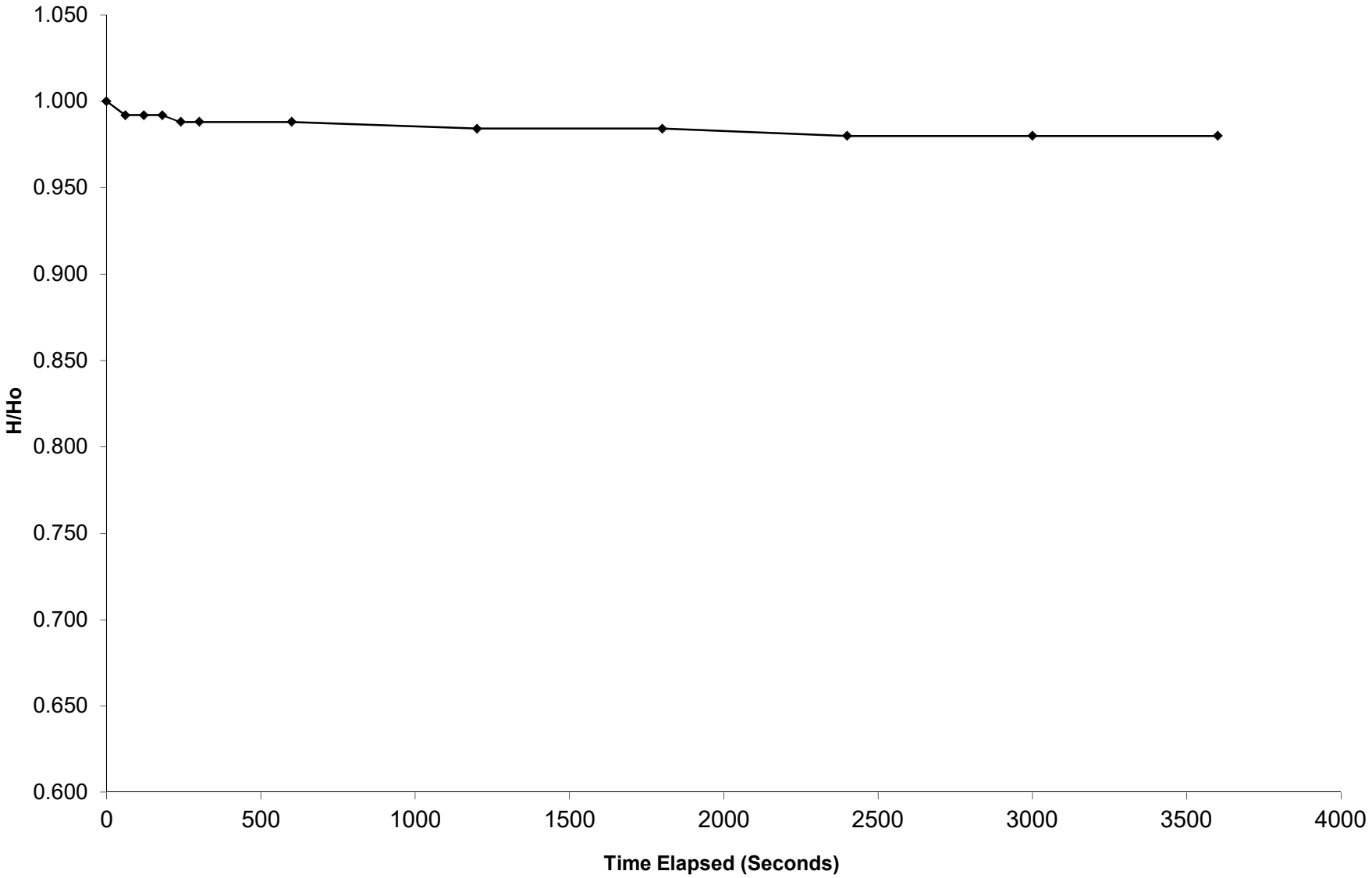
| | | | |
|---|---|---|---|
| L= | 2.00 | m | |
| D= | 0.050 | m | |
| L/D= | 40.00 | | |
| $t_1$= | 0 | s | |
| $t_2$= | 3600 | s | |
| $H_1$= | 2.50 | m | |
| $H_2$= | 2.45 | m | |
| A= | 0.00196 | $m^2$ | |
| F= | 2.8676 | | From (i) |
| T= | | s | |
| k= | 3.84253E-09 | $ms^{-1}$ | From (ii) |

