SHAPE
ENGINEERING

HIGHMOOR FARM, CLITHEROE

FLOOD RISK ASSESSMENT AND DRAINAGE STATERGY

Revision E
31st MARCH 2026

CONTENTS

1.0 INTRODUCTION

1.1 Shape Engineering have been commissioned by Morris Homes to provide a Flood Risk Assessment (FRA) and Drainage Strategy in respect of a Planning Application for a residential development providing 124 units at Highmoor Farm, Clitheroe, BB7 1PN.

1.2 In accordance with national planning policy, the site-specific Flood Risk Assessment will review all sources of flood risk to both the proposed development and to the adjacent areas as a result of the development proposals

1.3 The Flood Risk Assessment and Drainage Strategy will aim to mitigate any potential flood risk as a result of the development.

2.0 SITE DESCRIPTION

Existing Development

2.1 The site is located at Highmoor Farm, Clitheroe. An approximate postcode for the site is BB7 1PN and NGR SD751415. The location of the site is indicated in Appendix A.

Area	5.16 hectares or 50,160m²
Existing Surfacing	The existing site is predominately greenfield. At the centre of the site is Highmoor Farm and associated buildings, these are located outside of the development boundary. There is an unnamed lane that runs through the centre of the site and appears to provide connectivity to surrounding agricultural fields.
General Topography	A topographical Survey has been completed by The Survey Association in September 2018. Levels at the site generally fall away from the existing buildings at the centre of the site, in a Northern, Eastern and South-Eastern direction. Within the vicinity of the existing buildings, levels are circa 97.7-99m AOD. To the north of the site, levels typically range from 88m-92m AOD and rise to circa 95m AOD at the north-west of the site and 98m AOD at the north-east. At the south-west of the site, levels are approximately 95m-96m AOD. Levels rise again at the south of the development to circa 103m AOD.
Current Use	The site is predominately agricultural land. To the centre of the site there is infrastructure associated with Highmoor Farm.
Previous Use	The Phase 2 ground investigation undertaken by Remada Geo Consultants in July 2025 indicates that the site has formerly been

		unoccupied fields. Buildings associated with Highmoor Farm were assumed to be erected circa 1965. There has previously been a Mill Pond / Reservoir to the south-west of the site which has been infilled / drained and is now Highmoor Car Park.
Watercourses		There are 2no. watercourses which flow adjacent to the northern and southern boundaries of the site flowing to Mearley Brook and Shaw Brook respectively. On the Environment Agency (EA) Flood Map for Planning, Shaw Brook is classified as a Main River.
Boundaries	**North**	Mearley Brook and greenfield land beyond.
	East	Greenfield land.
	South	Greenfield land and pond.
	West	Highways and residential development.
Access	**Vehicular**	Highmoor Park (highway) to the west of the site provides access to the unnamed lane which bisects the site.
	Pedestrian	Highmoor Park (highway) to the west of the site also provides pedestrian access to the unnamed lane which bisects the site. There are a series of paths located within the greenspace areas surrounding the development.

2.2 The total site area is 5.16 hectares and comprises of greenfield land. Highmoor Farm and associated buildings are located at the centre of the site but are not classified as being within the development boundary.

2.3 The site can be seen from an aerial photograph in Figure 1 below.

Figure 1 - Site Plan (Source: Google Earth Pro, 2025)

Proposed Development

2.4 The development proposals are to provide a residential development providing 124 units comprising of apartment blocks, bungalows, mews, semi-detached and detached dwellings.

2.5 As part of the development proposals there is to be associated highway infrastructure, parking and a mixture of hard and soft landscaping throughout the site.

2.6 The development masterplan is provided in Appendix B.

2.7 Vehicular access is proposed via the existing Highmoor Park (highway) located to the west of the site.

2.8 Pedestrian footpaths are located throughout the site.

3.0 POLICY & GUIDANCE

DEFRA 2025 National Standards for Sustainable Drainage Systems

3.1 The DEFRA guidance document National Standards for Sustainable Drainage Systems was published 30th June 2025. The national standards provide information for designers, property developers, local authorities and other interested parties, such as sewerage undertakers and the Environment Agency.

3.2 The principles for surface water drainage design explain the objectives and approach for applying the standards.

3.3 There are 2 types of standards:

3.3.1 The hierarchy standard (standard 1) gives criteria for prioritising the choice of final runoff destination

3.3.2 Fixed standards (standards 2 to 7) state the minimum design criteria that all surface water drainage systems should satisfy and how they should be built, maintained and operated

3.4 Both types of standards have accompanying requirements which provide detail on how to interpret, deliver and evaluate each standard.

National Planning Policy Framework

3.5 The National Planning Policy Framework (NPPF) was published in England in March 2012 and the latest re-issue on 12th December 2024.

3.6 The NPPF is to ensure that flood risk is taken into account at all stages of the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk.

3.7 This document has been prepared in accordance with the recommendations and the policies contained within the NPPF 2024.

Planning Policy Guidance

3.8 The Planning Policy Guidance for flood risk and coastal change advises how to take account of and address the risks associated with flooding and coastal change in the planning process.

3.9 Proposed developments are required to increase the promotion of Natural Flood Management (NFM) techniques in new developments with specific emphasis on de-culverting and re-naturalisation of watercourses.

3.10 More emphasis on SuDS providing the '4 pillars' of SuDS which are: water quantity, water quality, biodiversity and amenity is also required.

Flood and Water Management Act 2010

3.11 The Flood and Water Management Act 2010 received Royal Assent on 8th April 2010. This Act provides duties on the Environment Agency, Local Authorities, Developers and other bodies to manage flood risks.

LLFA Technical Requirements

3.12 The LLFA for the area is Lancashire County Council. An approach is to be made to the LLFA for pre-development enquiry advice. Once advice is received, this should be incorporated into the flood risk consideration and proposed drainage strategy for the development.

3.13 Lancashire County Council have previously been approached for a similar development at the site in 2020 during outline planning stage. At this stage, the LLFA provided the following conditions;

Condition 1 (final surface water drainage scheme):

No development shall commence until final details of the design and implementation of an appropriate surface water drainage scheme have been submitted to and approved in writing by the local planning authority. Those details shall include:

a) Evidence of an assessment of the site conditions to include site investigation and test results to confirm infiltrations rates;

b) A final surface water drainage layout plan; appropriately labelled to include all pipe/structure references, dimensions, design levels, finished floor levels and external ground levels (in AOD);

c) A full set of flow calculations for the surface water drainage network. The calculations must show the full network design criteria, pipeline schedules and simulation outputs for the 1 in 1 year, 1 in 30 year and 1 in 100 year return period, plus an additional 40% allowance for climate change and a 10% allowance for urban creep. The calculations must demonstrate that surface water runoff will not exceed the existing pre-development greenfield runoff rates and volumes for the corresponding rainfall event;

d) A final site plan showing all on-site surface water catchment areas, i.e. areas that will contribute to the proposed surface water drainage network;

e) Confirmation of how surface water is to be managed within any non-drained areas of the site, i.e. gardens and public open space;

f) A final site plan showing all overland flow routes and flood water exceedance routes, both on and off site;

g) Details of any measures taken to prevent flooding and pollution of the receiving groundwater and/or surface waters, including watercourses; and

h) Details of an appropriate management and maintenance plan for the surface water drainage network over the lifetime of the development.

The scheme shall be implemented in accordance with the approved details prior to first occupation of any of the approved dwellings, or completion of the development, whichever is the sooner. Thereafter the drainage system shall be retained, managed and maintained in accordance with the approved details.

Reasons:

1) To ensure that the proposed development can be adequately drained;

2) To ensure that there is no flood risk on or off the site resulting from the proposed development;

3) To ensure that water quality is not detrimentally impacted by the development proposal; and

4) To ensure that appropriate maintenance mechanisms are put in place for the lifetime of the development.

Condition 3 (construction phase surface water management plan):

No development shall commence until details of how surface water and pollution prevention will be managed during each construction phase have been submitted to and approved in writing by the local planning authority.

Reasons:

1)To ensure that the construction phase(s) of development does not pose an undue flood risk on site or elsewhere;

2) To ensure that any pollution arising from the development as a result of the construction works does not adversely impact on existing or proposed ecological or geomorphic condition of water bodies.

3.14 The LLFAs full response can be found in Appendix C.

4.0 EXISTING SITE CHARACTERISTICS

4.1 To the centre of the site there is Highmoor Farm with associated buildings however, this is not considered to be within the development boundary.

4.2 The site is predominately greenspace with the exception of the unnamed lane which bisects the site and provides vehicular and pedestrian access.

Greenfield Runoff Rates – Developable Area

4.3 The total developable area of the site, including the basin area and excluding remaining permeable POS, is 3.973ha.

4.4 An assessment of the existing greenfield runoff rates for the developable area has also been undertaken using Flow. Calculations are summarised in the table below.

Return Period (Yr.)	Existing Runoff Rate (l/s)
1 Year	32.6
30 Year	63.7
100 year	78.0
QBar	37.5

4.5 The greenfield runoff rate (QBar) for the 3.973ha developable area of the site has been calculated as 37.5l/s.

4.6 The greenfield runoff calculations are provided in Appendix E.

Existing Public Sewers

4.7 United Utilities are the sewer provider for the area. UU sewer records are attached in Appendix N

4.8 Given that the site is greenfield, it is likely that there are no sewers within the development boundary. However, there are likely to be sewers serving Highmoor Farm located within the centre of the site.

4.9 To the east of the site, in Highmoor Park (highway), Google Earth (2025) shows the presence of manholes indicating that there is a sewer system present within the vicinity of the site.

Watercourses, Land Drainage and other Waterbodies

4.10 Mearley Brook is located to the north of the site. The watercourse flows west at this location before ultimately flowing towards the River Ribble south-west of the site.

4.11 Shaw Brook is located to the south of the site and flows west in this location. Shawbrook is culverted to the west of the site, outside of the site boundary.

4.12 Shaw Brook is classified by the EA as a main river.

5.0 PHASE 2 GROUND INVESTIGATION

5.1 A Phase 2 Ground Investigation was carried out by Remada Geo Consultants in 2025. A summary of the investigation can be found in Appendix F.

Historical Land Use

5.2 The Phase 2 Ground Investigation indicates that from 1847, when the earliest available mapping is dated, the site was unoccupied fields. The mapping indicates that the lane which runs through the site is present at this time.

5.3 In 1886, Highmoor Farm occupied the site.

5.4 Previously, there has been a Mill Pond / Reservoir which appears to have been infilled / drained and now comprises Highmoor Car Park.

5.5 The ground investigation also suggests that a small area of the site was recorded as being occupied by a refuse tip in 1965 but this is not confirmed.

Geology

5.6 As part of the Phase 2 Ground Investigation, window samples, trial pitting, soakaway testing and groundwater monitoring was conducted along with chemical and gas monitoring.

5.7 The investigation indicates that made ground was encountered at one location. Topsoil was encountered at all other locations and comprised slightly clayey sand.

5.8 Superficial deposits were encountered across the site and comprised gravel and clay. Gravel comprised of mudstone, sandstone and local limestone.

5.9 Bedrock was not encountered across the site.

BRE365 Soakaway Testing

5.10 3no. soakaway tests were undertaken in accordance with the BRE365 specification.

5.11 A reduction in water level from 75% to 50% of the pit volume was not achieved within a 24 hour period during soakaway testing.

5.12 The 3no. tests were therefore not sufficient to provide infiltration.

Groundwater

5.13 10no. of the trial pits were recorded as being damp at 0.6 metres below ground level (m.bgl) or lower.

5.14 Groundwater was encountered at WS1 at 3m.bgl.

5.15 Within all monitoring wells, groundwater levels were recorded at depths of between 0.2m.bgl and 2.6m.bgl.

6.0 FLOOD RISK SOURCE

6.1 Shape Engineering has considered all forms of flooding in accordance with National Planning Policy. Information has been obtained from the Government Website relating to flood risk and is summarised below.

Fluvial Flood Risk

6.2 Fluvial flooding (River Flooding) is defined as flooding resulting from a river overflowing its banks onto adjacent land. This can be caused by heavy rainfall, blocked channels, high tide levels, urbanisation or a combination of these.

6.3 Examination of flood maps from the EA shows that the site for the most part is located within an area classified as Flood Zone 1. The risk of flooding is classified as very low and having a 0.1% (1 in 1000) chance of flooding.

6.4 The Ribble Valley Strategic Flood Risk Assessment (2017) states the following regarding the Clitheroe area;

The Low Moor area of Clitheroe is at risk of flooding from the River Ribble, whereas other parts of Clitheroe are at risk of flooding from Mearley Brook.

6.5 A small extent of the site, to the west, is classified as being located within Flood Zones 2 and 3. Flood Zone 2 is classified as having between a 0.1% (1 in 1000) and 1% (1 in 100) chance of flooding. Flood Zone 3 is classified as having a 1% (1 in 100) or greater chance of flooding.

6.6 No new development is proposed within Flood Zones 2 or 3.

6.7 See the flood risk for the site in Figure 3 below and Appendix G.

Figure 3 - Environment Agency's Flood Map for Planning (Source: EA Product 4 2025)

Pluvial Flood Risk

6.8 Pluvial flooding is defined as flooding resulting from rainfall-generated overland flow before runoff enters any watercourse or sewer.

6.9 The site is at risk of surface water flooding. The site is at risk of flooding from surface water during all events above and including the 3.3% AEP (1 in 30) event.

6.10 Figure 4 below shows the surface water flood risk during the 1 in 30 year (3.3%) AEP event.

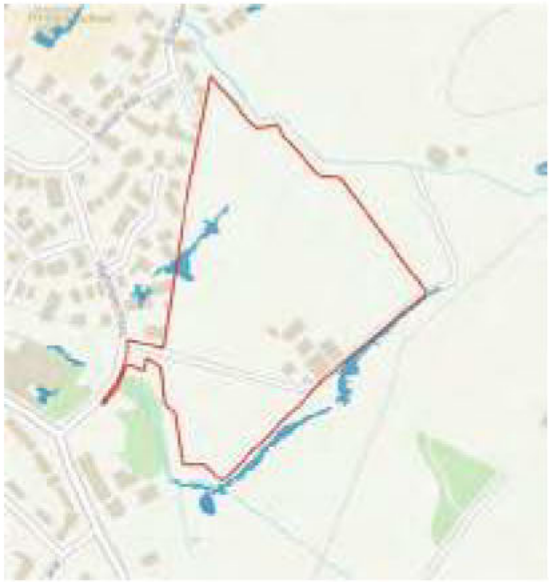


Figure 4 - Environment Agency's flooding from surface water 1 in 30 AEP
(Source: EA online maps 2025)

6.11 Figure 5 below shows the surface water flood risk during the 1 in 100 year (1%) AEP event.

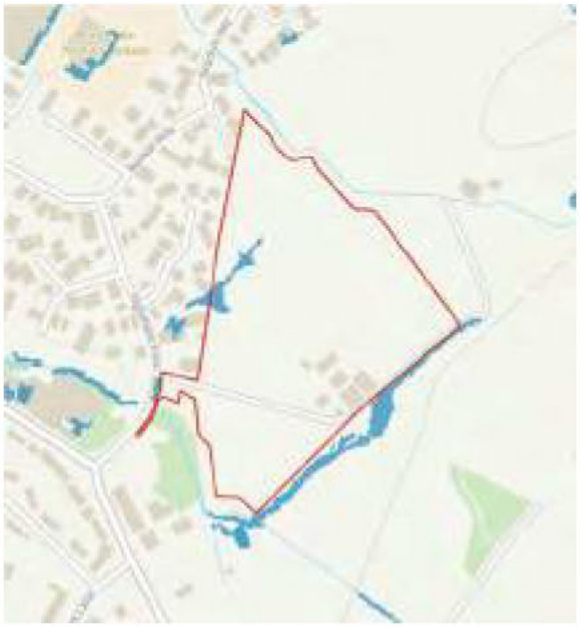


Figure 5 - Environment Agency's flooding from surface water 1 in 100 AEP
(Source: EA online maps 2025)

6.12 Areas at risk of surface water flooding at the site during the 1 in 1000 year (0.1% AEP) event are shown in Figure 6.

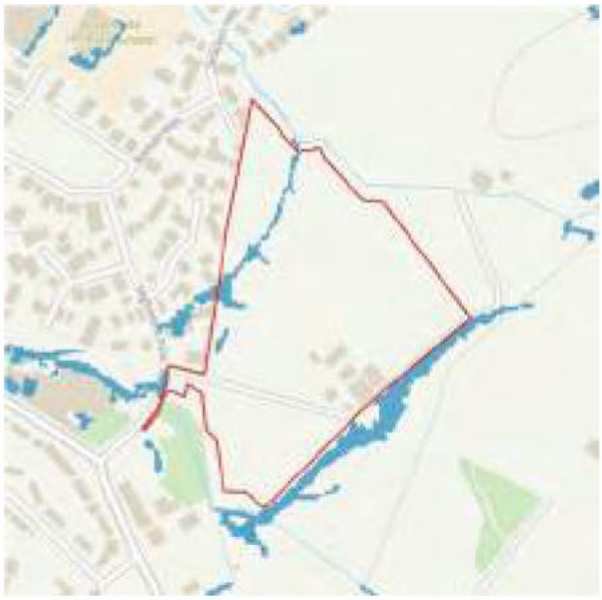


Figure 6 - Environment Agency's flooding from surface water 1 in 1000 AEP

6.13 Surface water flooding is mostly shown at the northern extent of the site.

6.14 Surface water flooding is also shown to be located at the south-eastern extent of the site, outside of the development boundary. Surface water in this area is shown to encroach on the existing unnamed lane and not beyond towards the site.

6.15 The areas highlighted at being at risk of surface water flooding to the north are to be a mixture of dwellings and highways. FFLs of dwellings in this region are circa 96.8m – 95.6m AOD. Levels fall either north towards the basin or west towards ditches adjacent to private highways.

6.16 Therefore, any surface water in this area would be directed away from dwellings towards ditches or ponds as part of the development proposals.

Environment Agency Reservoir or Canal Failure Flood Map

6.17 The Environment Agency website shows that the development site is not at risk of flooding from reservoirs or canal failures.

Groundwater Flood Risk

6.18 The Environment Agency define ground as: *'water that is usually held in rocks and soil underground. Groundwater flooding happens when this water rises and flows above the surface.'*

6.19 Groundwater flooding can occur from, raised water tables, seepage and percolation, and groundwater recovery or rebound.

6.20 The Ribble Valley Strategic Flood Risk Assessment (2017) states that;

Following consultation with the EA, no evidence of groundwater flooding in the area has been identified.

6.21 During the intrusive site investigations, completed as part of the Phase 2 Ground Investigation, groundwater was encountered across the site and damp ground was also indicated at numerous excavation locations.

6.22 The Phase 2 Ground Investigations indicates that the site is not located within a groundwater source protection zone.

6.23 MagicMaps online indicates that the site is located within a medium-low groundwater vulnerability area.

6.24 When natural groundwater levels are close to the surface, an increased risk of flooding can occur during intense rainfall.

Sewer Flood Risk

6.25 The Ribble Valley Strategic Flood Risk Assessment (2017) states the following regarding the Clitheroe area;

This area does not have a significant sewer flooding (DG5) problem, although actual theoretical risk of such flooding is unclear.

Summary of Flood Risk

Source	Definition	Likelihood
Fluvial	River Flood	Low
Pluvial	Surface Water Flooding	Low to Medium
Coastal - Sea	Tidal Surge	Not Applicable
Coastal - Estuarine	Tidal Surge	Not Applicable
SWS, FWS, CS, CSO	Sewer Flooding	Low
Groundwater	Emergence from ground	Medium

7.0 SURFACE WATER MANAGEMENT

Standard 1: Runoff Destinations

7.1 As set out in the DEFRA guidance document National Standards for Sustainable Drainage Systems, Standard 1: Runoff Destinations;

7.2 *A 'SuDS approach' shall be adopted to address the management of surface water by the development and where it should be discharged. Runoff shall be treated as a resource and managed in a way that avoids negative impacts of the development on flood risk, the morphology and water quality of receiving waters and the associated ecology.*

7.3 *Runoff from the development shall be discharged to the following final destinations, to the maximum extent practicable, in accordance with the below hierarchy:*

7.3.1 Priority 1: collected for non-potable use

7.3.2 Priority 2: infiltrated to ground

7.3.3 Priority 3: discharged to an above ground surface water body

7.3.4 Priority 4: discharged to a surface water sewer, or another piped surface water drainage system

7.3.5 Priority 5: discharged to a combined sewer

Priority 1: Collected for Non-potable Use

7.4 *Rainwater harvesting shall be considered in all circumstances where any of the following apply:*

7.4.1 There is a demand for non-potable water and available contributing catchment area that will deliver safe and efficient water savings.

7.4.2 There is a need for landscape irrigation.

7.4.3 The development is in an area identified as seriously water stressed.

7.5 There is no demand for non-potable water identified through pre-development applications with planners, the lead local flood authority or through the developers own viability assessments for the site.

7.6 There is very limited landscaping on the site, with the vast majority comprising of private gardens and remaining public open space areas with low-maintenance landscaping.

7.7 As noted in the Environment Agency Report: Water Stressed Areas - 2021 classification published 1st July 2021. The site is not located in an area determined to be not seriously stressed for metering.

7.8 Therefore, rainwater harvesting does not need to be considered under this standard. However, the developer has proposed to utilise Water Butts to selected properties throughout the development, to provide an element of non-potable use.

Priority 2: Infiltration to Ground

7.9 *The DEFRA standard states:*

7.9.1 The use of infiltration drainage shall be dependent on the ground conditions being suitable and adequate infiltration rates being identified using the assessment methods detailed in standard 3.

7.9.2 The approving body may consider appropriate industry mapping to form an initial evidence base on the appropriateness of infiltration and whether further ground investigations are necessary.

7.10 The Phase 2 Ground Investigation carried out by Remada Geo Consultants involved 3no. soakaway tests being undertaken in accordance with the BRE365 specification.

7.11 A reduction in water level from 75% to 50% of the pit volume was not achieved within a 24 hour period during soakaway testing.

7.12 The 3no. tests were therefore not sufficient to provide infiltration and infiltration is therefore not considered a feasible method for the disposal of surface water runoff from the site.

7.13 However, as part of the proposed drainage strategy, ditches are proposed adjacent to private highways at the north-western extent of the site to collect water from adjacent impermeable areas and direct flows towards the basin to the north. The ditches will support infiltration where possible, to mitigate surface-level ponding to permeable areas.

7.14 To remaining private highway areas, a permeable surfacing is proposed to collect surface water before ultimately providing connectivity to the proposed surface water system.

Priority 3: Discharge to an above ground surface water body

7.15 There are 2no. watercourses which flow adjacent to the northern and southern boundaries of the site. These watercourses flow to Mearley Brook and Shaw Brook respectively.

7.16 On the Environment Agency (EA) Flood Map for Planning, Shaw Brook is classified as a Main River.

7.17 The topographical survey indicates that levels at the site generally fall away from the existing buildings at the centre of the site in Northern, Eastern and South-Eastern direction.

7.18 Therefore, discharge of surface water by watercourse to the north is considered feasible for the development site.

7.19 The LLFA are to be consulted with regards to discharging into the existing watercourses at the site.

Priority 4: Discharge to a surface water sewer or another piped surface water drainage system

7.20 United Utilities Asset maps have not been obtained.

7.21 Given that the site is predominantly greenfield, it is considered unlikely that there is a surface water network within the development site.

7.22 United Utilities were consulted with similar development proposals for a development at the site in 2020. In their response, United Utilities stated;

Condition 1 – Surface water

The drainage for the development hereby approved, shall be carried out in accordance with principles set out in the submitted Flood Risk Assessment (Ref No.: 18522, Dated: Jan 2021) which was prepared by Topping Engineers. No surface water will be permitted to drain directly or indirectly into the public sewer. Any variation to the discharge of foul shall be agreed in writing by the Local Planning Authority prior to the commencement of the development. The development shall be completed in accordance with the approved details.

7.23 United Utilities full response can be found in Appendix H.

7.24 Therefore, it is considered unlikely that connectivity to a surface water sewer system will be feasible at the site for the main surface water network

7.25 A small length of highway drainage at the site entrance is proposed to discharge into existing surface water system in Highmoor park road, at a restricted rate

Priority 5: Discharge to a combined sewer

7.26 United Utilities Asset maps have not been obtained.

7.27 As discussed in priority 4 above, UU have previously been consulted with similar development proposals in 2020.

7.28 In their response, United Utilities also stated;

Condition 2 – Foul water

Foul and surface water shall be drained on separate systems.