Remarks

**Drainage Characteristics: POOR / PRACTICALLY IMPERVIOUS**
**Permeability Classification: VERY LOW**

| Elapsed (minutes) | Elapsed (seconds) | Total seconds | Water Depth (m) | Head (metres) | H/Ho |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0.500 | 2.500 | 1.000 |
| 1 | 0 | 60 | 0.520 | 2.480 | 0.992 |
| 2 | 0 | 120 | 0.520 | 2.480 | 0.992 |
| 3 | 0 | 180 | 0.520 | 2.480 | 0.992 |
| 4 | 0 | 240 | 0.530 | 2.470 | 0.988 |
| 5 | 0 | 300 | 0.530 | 2.470 | 0.988 |
| 10 | 0 | 600 | 0.530 | 2.470 | 0.988 |
| 20 | 0 | 1200 | 0.540 | 2.460 | 0.984 |
| 30 | 0 | 1800 | 0.540 | 2.460 | 0.984 |
| 40 | 0 | 2400 | 0.550 | 2.450 | 0.980 |
| 50 | 0 | 3000 | 0.550 | 2.450 | 0.980 |
| 60 | 0 | 3600 | 0.550 | 2.450 | 0.980 |

## Variable Head (Falling) Permeability Test at BH02



# Geol Consultants Limited

## VARIABLE HEAD (FALLING) PERMEABILITY TEST

SITE DETAILS: Land at Hawthorne Farm, Hawthorne Place, Clitheroe BOREHOLE: BH06 at 3.00mBGL

| | | |
|---|---|---|
| Bottom of Borehole | 2.00 | mBGL |
| Base of casing | 1.00 | mBGL |
| Diameter of casing | 50.00 | mm |
| Height of casing | 0.00 | mAGL |
| Elevation of Borehole | | mAOD |
| Groundwater Level | 2.00 | mBGL |

| | | |
|---|---|---|
| Operator | RS | |
| Date | 30/08/2019 | |
| Time | 11.10 | |
| Weather | Dry | |
| Input volume of water | c.5 | litres |
| Test Zone | 1.00 | m |

### TEST CALCULATION

Intake Factor (F)

$$F = \frac{2\pi L}{\log_e [(L/D) + \sqrt{\{1+(L/D)^2\}}]} \quad \text{(i)}$$

(From BS 5930:2015 for standpipes)

L=length of test zone
D=diameter of standpipe

Permeability (k)

$$k = \frac{A}{F(t_2 - t_1)} \times \log_e (H_1/H_2) \quad \text{(ii)}$$

or

$$k = \frac{A}{FT} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor corresponding to an H/Ho value of 0.37