Reason: To secure proper drainage and to manage the risk of flooding and pollution.

7.29 It is therefore unlikely that connectivity into a combined system, even if present within the vicinity of the site, would be accepted by United Utilities.

Climate Change

7.30 The updated EA allowances have now been directly linked to River Basin Catchments. The climate change allowance has been reviewed using the Environment Agency's website to locate the River Basin Catchment for the site's location.

7.31 The site is in the Ribble Management Catchment. The below Figure 7, an extract from the Environment Agency's website, indicates the climate change considerations for this catchment.

Ribble Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch

	Central allowance	Upper end allowance
2050s	25%	35%
2070s	30%	40%

1% annual exceedance rainfall event

Epoch

	Central allowance	Upper end allowance
2050s	25%	40%
2070s	35%	50%

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

Figure 7 - Environment Agency's climate change considerations (Source: EA website 2025)

7.32 As recommended by the EA, both the central and upper end allowances have been considered for the purpose of surface water drainage strategy and assessment of exceedance flow pathways.

7.33 Therefore, the climate change allowance for the site has been identified at 40%.

8.0 SUDS ASSESSMENT

8.1 A SUDS assessment for the proposed development site has been completed. SUDS techniques for the development site have been considered in the table below:

SuDS Technique	Suitable for This Development?	Reasoning
Green Roof	×	Impractical due to the residential nature of development.
Rainwater Harvesting	✓	Water butts will be used at some of the dwellings.
Basins or Ponds	✓	Suitable as a form of attenuation storage without infiltration.
Filter Strips	× & ✓	The Phase 2 ground investigation indicates that infiltration is not a feasible method for the disposal of surface water runoff from the site. However, filter strips could be utilised in soft landscaped areas to aid filtration of permeable areas, mitigating overland flows during exceedance events.
Swales/Ditches	✓	Small conveyance ditches may be suitable adjacent to private driveways to the north of the development to collect and convey surface water run off.
Soakaways	×	The Phase 2 ground investigation indicates that infiltration is not a feasible method for the disposal of surface water runoff from the site.
Rain Gardens	× & ✓	The Phase 2 ground investigation indicates that infiltration is not a feasible method for the disposal of surface water runoff from the site. However, rain gardens could be utilised in soft landscaped areas to aid infiltration of permeable areas, mitigating overland flows during exceedance events
Permeable Surfaces	× & ✓	The Phase 2 ground investigation indicates that infiltration is not a feasible method for the disposal of surface water runoff from the site. However, lined permeable surfaces with positive discharges to the sewer could be utilised in private areas, to improve water

		quality and accommodate for interception while providing a form of source control.
Tank / Oversized Pipe Systems	✓	Suitable.

8.2 The SUDS assessment suggests that several options are available for SUDS techniques on the site.

8.3 The topography of the site is likely to limit the ability of above ground SUDS features. The features used are therefore restricted to methods not involving infiltrating to the ground and above ground methods providing wider benefits such as ditches, water butts and permeable surfacing.

9.0 SURFACE WATER DRAINAGE STRATEGY

9.1 A proposed Drainage Strategy drawing has been provided in Appendix I. The drainage strategy is subject to detailed design and coordination with other design elements of the proposed development.

9.2 The main drainage network is to be adopted under a S104 agreement and will comprise storage tanks, oversized pipes, ditches, permeable surfacing and a basin.

9.3 A smaller highway drainage network at the site entrance will remain private and is subject to approval from the Local Highway Authority

9.4 The proposed developable impermeable area for the site is estimated to be 2.348ha (subject to detailed design) which consists of houses, private access, footpaths and highways. All these areas will generate surface runoff.

9.5 The discharge rate is based on the existing 40% AEP greenfield runoff (QBar) rate for the developable area of the full site as noted in Section 4. The QBar rate for this area has been calculated as 37.5/s (Appendix E).

9.6 A rate of 35l/s is therefore proposed for the flow control upstream of the detention basin.

9.7 A rate of 2.5l/s is therefore proposed for the flow control unit on the highway drainage network

9.8 Therefore, discharge rates for the developed site, will mimic the existing, undeveloped conditions.

9.9 Additional flow controls are to be used throughout the site, downstream of oversized pipes and attenuation tanks in the surface water system network.

9.10 Flow control details can be found in Appendix J.

9.11 Due to the nature of the proposed development, urban creep is to be considered to allow for future urban expansion within the development. An increase in paved surface area of 10% has been incorporated into the detailed surface water calculations.

9.12 As noted above in the hierarchy review, discharge of surface water runoff to the existing watercourse to the north of the site is the preferred method for the purpose of this report.

9.13 Due to the natural topography of the site, it will be possible to discharge into the watercourse via gravity.

9.14 The surface water drainage strategy for the development will be to collect and convey the surface water runoff and mitigate flood risk to the site, surrounding areas and downstream, by restricting the discharge rate into the culverted watercourse/existing surface water network and provide suitable attenuation within the development boundary.

9.15 Ditches are to be utilised adjacent to private highways to capture surface water runoff from impermeable areas during exceedance events, mitigating the risk of overland flooding. Ditches will be utilised to convey surface water runoff from these areas towards the basin at the north.

9.16 Water butts are proposed at some dwellings throughout the site to collect rainfall and minimise flows entering the surface water system.

9.17 A permeable surfacing is proposed to the east of the site in private highways to intercept rainfall. The permeable tarmac will also provide a form of source control prior to water entering the surface water network and being directed towards the basin.

9.18 Land drains are utilised to capture surface water runoff from permeable soft landscaped areas including rear gardens during exceedance events, mitigating the risk of overland flooding and surface level ponding. The land drains will also support interception of rainfall during low intensity rainfall events.

9.19 The land drains have been routed through the development site in a direction to maintain, as close as reasonably practicable, a route for surface water runoff to mimic the existing condition and prevent exceedance flows, that are not captured for interception or infiltration, eventually discharging to the watercourse to the eastern boundary.

9.20 Rain gardens have been proposed to some of the land drains to further support with interception and limited infiltration prior to surface water continuing overland towards the watercourse as per the existing undeveloped site condition.

9.21 Surface water flows at the site are to be restricted, therefore attenuation will be required for the site. The attenuation volume for the development site has been calculated based on an impermeable area of 2.348ha and will cater for up to the 1 in 100-year storm + 40% climate change.

9.22 Surface water pipes are to be used across the site to convey the surface water and where oversized will provide attenuation for all storm events up to and including the 1 in 30 year plus 40% climate change event.

9.23 Flows from site, up to and including, 1 in 100 years plus 40% climate change event will be attenuated within online and offline tanks located throughout the site. The location of tanks can be seen in Appendix I.

9.24 The detention basin located to the north of the site has been sized to accommodate storms up to and including the the 1 in 100 year plus 40% climate change event and provides approximately 636m^3 of storage.

9.25 The basin will discharge into the watercourse at the northern extent of the site.

9.26 The small length of highway drainage at the site entrance will be attenuated within the surface water pipe up to and including the the 1 in 100 year plus 40% climate change event

9.27 The calculations provided in Appendix K prove that the proposed drainage apparatus can sufficiently control and attenuate surface water runoff to meet this criteria.

9.28 A storage estimate for the development site has concluded that a total storage of between 2,474^3 and 3,972m^3 of storage will be required for the 30-year plus 40% climate change storm event, as Figure 8 below.

Figure 8 - Quick Storage Estimate for 30yr+40% Storm event (Flow

9.29 A storage estimate for the development site has concluded that between 3,468m³ and 5,109m³ of total storage will be required for the 100-years plus 40% climate change storm event, as Figure 9 below.

Figure 9 - Quick Storage Estimate for 100yr+40% Storm event (Flow 2025)

9.30 Attenuation will be provided in the form of oversized pipes, a basin and a combination of online and offline cellular storage tanks.

9.31 Storage tanks at the site will also ultimately discharge into watercourse at the northern extent of the development site.

10.0 DESIGN PARAMETERS

Urban Creep

10.1 A 10% urban creep allowance has been included added as 'additional area' in simulation calculations for the 30 year and 100 year storm events plus climate change.

10.2 The impermeable area for the site is estimated to be 3.973ha. When accounting for 10% urban creep, the impermeable area of the site is 4.370ha.

10.3 The surface water calculations are provided in Appendix K.

Impermeable Areas

10.4 A surface water catchment plan has been provided in Appendix D.

10.5 The surface water catchment plan has been utilised to inform the contributing areas within the surface water calculations.

10.6 The drainage system has been designed based on the impermeable areas of the site only.

'Non-drained' Areas

10.7 As shown on the surface water catchment plan, Appendix D, there are areas which have not been considered to contribute towards the impermeable area within the surface water drainage calculations.

10.8 These areas may include; roadside verges, private gardens and areas of public open space.

10.9 These areas are not shown on the catchment plan as they are either permeable, drain onto a permeable surface or the water shedding from these areas is considered to be negligible and therefore will not significantly contribute to the surface water drainage system.

10.10 However, a volumetric runoff coefficient value of 1.0 has been applied to the design to make an allowance for runoff from these areas.

10.11 Ditches have been provided at the western extent of the site adjacent to private highways to capture surface water runoff from adjacent impermeable areas during exceedance events to improve infiltration locally while mitigating overland flooding.

10.12 The greenfield discharge rate for the development has not considered the non-drained areas within the calculation. Therefore, allowing non-drained areas to infiltrate or providing ditches to direct these flows towards the existing northern basin, the post-developed site will mimic the existing condition surface water discharge.

Surrounding Flow Routes

10.13 Surface water flows from outside of the development boundary should be considered where applicable, when applying contributing area to the proposed SUDs at the site.

10.14 The EA surface water flood mapping shows that there are areas at risk of surface water flooding at the northern extent of the site.

10.15 As part of the adjacent development proposals, the site will fall towards this area and beyond to the basin located in the north. Therefore any surface water in this area will also be directed towards the basin.

10.16 Drainage channels / gullies have been proposed to the new highways / shared parking areas adjacent to the highways to prevent surface water runoff from the site entering the existing highway.

Mitigation of Surface Water Runoff

10.17 There is the potential for increased surface water runoff to be generated from the development boundary.

10.18 Surface water flood exceedance routes have therefore been considered, and a flood exceedance plan has been provided in Appendix L.

10.19 Water butts are proposed at selected dwellings to improve local infiltration of permeable areas and mitigate overland flooding during exceedance events.

10.20 All finished floor levels at the development site are to be set 150mm above external levels to minimise the likelihood of surface water flows entering properties.

Surcharged Outfall

10.21 Within the surface water calculations, a surcharged outfall has been applied.

10.22 The surcharged outfall has been provided at 1.0m above the soffit level of the receiving watercourse in the drainage calculations.

10.23 This surcharge has been applied at all times to all storm intensities and durations that have been simulated.

Natural Flow Routes

10.24 In line with the National Planning Policy Framework and Planning Practice Guidance, developments should be designed so that natural flow routes are not disrupted and that any surface water that enters the site from off-site sources is conveyed safely around or through the site.

10.25 The existing natural flows have been considered within the development proposals.

10.26 All surface water runoff from site is to be directed towards the existing watercourse to the north as per the existing arrangement.

10.27 This will direct surface water runoff away from proposed dwellings at the site and/or existing properties offsite.

Modelling Parameters

10.28 Within the surface water runoff calculations, the following modelling parameters have been used for a conservative approach to the drainage network of the site.

10.29 The FSR rainfall runoff method has been used for surface water calculations.

10.30 As stated in Ciria 753 (2015) Page 509 Design Rainfall: Although FEH can be used for durations as short as 30 minutes, flood estimation guidance from the EA (2015) currently recommends that, for shorter durations, FSR rainfall statistics should be used to scale down the corresponding FEH 1-hour rainfall.

10.31 The FSR data utilises sub-hourly rainfall information to accurately analyse shorter storm events. The simulation calculations indicate that the 15 minute storm duration is critical, supporting the rational that FSR method is practical to this site.

10.32 Run-off coefficient value (Cv) has been updated to 1.0 as per LLFA requirements.

10.33 Maximum Rainfall has been set to 150mm/hr. However, this value is only used within the software for preliminary pipe sizing and not in simulation.

10.34 Madd Factor has been set to 0 on all calculations. Note that this is referenced as "Additional Storage (m3/ha) within the software used (Causeway Flow).

10.35 A 1.0m surcharged outfall has been applied to all storm event simulations.

10.36 A 40% climate change allowance has been applied to the 30-year storm event simulation.

10.37 A 40% climate change allowance has been applied to the 100-year storm event simulation.

10.38 10% Urban Creep allowance has been applied to all storm event simulations.

11.0 DEFRA NATIONAL STANDARDS FOR SUSTAINABLE DRAINAGE SYSTEMS (SUDS) – FIXED STANDARDS 2-7

Standard 2: Management of Everyday Rainfall (Interception)

> 2.1 Apply a 'SuDS approach' so that at least the first 5mm of rainfall for the majority of rainfall events does not result in runoff from the site to surface waters or piped drainage systems.
>
> 2.2 Evidence shall be provided that the approach to managing runoff from 'everyday' rainfall has been developed alongside and in support of the management of runoff quality (standard 4) and the delivery of amenity and biodiversity benefits (standards 5 and 6).

Figure 10 – Standard 2 wording

Rainwater Harvesting

11.1 This standard is applied where there is consistent daily demand for non-potable water. Which, as discussed in Chapter 7, is not a requirement for this development.

11.2 However, water butts are proposed at selected dwellings across the site to provide an element of non-potable use.

11.3 Therefore, it is considered that the rainwater harvesting proposals exceed the requirement for the site.

Permeable Surfaces

11.4 The guidance states: *All permeable surfaces, whether lined or not, shall be assumed to comply, provided there is no additional area drained to the permeable pavement.*

11.5 Therefore, all landscaped areas, including rear gardens comply with this standard.

11.6 Due to the nature of the development containing adoptable highways, compliance with local highway authority standards is required, which do not allow for permeable finishes. Therefore, it is not possible to provide interception, at source, to these areas.

11.7 Permeable surfacing is proposed to private highways to collect surface water runoff before ultimately contributing to the surface water network.

11.8 Ditches are proposed adjacent to private access roads to collect runoff and convey flows to the basin, while supporting interception and infiltration where possible.

Swales

11.9 Ditches are proposed adjacent to private access roads to collect runoff and convey flows to the basin, while supporting interception and infiltration where possible.

11.10 The area of ditches is approximately 120m² in total. In accordance with the standards, this will provide suitable interception for 600m² impermeable areas (5 x Area).

Detention Basin

11.11 A detention basin with a surface area of 633m² will serve the entire surface water network.

11.12 In accordance with the standards, this will provide suitable interception for 3,165m² impermeable areas (5 x Area), which is greater than the entire site impermeable catchment area.

11.13 Therefore, this standard has been fully considered and interception in excess of the requirements has been provided.

Standard 3: Management of Extreme Rainfall and Flooding

3.1 A 'SuDS approach' shall be adopted to address the management of development runoff during extreme rainfall, including allowances for climate change and urban creep to:

- protect people and property on the development from flooding of the surface water drainage system
- mitigate any increased flood risk to people and property adjacent to or downstream of the development
- protect the receiving water body from morphological damage or minimise the impact on sewer capacity

3.2 When discharging to an infiltration feature, the system shall be appropriately sized to accommodate the design event based on ground conditions and contributing areas.

3.3 When discharging to an above ground surface water body, sewer or other piped drainage system, the surface water runoff (rate and volume) for the 1% annual exceedance probability (AEP) event shall be controlled to ensure the runoff from the development does not increase flood risk elsewhere.

3.4 When discharging to an above ground surface water body, sewer or other piped drainage system, the surface water runoff rate for the 50% AEP event shall be controlled to ensure development runoff from an event of this magnitude has no negative impact.

3.5 Any flooding from the surface water drainage system for events up to the 1% AEP event shall be managed within the development.

3.6 Any flooding from off-site sources for the 1% AEP event should be managed on site or safely routed through the site, ensuring any downstream risks are not increased compared to the pre-development scenario.

3.7 The risks (both on and off the development) associated with flooding from the surface water drainage system for exceedance events greater than the 1% AEP event shall be appropriately managed.

Figure 11 – Standard 3 wording

11.14 As noted in Chapter 4 and reference to Appendix E, the greenfield run off calculations have been based on the developable area to advise a discharge rate for the 40% AEP (Qbar) required for item 3.4 in Figure 11 above.

11.15 As set out in the Design Parameters in Chapter 10 and the hydraulic calculations provided in Appendix I, the design strategy and details comply with items 3.1, 3.3, 3.4, 3.5 & 3.6 in Figure 11 above.

11.16 The Flood Exceedance Plan provided in Appendix L complies with item 3.7 in figure 11 above.

11.17 Therefore, the drainage strategy fully complies with standard 3 of the DEFRA National standards for sustainable drainage systems (SuDS).

Standard 4: Water Quality

> 4.1 Apply a 'SuDS approach' that protects surface waters, groundwater and coastal waters by managing the quality of the surface water runoff to adequately address water quality risks from the development.
>
> 4.2 The proposed SuDS management train(s) shall be based on a robust water quality risk assessment, appropriate to the pollution hazard and sensitivity of receiving waters, reflecting industry recognised guidance[footnote 21] or other quantitative assessment as agreed with the approving body and permitting requirements[footnote 22]

Figure 12 – Standard 4 wording

11.18 The Simple Index Approach as described in Ciria C753 The SUDS Manual, has been applied to demonstrate the pollutant risk assessment.

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
• Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change eg schools, offices ie - traffic movements/day	Low	0.5	0.4	0.4

	Mitigation Indices		
Types of SuDS component	TSS	Metals	Hydrocarbons
Permeable pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6

11.19 The use of permeable paving to the private highways provides mitigation in excess of the expected generation from the development.

11.20 Residential roofs have a very low pollution hazard level and it is therefore not considered necessary to provide additional pollution control to these areas.

11.21 Standard 4 has therefore been considered and implement where reasonably practicable and necessary.

12.0 FOUL WATER DRAINAGE STRATEGY

Foul Water Capacity and Point of Connection

12.1 The proposed foul network is outlined within the proposed drainage strategy in Appendix I.

12.2 Foul water from dwellings will be collected via a traditional piped network.

12.3 The foul water drainage from the dwellings is proposed to connect via a traditional piped network into an existing sewer at the west of the site, outside of the development boundary in Highmoor Park (highway).

12.4 The exact outfall locations are to be confirmed during detailed design once drainage surveys can confirm the existing sewer locations outfalls to the public sewer are agreed with the sewerage undertaker.

12.5 The proposed foul flows have been calculated using 4000 litres per dwelling per day as per the DCG, and therefore the proposed foul peak flow is 5.74l/s.

13.0 SUMMARY & RECOMMENDATIONS

13.1 Shape Engineering have been commissioned by Morris Homes to provide a Flood Risk Assessment and Drainage Strategy in respect of a planning application for a residential development comprising of 124 units including associated landscaping, access road, highways and private parking at Highmoor Farm, Clitheroe, BB7 1PN.

13.2 The existing site is currently a greenfield site with a total area of 5.16ha.

13.3 The site is mostly located in an area with less than 0.1% risk of fluvial flooding (Flood Zone 1). Small areas of the site are considered to be located within Flood Zones 2 and 3.

13.4 The private drainage network will be designed for up to 1 in 100 year plus an allowance of 40% climate change storm events and consideration will be given to the use of sustainable urban drainage (SuDS) techniques.

13.5 A Phase 2 ground investigation has been carried out for the site. 3no. soakaway tests were undertaken in accordance with the BRE365 specification. The 3no. tests were therefore not sufficient to provide infiltration. Groundwater was encountered at one of the trial pits during infiltration testing.

13.6 There is a watercourse located at the northern boundary of the site. It is therefore proposed to discharge the majority of surface water runoff from the site to the existing watercourse.

13.7 A small section of highway drainage at the site entrance is proposed to discharge into existing surface water network in Highmoor Park Road and will need to be accepted and confirmed by Local Highway Authority

13.8 The proposed surface water discharge rate for the development is to be restricted to the 40% AEP greenfield runoff rate (QBar) calculated for the developable area of the site.

13.9 The total discharge rate for surface water at the site has therefore been calculated at 37.5l/s and will need to be accepted and confirmed by the LLFA. The discharge from the site will be controlled by flow control units.

13.10 This total discharge rate is split between the two proposed networks. 35l/s is proposed to discharge to existing watercourse to the north of the site via the main surface water network. 2.5l/s is proposed to discharge via highway drainage network at the site entrance into existing surface water network in Highmoor Park Road.

13.11 Attenuation will be primarily provided in the form of a detention basin and online attenuation tanks. Additional storage will be provided in the form of oversized pipes located beneath private highways and offline cellular tanks.

13.12 A detention basin is to be located at the northern extent of the site and will provide storage prior to flows entering the watercourse to the north of the site.

13.13 The basin will provide approximately 636m^3 of storage for storms in excess of the 100-year plus 40% climate change flood event.

13.14 Ditches are proposed to the west of the site to collected surface water from impermeable areas and convey flows towards the basin at the north.

13.15 Water butts are proposed at selected dwellings across the site to provide an element of non-potable use.

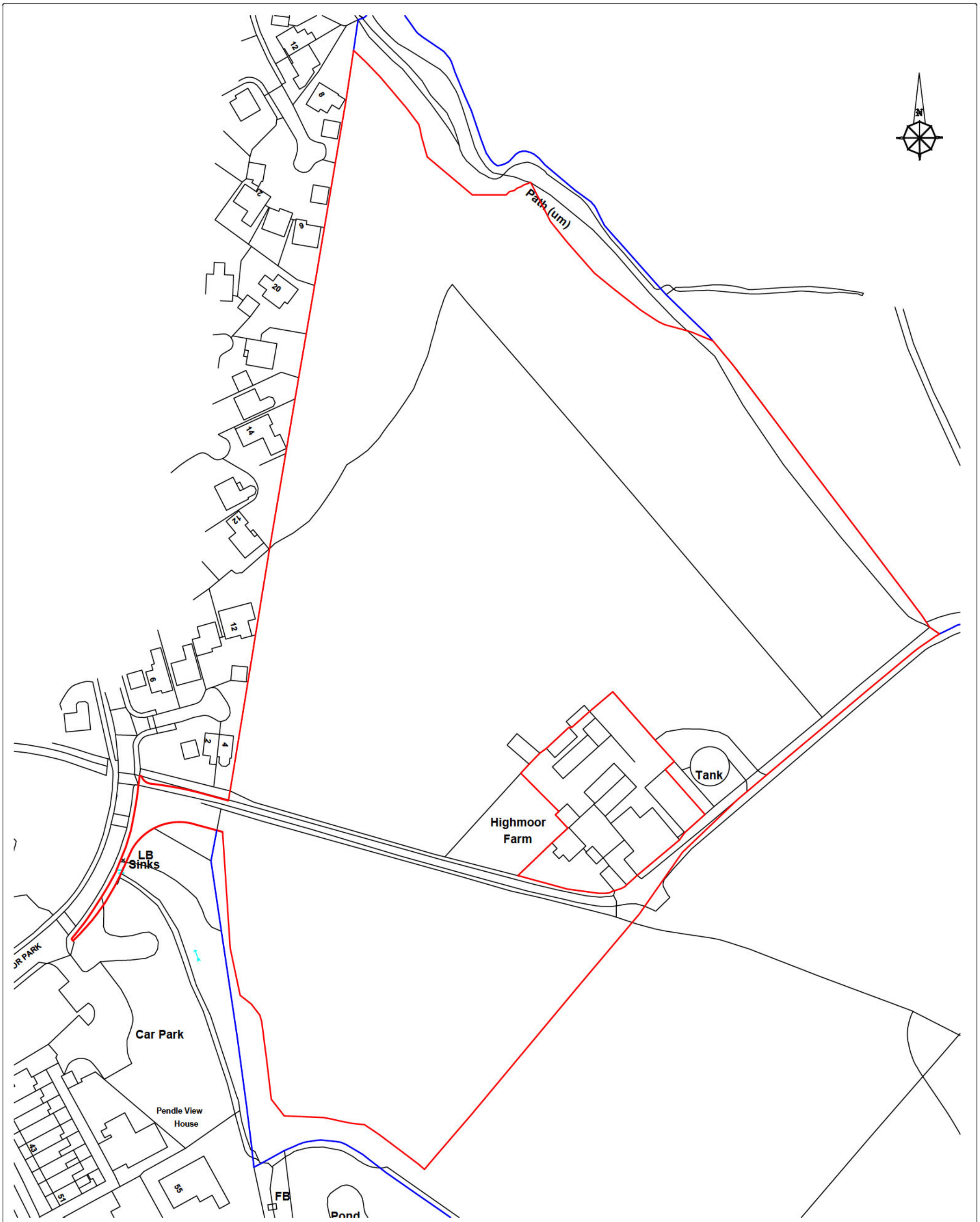
13.16 SuDs features are to be used on site with being implemented in the strategy to improve interception throughout site. These include permeable surface, swales/ditches, land drains and rain gardens.