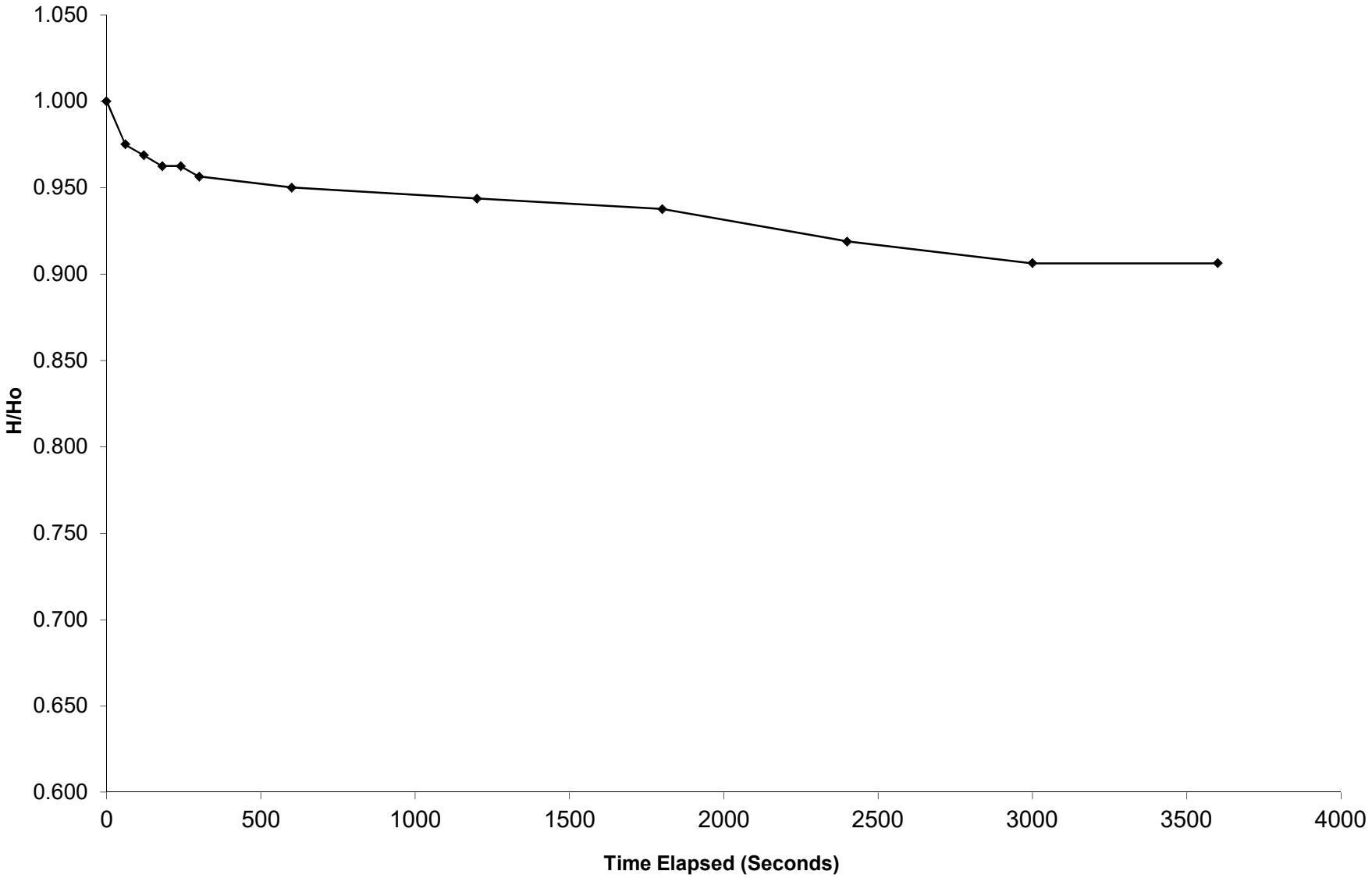
| | | | |
|---|---|---|---|
| L= | 1.00 | m | |
| D= | 0.050 | m | |
| L/D= | 20.00 | | |
| $t_1$= | 0 | s | |
| $t_2$= | 3600 | s | |
| $H_1$= | 1.60 | m | |
| $H_2$= | 1.45 | m | |
| A= | 0.00196 | $m^2$ | |
| F= | 1.7030 | | From (i) |
| T= | | s | |
| k= | 3.15273E-08 | $ms^{-1}$ | From (ii) |