13.17 The foul water drainage from the dwellings is proposed to connect via a traditional piped network into an existing sewer at the west of the site, outside of the development boundary in Highmoor Park (highway).

13.18 Surface water and foul water proposals are subject to approval and agreement with the EA, LLFA, Local Highway Authority and Sewerage Undertaker (United Utilities).

13.19 The flood risk and drainage strategy proposals will not increase flood risk to the site and surrounding areas.

14.0 APPENDIX A – SITE LOCATION PLAN



Gary Hoerty Associates Chartered Surveyors
Suite 9 - Grindleton Business Centre
The Spinney
Grindleton
Clitheroe
Lancashire BB7 4DH

T: 01200 449700
Email: info@ghaonline.co.uk

Drawing No: VHLP/778/2576/02

Project: (No: VHLP.778.2576)

Proposed Development of Land at

Highmoor Farm
Clitheroe

Title: Site Plan

Notes:
All work is to be carried out to the latest current British standard Codes of Practice and recognised working practices. All work and materials should comply with Health and Safety legislation. All dimensions are in millimetres except where explicitly shown otherwise. The contractor should check and certify all dimensions as work proceeds and notify the architect of any discrepencies. Do not scale off the drawings, if in doubt ask.

Client: VH Land Partnerships Ltd +
The Clitheroe Royal Grammar School Foundation

Drawn: PF

Date: 23.07.2020

Scale: 1:1250 @ A3

Amendments:

15.0 APPENDIX B – DEVELOPMENT MASTERPLAN

LEGEND

- Proposed dwelling
- Proposed dwelling to be built opposite hand
- Proposed brick built garage
- Propsed garage space
- Common areas of shared drives in contrasting material or kerb edgings to delinate shared drive area
- SF1 — Proposed 1.8m high feather edge boarded timber screen fence
- SF2 — Proposed 1.8m high feather edge boarded timber screen fence with P.C.C. posts & gravel boards
- W/F — Proposed 1.8m high/0.44m square brick piers at 2.0m ctrs with 0.65m high brick dwarf wall/feather edged borded infill panels
- Proposed 0.45m high timber post & rail divisional fence
- RL — Proposed 1.2m high metal railings
- SPF — Proposed 1.2m high timber post and 4 rail fence
- Proposed 0.45m high timber 'V'-rail fence
- Exis ing hedge to be retained
- Exis ing hedge to be removed
- Exis ing tree to be retained
- Exis ing tree to be removed
- * AFF — Generic label to indicate 'Affordable' housing.

Sketch 4

NAME	DESCRIPTION	SIZE (sqft)	Units	TOTAL (sqft)	Percentage
WALTON	1 BED APARTMENT	635	4	2540	
GRANTHAM	1 BED APARTMENT	550	2	1100	
ALDEBURY	1 BED APARTMENT	653	2	1306	
PATERDALE	2 BED MEWS/SEMI	825	1	825	
ESKDALE	2 BED MEWS/SEMI	843	1	843	
DARWIN	2 BED BUNGALOW	688	7	4816	
DEPTFORD	3 BED BUNGALOW	1174	1	1174	
BUXTON	3 BED MEWS/SEMI	963	9	8667	
BRAMLEY	3 BED MEWS/SEMI	986	2	1972	
CALDBECK	4 BED MEWS/SEMI	1062	8	8496	30%
DISLEY	3 BED SEMI	934	9	8406	
DALTON	3 BED DETACHED	938	4	3752	
CAPESTHORPE	3 BED SEMI	947	4	3788	14%
COTSWOLD	3 BED DETACHED	947	2	1894	
DAVENHAM	3 BED DETACHED	957	5	4785	
DALTON	3 BED DETACHED	938	3	2814	8%
ADLINGTON	4 BED DETACHED	1119	9	10071	
DIDLINGTON	4 BED SEMI	1128	6	6768	
COTSWOLD PLUS	4 BED DETACHED	1141	4	4564	
DAVENHAM PLUS	4 BED DETACHED	1151	1	1151	
BRANCASTER	4 BED DETACHED	1169	2	2338	
HOUGHTON	4 BED DETACHED	1325	4	5300	
MORETON	4 BED DETACHED	1326	1	1326	
CRANLEIGH	4 BED DETACHED	1358	2	2716	
HENLEY	4 BED DETACHED	1462	2	2924	
OXFORD	4 BED DETACHED	1498	3	4494	
ABINGDON	4 BED DETACHED	1469	3	4407	
NORFOLK	4 BED DETACHED	1502	3	4506	
BURFORD	4 BED DETACHED	1552	8	12416	
PICKMERE	4 BED DETACHED	1780	1	1780	
WINSTER	4 BED DETACHED	1796	1	1796	
SEVERN	4/5 BED DETACHED	1867	3	5601	
WINCHESTER	5 BED DETACHED	2085	4	8340	
PAILTON	5 BED DETACHED	2128	3	6384	48%
	GRAND TOTAL		124	144060	100%

Total Site Area	(Acres)	12.76
Nett Site Area	(Acres)	9.64
Total Site Area	(Hectares)	5.16
Nett Site Area	(Hectares)	3.90
SQFT/Acre		14939.18

PROW - FP0301009

PROW - FP0301010

POTENTIAL FUTURE ACCESS POINT

LEAP

BALANCING POND

Car Park

REV	DESCRIPTION	DATE	INIT
F	Pond size reduced and layout amended to get back to 124 units. PROW added to Open space calculation. Access Rd reduced from 7.3m wide to 6.5m following highway comments.	05.12.25	HS
E	Open Space area increased to allow for SUD features. Reducing total by 8 units.	03.12.25	HS
D	Plus types with room over carport/garage added. 7.3m wide entrance road length reduced.	18.11.25	HS
C	Layout reviewed and updated to increase footage where possible. Schedule updated.	11.11.25	HS
B	Plots on additional land (Highmoor Farm) reduced to 7no.	30.06.25	HS
A	Plots 1-24 & 112-114 amended.	29.05.25	HS

Morris Homes (North) Limited
Morland House
Altrincham Road
Wilmslow
Cheshire SK9 5NW
Tel: (01625) 544 444
Fax: (0845) 833 1845

Job. Title
HIGHMOOR FARM
CLITHEROE

Dwg. Title
SKETCH 04

date	drawn	checked	scale	dwg.no	rev
13/05/25	HS		1:500 @ A1	SK04	F

16.0 APPENDIX C – PREVIOUS LLFA CONSULATION

Lancashire County Council

Phone: [redacted]
Email:

Date: 14 September 2020

Dear Sir/Madam

APPLICATION CONSULTATION RESPONSE

Application Number:	3/2020/0601
Location:	Land at Highmoor Farm Clitheroe BB7 1PN
Proposal:	Outline planning for the construction of up to 125 dwellings with public open space, landscaping and sustainable drainage system and vehicular access point from Highmoor Park. All matters reserved except for means of access.

Thank you for consulting the Lead Local Flood Authority (LLFA) on the above application. The Flood and Water Management Act 2010 sets out the requirement for LLFAs to manage 'local' flood risk within their area. 'Local' flood risk refers to flooding or flood risk from surface water, groundwater or from ordinary watercourses.

Comments provided in this representation, including conditions, are advisory and it is the decision of the Local Planning Authority (LPA) whether any such recommendations are acted upon. It is ultimately the responsibility of the Local Planning Authority to approve, or otherwise, any drainage strategy for the associated development proposal. The comments given have been composed based on the current extent of the knowledge of the LLFA and information provided with the application at the time of this response.

Lead Local Flood Authority (LLFA) Position:

The Lead Local Flood Authority has **no objection** to the proposed development, subject to the inclusion of the following conditions:

Condition 1 (final surface water drainage scheme):

No development shall commence until final details of the design and implementation of an appropriate surface water drainage scheme have been submitted to and approved in writing by the local planning authority. Those details shall include:

a) Evidence of an assessment of the site conditions to include site investigation and test results to confirm infiltrations rates;

b) A final surface water drainage layout plan; appropriately labelled to include all pipe/structure references, dimensions, design levels, finished floor levels and external ground levels (in AOD);

c) A full set of flow calculations for the surface water drainage network. The calculations must show the full network design criteria, pipeline schedules and simulation outputs for the 1 in 1 year, 1 in 30 year and 1 in 100 year return period, plus an additional 40% allowance for climate change and a 10% allowance for urban creep. The calculations must demonstrate that surface water runoff will not exceed the existing pre-development greenfield runoff rates and volumes for the corresponding rainfall event;

d) A final site plan showing all on-site surface water catchment areas, i.e. areas that will contribute to the proposed surface water drainage network;

e) Confirmation of how surface water is to be managed within any non-drained areas of the site, i.e. gardens and public open space;

f) A final site plan showing all overland flow routes and flood water exceedance routes, both on and off site;

g) Details of any measures taken to prevent flooding and pollution of the receiving groundwater and/or surface waters, including watercourses; and

h) Details of an appropriate management and maintenance plan for the surface water drainage network over the lifetime of the development.

The scheme shall be implemented in accordance with the approved details prior to first occupation of any of the approved dwellings, or completion of the development, whichever is the sooner. Thereafter the drainage system shall be retained, managed and maintained in accordance with the approved details.

Reasons:

1) To ensure that the proposed development can be adequately drained;

2) To ensure that there is no flood risk on or off the site resulting from the proposed development;

3) To ensure that water quality is not detrimentally impacted by the development proposal; and

4) To ensure that appropriate maintenance mechanisms are put in place for the lifetime of the development.

Condition 3 (construction phase surface water management plan):

No development shall commence until details of how surface water and pollution prevention will be managed during each construction phase have been submitted to and approved in writing by the local planning authority.

Reasons:

1. To ensure that the construction phase(s) of development does not pose an undue flood risk on site or elsewhere;
2. To ensure that any pollution arising from the development as a result of the construction works does not adversely impact on existing or proposed ecological or geomorphic condition of water bodies.

Lead Local Flood Authority Advice:

Surface water drainage:

The surface water drainage proposals outlined within the applicant's flood risk assessment (ref: 18522, dated: August 2019) are only preliminary and may change following further detailed design and investigation. The applicant will therefore be expected to provide a final surface water drainage scheme for the site once all detailed design and investigation work has been completed. The final scheme will need to be submitted to and approved by the LPA prior to the commencement of any development, and must comply with the requirements of the National Planning Policy Framework and the non-statutory technical standards for sustainable drainage systems; March 2015. The strategy must also be accompanied by an appropriate management and maintenance plan that details how the surface water drainage network will be managed and maintained over the lifetime of the development. The LLFA is satisfied that these details can be secured through the inclusion of the above recommended planning condition.

For the avoidance of doubt, the LLFA is not able to assess or comment on the suitability of the proposed surface water runoff rates or volumes at this time. That is because the final surface water runoff rates and volumes are directly influenced by the amount of impermeable area within the proposed development site. An agreement on this can only be reached once the final site layout has been agreed with the LPA.

The applicant is reminded that the final surface water drainage scheme must comply with the drainage hierarchy established under planning practice guidance. Before a drainage connection to the watercourse can be agreed, the applicant will need to provide further evidence and justification to show why disposal via infiltration is not possible. This should include an assessment of the site conditions to confirm infiltrations rates.

Sustainable Drainage Systems:

The applicant is encouraged to maximise the use of sustainable drainage systems (SuDS) when designing the surface water drainage scheme for the development site. That is because sustainable drainage systems offer significant advantages over conventional piped drainage systems in reducing flood risk.

Sustainable drainage systems can attenuate the rate and quantity of surface water run-off from a site, and they can also absorb diffuse pollutants and promote groundwater recharge. Ponds, reed beds and seasonally flooded grasslands are also particularly attractive features within public open space. The wide variety of available sustainable drainage techniques means that virtually any development should be able to include a scheme based around these principles and provide multiple benefits, reducing costs and maintenance needs.

Some SuDS features, for example rainwater harvesting and permeable paving used on roads and driveways, must not be included as part of the hydrological calculations for the site. This is because occupants may change or remove these features in the future and this could have the potential to increase surface water runoff from the site. Where SuDS features such as rainwater harvesting and permeable paving are included in the hydrological calculations, the local planning authority would be advised to consider the removal of permitted development rights.

Land Drainage Consent:

The LLFA are the consenting body for works on Ordinary Watercourses. Under Section 23 of the Land Drainage Act 1991 (the "LDA") (as amended by paragraph 32 of Schedule 2 of the FWMA 2010) anyone who intends to carry out works which may obstruct or affect the flow of an ordinary watercourse needs written consent from Lancashire County Council.

It is important to note that Land Drainage Consent is a separate application process that lies outside the planning legislation. It should not be assumed therefore the grant of planning permission means that Land Drainage Consent will automatically be given. Parallel processing of Land Drainage Consent applications is advised, as any land drainage consenting issues could directly impact the suitability of the proposed site layout.

Land Drainage Consent applications can take up to eight weeks to process following receipt of all required information and payment (£50 per structure). Retrospective consent cannot be issued.

Construction Phase including enabling works:

It is critical that flood risk is appropriately managed during the construction phase(s) of the development. Compaction of the soil is likely to speed up the run-off rate whilst the site is cleared and the permanent drainage systems and/or attenuation systems are constructed and brought into use.

The developer should identify the flood risk associated with this phase of the development and provide details of how surface water will be managed during construction, including any mitigation. The LLFA is satisfied that these details can be secured through the inclusion of the above recommended planning condition.

Highway Drainage / Highway Adoption:

This response does not cover highway drainage, matters pertaining to highway adoption (s38 Highways Act 1980) and/or off-site highway works (s278 Highways Act 1980). Should the applicant intend to install any sustainable drainage systems under or within close proximity to a public road network (existing or proposed), then they would need to separately discuss the use and suitability of those systems with the local highway authority.

The applicant is also encouraged to discuss the suitability of any overland flow routes and/or flood water exceedance with the local highway authority should they have the potential to impact the public highway network and/or public highway drainage infrastructure (either existing or proposed).

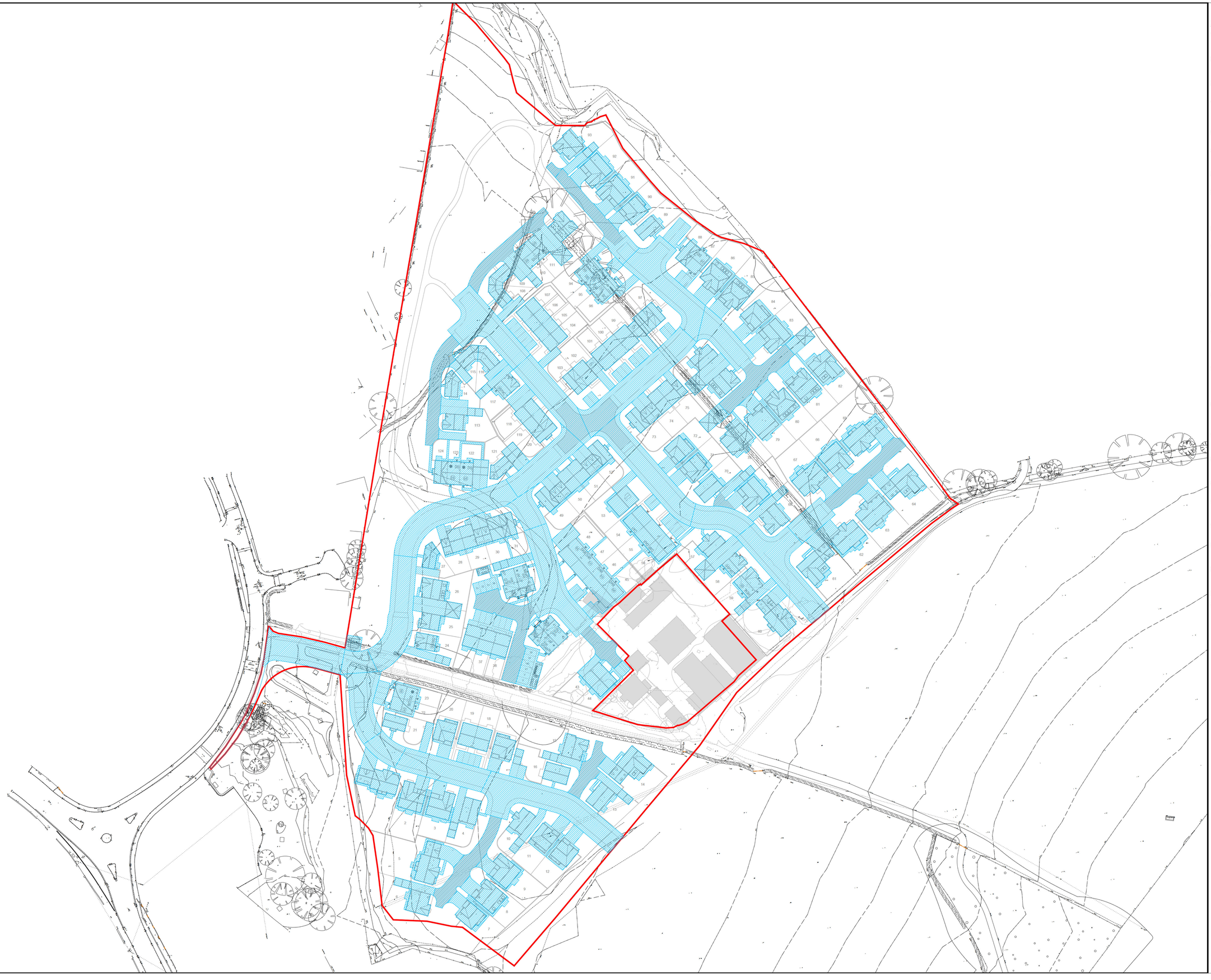
Material changes:

If there are any material changes to the submitted information which impact on surface water, the local planning authority is advised to consider re-consulting the LLFA. The LLFA also wishes to be formally consulted on all subsequent drainage strategies for this proposed development.

Yours faithfully,

Chris Dunderdale
Lead Local Flood Authority

17.0 APPENDIX D – IMPERMEABLE AREAS / CATCHMENT PLAN



NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SPECIALIST DESIGN DRAWINGS AND DETAILS.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS NOTED OTHERWISE.
3. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
4. LOCATION AND LEVELS OF EXISTING PUBLIC SEWERS BASED ON WATER AUTHORITY SEWER RECORDS. SEWERS TO BE FULLY SURVEYED, ALL LOCATIONS TO BE CONFIRMED.
5. SETTING OUT SHALL BE UNDERTAKEN USING ONLY THE INFORMATION GIVEN.
6. ALL SEWERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE DESIGN AND CONSTRUCTION GUIDANCE AND WHERE APPLICABLE UNITED UTILITIES DETAILS
7. THE MINIMUM GRAVITY PIPE DIAMETER UNDER ADOPTABLE HIGHWAYS SHALL BE 150mm
8. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL INFORMATION GIVEN WITH REGARDS TO EXISTING SERVICES AND DRAINAGE CONNECTIONS ETC. PRIOR TO COMMENCING THE WORKS. THE CONTRACTOR SHALL ADHERE TO THE CDM REGULATIONS AT ALL TIMES
9. EXISTING FLOWS IN WATERCOURSES, SEWERS AND LAND DRAINS SHALL BE MAINTAINED AT ALL TIMES
10. ALL MATERIALS TO BEAR THE RELEVANT B.S. KITEMARK AND COMPLY FULLY WITH THE SPECIFICATIONS. ALL CONCRETE & CONCRETE PRODUCTS MUST USE SULPHATE RESISTANT CEMENT (UNLESS THE SITE INVESTIGATION REPORT PROVES THAT SULPHATE ATTACK FROM SOILS AND GROUNDWATER WILL NOT OCCUR TO WITHSTAND A CLASS
11. ALL OPENING NOTICES ETC. AS REQUIRED UNDER HIGHWAYS ACTS ETC. ARE TO BE OBTAINED PRIOR TO COMMENCEMENT OF WORKS. ALL WORKS ARE TO BE INSPECTED BY L.A., NHBC OR THE NETWORK OPERATOR AS APPLICABLE.
12. WHERE "ULTRA RIB" UPVC PIPES (OR SIMILAR APPROVED) ARE USED IN ADOPTABLE DRAINAGE THEY SHALL STILL BE HANDLED AND LAID IN ACCORDANCE WITH THE SPECIFICATION AND GUIDANCE ISSUED BY THE HIGH-PERFORMANCE PIPE ASSOCIATION.
13. A CLASS S BED AND SURROUND MUST BE USED FOR SUCH PIPES. TRENCH BACKFILL IN HIGHWAYS TO WITHIN 1m OF HIGHWAY SHALL, AS DIRECTED BY THE HIGHWAY AUTHORITY BE A SUITABLE GRANULAR MATERIAL ALL IN ACCORDANCE WITH SEWERS FOR ADOPTION CL. 4.3.4.
14. DOMESTIC DRAINAGE SHALL BE TO BUILDING REGULATIONS APPROVED DOCUMENT H. 100mm U.P.V.C. PIPES LAID TO THE FOLLOWING MINIMUM FALLS UNLESS OTHERWISE SHOWN.
15.

	FOUL	S.W.
HEAD RUN	1 IN 40	1 IN 60
ELSEWHERE	1 IN 80	1 IN 100

16. ALL LATERAL CONNECTIONS FROM THE PRIVATE NETWORK TO BE 150mm U.P.V.C PIPES UNLESS STATED OTHERWISE
17. ALL GULLY CONNECTIONS TO BE 150mm VITRIFIED CLAY UNLESS NOTED OTHERWISE
18. MINIMUM COVER TO DRAINAGE SOFFIT LEVEL:

LANDSCAPING	TRAFFICKED AREAS	HIGHWAYS
0.600m	0.900m	1.200m

19. CLASS 'S' BEDDING AND SURROUND TO BE USED WHERE MINIMUM COVER IS ACHIEVED.
20. WHERE MINIMUM COVER IS NOT ACHIEVED CLASS 'Z' BEDDING AND SURROUND (CONCRETE ENCASEMENT) IS TO BE USED.
21. ANY DAMAGE TO THE EXISTING SEWER NETWORK BECAUSE OF THE DEVELOPMENT SITES ACTIVITIES WILL NEED TO BE RECTIFIED AT THE DEVELOPERS EXPENSE.