Remarks

**Drainage Characteristics: POOR**
**Permeability Classification: VERY LOW**

| Elapsed (minutes) | Elapsed (seconds) | Total seconds | Water Depth (m) | Head (metres) | H/Ho |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0.400 | 1.600 | 1.000 |
| 1 | 0 | 60 | 0.440 | 1.560 | 0.975 |
| 2 | 0 | 120 | 0.450 | 1.550 | 0.969 |
| 3 | 0 | 180 | 0.460 | 1.540 | 0.963 |
| 4 | 0 | 240 | 0.460 | 1.540 | 0.963 |
| 5 | 0 | 300 | 0.470 | 1.530 | 0.956 |
| 10 | 0 | 600 | 0.480 | 1.520 | 0.950 |
| 20 | 0 | 1200 | 0.490 | 1.510 | 0.944 |
| 30 | 0 | 1800 | 0.500 | 1.500 | 0.938 |
| 40 | 0 | 2400 | 0.530 | 1.470 | 0.919 |
| 50 | 0 | 3000 | 0.550 | 1.450 | 0.906 |
| 60 | 0 | 3600 | 0.550 | 1.450 | 0.906 |

## Variable Head (Falling) Permeability Test at BH06



# Geol Consultants Limited

## VARIABLE HEAD (FALLING) PERMEABILITY TEST

SITE DETAILS: Land at Hawthorne Farm, Hawthorne Place, Clitheroe BOREHOLE: BH15 at 2.72mBGL

| | | |
|---|---|---|
| Bottom of Borehole | 2.72 | mBGL |
| Base of casing | 0.72 | mBGL |
| Diameter of casing | 50.00 | mm |
| Height of casing | 0.00 | mAGL |
| Elevation of Borehole | | mAOD |
| Groundwater Level | 2.72 | mBGL |

| | | |
|---|---|---|
| Operator | RS | |
| Date | 30/08/2019 | |
| Time | 11.20 | |
| Weather | Dry | |
| Input volume of water | c.8 | litres |
| Test Zone | 2.00 | m |

### TEST CALCULATION

Intake Factor (F)

$$F = \frac{2\pi L}{\log_e [(L/D) + \sqrt{\{1+(L/D)^2\}}]} \quad \text{(i)}$$

(From BS 5930:2015 for standpipes)

L=length of test zone
D=diameter of standpipe

Permeability (k)

$$k = \frac{A}{F(t_2 - t_1)} \times \log_e (H_1/H_2) \quad \text{(ii)}$$

or

$$k = \frac{A}{FT} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor corresponding to an H/Ho value of 0.37

| | | | |
|---|---|---|---|
| L= | 2.00 | m | |
| D= | 0.050 | m | |
| L/D= | 40.00 | | |
| $t_1$= | 0 | s | |
| $t_2$= | 3600 | s | |
| $H_1$= | 2.42 | m | |
| $H_2$= | 2.37 | m | |
| A= | 0.00196 | $m^2$ | |
| F= | 2.8676 | | From (i) |
| T= | | s | |
| k= | 3.97089E-09 | $ms^{-1}$ | From (ii) |

Remarks

**Drainage Characteristics: POOR / PRACTICALLY IMPERVIOUS**
**Permeability Classification: VERY LOW**

| Elapsed (minutes) | Elapsed (seconds) | Total seconds | Water Depth (m) | Head (metres) | H/Ho |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0.300 | 2.420 | 1.000 |
| 1 | 0 | 60 | 0.320 | 2.400 | 0.992 |
| 2 | 0 | 120 | 0.320 | 2.400 | 0.992 |
| 3 | 0 | 180 | 0.320 | 2.400 | 0.992 |
| 4 | 0 | 240 | 0.320 | 2.400 | 0.992 |
| 5 | 0 | 300 | 0.320 | 2.400 | 0.992 |
| 10 | 0 | 600 | 0.330 | 2.390 | 0.988 |
| 20 | 0 | 1200 | 0.330 | 2.390 | 0.988 |
| 30 | 0 | 1800 | 0.340 | 2.380 | 0.983 |
| 40 | 0 | 2400 | 0.340 | 2.380 | 0.983 |
| 50 | 0 | 3000 | 0.350 | 2.370 | 0.979 |
| 60 | 0 | 3600 | 0.350 | 2.370 | 0.979 |

## Variable Head (Falling) Permeability Test at BH15