DRAINAGE NOTES:

TOTAL IMPERMEABLE AREA = 2.348ha

Rev	Date	By	Description
P02	31.03.26	KF	REVISED TO SUIT DRAINAGE STRATEGY
P01	16.01.26	PB	FIRST ISSUE

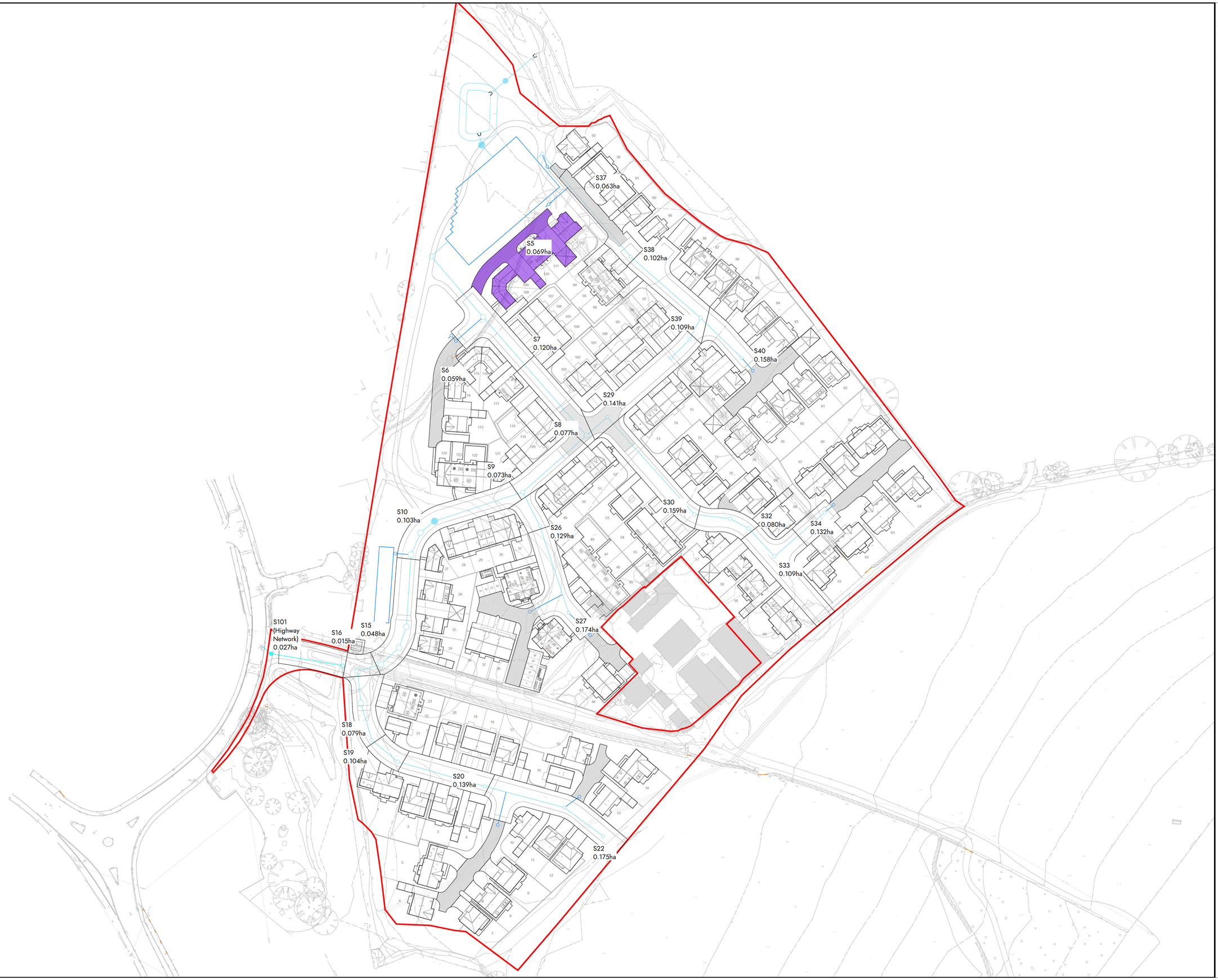
SHAPE ENGINEERING
Liverpool Innovation Park | Edge Lane | Liverpool | L7 9NJ
T: 0151 305 0700
www.shapeengineering.co.uk

Client: MORRIS HOMES

Project: HIGHMOOR FARM, CLITHEROE

Title: IMPERMEABLE AREAS PLAN

Status	Suitability Description	Structural Stage	Date
-	PLANNING	-	16.01.26
Designed By	Drawn By	Scale @ A0	Project No.
PB	PB	1:500	2936
Sheet No.			Revision
2936-SCE-00-00-DR-C-0010			P02



NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SPECIALIST DESIGN DRAWINGS AND DETAILS.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS NOTED OTHERWISE.
3. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
4. LOCATION AND LEVELS OF EXISTING PUBLIC SEWERS BASED ON WATER AUTHORITY SEWER RECORDS. SEWERS TO BE FULLY SURVEYED, ALL LOCATIONS TO BE CONFIRMED.
5. SETTING OUT SHALL BE UNDERTAKEN USING ONLY THE INFORMATION GIVEN.
6. ALL SEWERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE DESIGN AND CONSTRUCTION GUIDANCE AND WHERE APPLICABLE UNITED UTILITIES DETAILS
7. THE MINIMUM GRAVITY PIPE DIAMETER UNDER ADOPTABLE HIGHWAYS SHALL BE 150mm
8. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL INFORMATION GIVEN WITH REGARDS TO EXISTING SERVICES AND DRAINAGE CONNECTIONS ETC. PRIOR TO COMMENCING THE WORKS. THE CONTRACTOR SHALL ADHERE TO THE CDM REGULATIONS AT ALL TIMES
9. EXISTING FLOWS IN WATERCOURSES, SEWERS AND LAND DRAINS SHALL BE MAINTAINED AT ALL TIMES
10. ALL MATERIALS TO BEAR THE RELEVANT B.S. KITEMARK AND COMPLY FULLY WITH THE SPECIFICATIONS. ALL CONCRETE & CONCRETE PRODUCTS MUST USE SULPHATE RESISTANT CEMENT (UNLESS THE SITE INVESTIGATION REPORT PROVES THAT SULPHATE ATTACK FROM SOILS AND GROUNDWATER WILL NOT OCCUR TO WITHSTAND A CLASS
11. ALL OPENING NOTICES ETC. AS REQUIRED UNDER HIGHWAYS ACTS ETC. ARE TO BE OBTAINED PRIOR TO COMMENCEMENT OF WORKS. ALL WORKS ARE TO BE INSPECTED BY L.A., NHBC OR THE NETWORK OPERATOR AS APPLICABLE.
12. WHERE "ULTRA RIB" UPVC PIPES (OR SIMILAR APPROVED) ARE USED IN ADOPTABLE DRAINAGE THEY SHALL STILL BE HANDLED AND LAID IN ACCORDANCE WITH THE SPECIFICATION AND GUIDANCE ISSUED BY THE HIGH-PERFORMANCE PIPE ASSOCIATION.
13. A CLASS S BED AND SURROUND MUST BE USED FOR SUCH PIPES. TRENCH BACKFILL IN HIGHWAYS TO WITHIN 1m OF HIGHWAY SHALL, AS DIRECTED BY THE HIGHWAY AUTHORITY BE A SUITABLE GRANULAR MATERIAL ALL IN ACCORDANCE WITH SEWERS FOR ADOPTION CL. 4.3.4.
14. DOMESTIC DRAINAGE SHALL BE TO BUILDING REGULATIONS APPROVED DOCUMENT H. 100mm U.P.V.C. PIPES LAID TO THE FOLLOWING MINIMUM FALLS UNLESS OTHERWISE SHOWN.
15.

	FOUL	S.W.
HEAD RUN	1 IN 40	1 IN 60
ELSEWHERE	1 IN 80	1 IN 100

16. ALL LATERAL CONNECTIONS FROM THE PRIVATE NETWORK TO BE 150mm U.P.V.C PIPES UNLESS STATED OTHERWISE
17. ALL GULLY CONNECTIONS TO BE 150mm VITRIFIED CLAY UNLESS NOTED OTHERWISE
18. MINIMUM COVER TO DRAINAGE SOFFIT LEVEL;

LANDSCAPING	TRAFFICKED AREAS	HIGHWAYS
0.600m	0.900m	1.200m

19. CLASS 'S' BEDDING AND SURROUND TO BE USED WHERE MINIMUM COVER IS ACHIEVED.
20. WHERE MINIMUM COVER IS NOT ACHIEVED CLASS 'Z' BEDDING AND SURROUND (CONCRETE ENCASEMENT) IS TO BE USED.
21. ANY DAMAGE TO THE EXISTING SEWER NETWORK BECAUSE OF THE DEVELOPMENT SITES ACTIVITIES WILL NEED TO BE RECTIFIED AT THE DEVELOPERS EXPENSE.

Rev.	Date	By	Description
P05	31.03.2026	KF	UPDATED DRAINAGE STRATEGY
P04	26.02.2026	KF	UPDATED DRAINAGE STRATEGY
P03	23.01.2026	PB	UPDATED DRAINAGE STRATEGY
P02	23.01.2026	PB	UPDATED DRAINAGE STRATEGY
P01	16.01.2026	KF	FIRST ISSUE

SHAPE ENGINEERING
Liverpool Innovation Park | Edge Lane | Liverpool | L7 9NJ
T: 0151 305 0700 www.shapeengineering.co.uk

Client
MORRIS HOMES

Project
HIGHMOOR FARM, CLITHEROE

Title
SURFACE WATER CATCHMENT PLAN

Status	Suitability Description	Structural Stage	Date
-	PLANNING	-	16.01.26

Designed By	Drawn By	Scale @ A0	Project No.
KF	KF	1:500	2936

Sheet No.
2936-SCE-00-00-DR-C-0011

Revision
P05

18.0 APPENDIX E – GREENFIELD RUNOFF RATES

Greenfield runoff rate estimation tool

www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	31/03/2026
Calculated by	kf
Reference	2936
Model version	2.2.3

Location

Site name	Highmoor Farm, Clitheroe
Site location	Clitheroe

Site easting (British National Grid)	375332
Site northing (British National Grid)	441753

Site details

Total site area (ha)	3.973 ha

Greenfield runoff

Method

Method	IH124

IH124

	My value		Map value
SAAR (mm)	1241 mm		1241
How should SPR be derived?	WRAP soil type		
WRAP soil type	4		4
SPR	0.47		
QBar (IH124) (l/s)	37.5 l/s		

Growth curve factors

	My value		Map value
Hydrological region	10		10
1 year growth factor	0.87		
2 year growth factor	0.93		
10 year growth factor	1.38		
30 year growth factor	1.7		
100 year growth factor	2.08		
200 year growth factor	2.37		

Results

Method	IH124
Flow rate 1 year (l/s)	32.6 l/s
Flow rate 2 year (l/s)	34.9 l/s
Flow rate 10 years (l/s)	51.7 l/s
Flow rate 30 years (l/s)	63.7 l/s
Flow rate 100 years (l/s)	78.0 l/s
Flow rate 200 years (l/s)	88.8 l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

19.0 APPENDIX F – PHASE 2 GROUND INVESTIGATION

Phase 2 Ground Investigation

Client: VH Land Partnerships Limited

High Moor Farm, Clitheroe

Report No: 1134.02.01

May 2025

REMADA GEO CONSULTANTS

Executive Summary

Remada Ltd was commissioned by VH Land Partnerships Limited (hereafter 'the client') to undertake a Phase 2 Ground Investigation for a proposed residential development at High Moor Farm, Clitheroe. This report follows a Phase 1 Preliminary Risk Assessment (Remada report reference 1134.01.01, issued in February 2025).

Summary of Phase 1 Desk Study

The earliest available historical mapping of 1847 indicates the site to be unoccupied as part of a larger series of fields. An unnamed lane bisects the site. By 1886, Highmoor Farm occupies the centre of the site, adjacent to the lane. The site remained relatively unchanged until 1965, where the footprint of the buildings was changed. Since this change, the site has remained relatively unchanged until present day.

Within the surrounding area, the historical mapping has indicated that the present-day Highmoor Car Park car park to the south-west of the study site has been constructed on an area formerly occupied by a Mill Pond / Reservoir, which has subsequently been infilled / drained. A small area was recorded as being a 'Refuse Tip' on the 1965 mapping, although this is not listed within the Envirocheck Report.

Published geological maps record that the site is underlain by Devensian Till, a Secondary (Undifferentiated) Aquifer and the Clitheroe Limestone Formation and Hodder Mudstone Formation (undifferentiated), a Secondary (B) Aquifer.

The site is located within an area which 'might not be' affected by coal mining activity and is not located within a Coal Authority designated Coal Mining Reporting Area. Consequently, no further action is considered necessary at this stage relating to coal mining at and beneath the site.

Intrusive Investigation

The investigation comprised the drilling of six (6 No) window sample holes (WS1 – WS6), excavation of twelve (12 No) trial pits (TP1 – TP12), execution of eight (8 No) DCP CBR tests and three (3 No) soakaway tests 2 between 2nd and 10th April 2025.

Made Ground was encountered in one location (WS1) to 0.45m bgl, comprising slightly clayey, slightly sandy GRAVEL. Elsewhere, topsoil was encountered to depths of between 0.05m and 0.3m bgl. Superficial Till deposits were encountered within all exploratory hole locations. The material recovered comprised brown locally slightly sandy slightly gravelly CLAY overlying stiff brownish grey gravelly locally very gravelly CLAY. The gravel comprised mudstone, sandstone and locally limestone.

GRAVEL deposits were encountered in WS5 from 2.0 to at least 3.5m bgl where it was not fully penetrated and in WS6 between 1.0 and 1.2m bgl, in the south-western and south-eastern areas of the site respectively.

Bedrock was not recovered within any of Remada's exploratory locations.

Human Health Assessment

The results of soil chemical analysis were compared to Human Health Generic Assessment Criteria for residential land use with home grown produce. Localised metal concentrations were recorded marginally in exceedance of their respective human health GAC protective of on-site workers.

Water Resources Assessment

The results of the soil chemical analysis undertaken has identified that concentrations of metals and inorganic contaminants are within the range that would be expected for 'typical' natural soils. Detectable concentrations of TPH and PAHs were encountered in some samples. However, the contaminants identified are of low solubility and mobility and as such are unlikely to present a risk to groundwater beneath the site.

The ground investigation has indicated that the majority of the site is underlain by CLAY, with water being localised and perched. The only groundwater strike recorded during Remada's investigation was in WS1 at

3.0m depth. However, standing water has been encountered within all six standpipes during the subsequent monitoring programme.

Consequently, the risk of leaching of contaminants as a result of infiltration of groundwater is limited. Therefore, the risk to controlled waters from contaminants within the soil at the site is considered to be low and does not warrant further consideration at this stage.

Waste Classification

The results of the assessment indicated that contaminant concentrations within the Made Ground, topsoil and natural soils were generally low and would generally classify the soils as non-hazardous with LoW Code 17 05 04 (soils and stones other than those mentioned in 17 05 03).

Waste Acceptance Criteria (WAC) analysis was undertaken on a sample of topsoil and two samples of natural soil. The assessment of samples indicated that both samples of clay (from WS6 at 0.5m and TP2 at 0.4m) met the requirements for disposal in an Inert landfill.

The topsoil sample from TP1 at 0.1m recorded a Total Organic Carbon (TOC) concentration of 4.6%, which would exceed the Inert Waste Landfill acceptance criteria (3%). Likewise, the Loss on Ignition concentration of 11% marginally exceeded the Hazardous Waste Landfill acceptance criteria (10%). However, it is considered likely that the site-won topsoil will be stripped during the redevelopment of the site and stockpiled for reuse as part of soft landscaping and garden areas.

Geotechnical Assessment

It is understood that the development will comprise two-storey housing for which a line load of 25kN/m per floor is considered appropriate. Hence the estimated pressure for 0.6m wide strip footing is 83 kPa. Based upon the window sample borehole information, the allowable bearing capacity of the firm CLAY (Cu = 50 kPa) beneath a strip footing of depth 1.2m and width 0.6m is estimated as 100 kPa to limit settlement to 25mm.

Foundations may need to be locally deepened where soft spots are present. A foundation schedule will be required for the proposed layout.

All samples of CLAY were reported as being LOW, INTERMEDIATE and HIGH plasticity with between 75% and 100% passing a 0.425mm sieve. The modified plasticity index equates at Low to Medium Volume Change Potential.

Due to a Total Potential Sulphate (TPS) = 1.45%, a Design Sulphate Class DS-4 is considered appropriate for buried concrete and an ACEC Class of AC-3s is considered appropriate for the location. It is recommended that additional BRE SD1 analysis is undertaken, in order to further investigate and potentially delineate the protection requirements for buried concrete on the site possibly as part of plot scheduling.

Three soakaway tests were conducted within trial pits located across the site. The results indicated that there was minimal infiltration and as such soakaways will not be suitable for the proposed development.

Side slopes within the clay are likely to remain stable in the short term without support or without being battered back to a safe slope gradient. However, a detailed inspection of the side slopes should be made during excavation and a risk assessment carried out to fully assess the support measures

Ground Gas

The ground gas and groundwater monitoring programme is ongoing, with the results to be forwarded upon completion. However, the results of the first three (3 No.) rounds of gas monitoring place the site into gas Characteristic Situation 3 and therefore ground gas protection measures will likely be required within the proposed buildings. It may be possible to zone the site between CS1 and CS3.

The site is located in a Lower Probability Radon Area as less than 1% of properties are above the Action Level, therefore no radon protective measures are necessary.

Contents

TABLES

GRAPHS

FIGURES

EXPLORATORY HOLE LOGS

APPENDICES

Issue No	*Date*	*Prepared By*	*Technical Review*	*Authorised*
01	*21.05.2025*	*K Szybut* [redacted]	*Dickinson* [redacted]	*G Jones* [redacted]

1 INTRODUCTION

Remada Ltd was commissioned by VH Land Partnerships Limited (hereafter 'the client') to undertake a Phase 2 Ground Investigation for a proposed residential development at High Moor Farm, Clitheroe at the location indicated in **Figure 1**.

1.1 Objectives

The objectives of this assessment are as follows:

- to examine whether there have been any potentially contaminative uses on the site or nearby land;
- to develop a conceptual model of the site to identify plausible pollutant linkages;
- to assess ground conditions in relation to the proposed development in relation to construction design issues including the presence, nature, likely severity and extent of soil and groundwater contamination, which may be present, its potential environmental impact and likely requirement for further work; and
- Provide preliminary foundation design recommendations for the proposed development.

1.2 Scope of Work

The scope and layout of this investigation and report is generally in accordance with BS10175:2011+A2 2017 and the Environment Agency's Land Contamination Risk Management guidance for land contamination reports.

The scope of work comprised:

- 1 No. Day of window sampling (target 6 No. boreholes) with SPTs at 1m intervals to a target depth of 5.0m bgl to prove competent natural strata.
- 2 No. Days of trial pitting using a backhoe excavator (JCB 3CX or equivalent) to a target depth of 3.0 – 4.0m bgl.
- 1 No. Day of soakaway testing in accordance with BRE 365 (2 – 3 locations, with up to 3 fills).
- 6 No. gas / groundwater monitoring wells installed with window sample boreholes.
- 6 No. rounds of gas/groundwater monitoring at different atmospheric pressures, in accordance with typical/idealized frequency of monitoring for a high sensitivity development (residential with gardens) as set out in CIRIA C665.
- 8 No. CBR tests within the road/pavement area on made ground or natural soil that will be at the development formation level. In the absence of any specific information the pavement formation level shall be considered to be a maximum of 500mm.
- Suite of geotechnical classification and strength tests as appropriate to the soils and 4 No BRE Sulphate suites in accordance with BRE SD1.
- 8 No Chemical Analysis for asbestos (quantitative), pH, Arsenic, Beryllium, Cadmium, Chromium (trivalent & hexavalent), Copper, Mercury, Nickel, Lead, Selenium, Vanadium, Zinc, Fraction of Organic Carbon, TPHCWG, PAH(16) and Phenol.
- 3 No. Waste Acceptance Criteria (WAC) analysis on recovered soils; and
- Combined Factual & Interpretative Geoenvironmental Report.

The investigation methodology is presented in **Section 4**, findings in **Section 5** and the exploratory hole

locations are indicated on **Figure 2.**

1.3 Proposed Development

It is understood that the proposed site use for the site will be a residential development. A proposed indicative site layout plan is presented as **Figure 3,** with the site being accessed off Highmoor Park, along the western boundary.

1.4 Previous Reports

The following reports have been previously prepared for the site:

- Phase 1 Site Investigation & Preliminary Risk Assessment. Remada Ltd Report ref: 1134.01.01, issued in February 2025.

1.5 Limitations

The comments given in this report and the opinions expressed are based on the information reviewed and observations during site work. However, there may be conditions pertaining to the site that have not been disclosed by this assessment and therefore could not be taken into account.

2 SUMMARY OF PREVIOUS REPORT

2.1 Summary of Phase 1 Desk Study

The Executive Summary and Conceptual Site Model presented within Remada's Phase 1 Desk Study for the site (ref: 1134.01.01 dated February 2025) are reproduced below:

Site Setting

The site occupied an irregular plot immediately to the east of the built-up area of Clitheroe. It is located adjacent to an existing residential area, located to the north of Pendle Road. The site predominantly comprises agricultural land, part of the former Highmoor Farm. The Highmoor Farm complex itself is excluded from the study site. The closest residential properties are those to the west of the site, on Highmoor Park, Abbot Walk and Bracken Hey.

The study site predominantly comprises three irregular-shaped fields. Two of these fields are present to the north of an asphalt-surfaced access road giving access from Highmoor Road in the west to Highmoor Farm. The third field is located immediately to the south of this road. With the exception of a large 'tank' feature associated with the Farm, there are no structures indicated to be present on-site. Field boundaries are typically formed of hedgerows and semi-mature to mature trees.

Site History

The earliest available historical mapping of 1847 indicates the site to be unoccupied as part of a larger series of fields. An unnamed lane bisects the site. By 1886, Highmoor Farm occupies the centre of the site, adjacent to the lane. The site remained relatively unchanged until 1965, where the footprint of the buildings was changed. Since this change, the site has remained relatively unchanged until present day.

Within the surrounding area, the historical mapping has indicated that the present-day Highmoor Car Park car park to the south-west of the study site has been constructed on an area formerly occupied by a Mill Pond / Reservoir, which has subsequently been infilled / drained. A small area was recorded as being a 'Refuse Tip' on the 1965 mapping, although this is not listed within the Envirocheck Report.

Geology / Hydrogeology

Published geological maps record that the site is underlain by Devensian Till, a Secondary (Undifferentiated) Aquifer and the Clitheroe Limestone Formation and Hodder Mudstone Formation (undifferentiated), a Secondary (B) Aquifer.

Mining

The site is located within an area which 'might not be' affected by coal mining activity and is not located within a Coal Authority designated Coal Mining Reporting Area. Consequently, no further action is considered necessary at this stage relating to coal mining at and beneath the site.

Radon

The site is located in a Lower Probability Radon Area as less than 1% of properties are above the Action Level, therefore no radon protective measures are necessary.

Unexploded Ordnance (UXO) Risk

The freely available Zetica UXO risk mapping indicates the site to be located within an area where the bomb risk is 'Low'. This is defined by Zetica as an area having an indicated bombing density of 15 bombs per 1000 acres or less during the Second World War.

Environmental Risk Assessment

Environmental

The desk study has identified a number of on-site and off-site potential sources of contamination that would require further investigation. The following is recommended:

- *Investigation of the lateral and vertical extent of made ground/fill beneath the proposed site footprint;*

- *Collection of soil and groundwater samples from the areas identified above for contaminants of concern; and*
- *Ground gas monitoring.*

Geotechnical

It is recommended that a ground investigation is undertaken to enable preliminary foundation design.

Potential Source Areas	Potential Contaminant of Concern	Pathways	Potential Receptor	Exposure Route (Human unless otherwise stated)	Potential Identified Linkage (unmitigated)	Findings of Ground investigation	Risk (Un-mitigated)	Proposed Remediation (Mitigation) Measures	Residual Risk Estimation
<u>On-site Sources</u> Agricultural Land Unspecified Tank ***<u>Off-site Sources</u>*** Former Cotton & Rayon Mills Infilled / drained mill pond / reservoir Refuse Tip General Made Ground Highmoor Farm Residential Properties Electrical sub-station	Asbestos / Metals As, Be, Cd, Cu, Cr (VI), Cr (III) Hg, Ni, Se, Va, Zn, *Boron, TPH /PAH, PCBs*	Disturbance due to construction plant causing direct contact, dusts, vapours. Direct Contact with occupants of the proposed development Inhalation of fibres / vapours / gases by occupants of proposed development Permeation of water supply pipework Leachate	Occupants of the development / building fabric Adjacent residents during construction Secondary Aquifers	• Direct Soil Ingestion	• Yes	To be assessed (TBA)	Potential risk	(To be assessed (TBA)	(To be assessed (TBA)
				• Indoor Dust ingestion	• Yes	As above	Potential risk	TBA	TBA
				• Skin Contact with Soils	• Yes	As above	Potential risk	TBA	TBA
				• Skin Contact with Dust	• Yes	As above	Potential risk	TBA	TBA
				• Inhalation of Outdoor Dust	• Yes	As above	Potential risk	TBA	TBA
				• Ingestion of home grown produce	• Yes	As above	Potential risk	TBA	TBA
				• Inhalation of Outdoor Vapours	• Yes	As above	Potential risk	TBA	TBA
				• Inhalation of Indoor Vapours	• Yes	As above	Potential risk	TBA	TBA
				• Inhalation of ground gas	• Yes	As above	Potential risk	TBA	TBA
				• Inhalation of radon gas	• No	Lower Probability Area	Negligible	None	Negligible
				• Ingestion via permeated water supply pipework	• Yes	As above	Potential risk	TBA	TBA
				• Direct contact with Secondary (Undifferentiated) Aquifer in Superficial Deposits	• Yes	As above	Potential risk	TBA	TBA
				• In-direct contact with Secondary (B) Aquifer in bedrock	• Yes	As above	Potential risk	TBA	TBA

Table 1: Outline Conceptual Site Model

Direct contact with subsurface soil and/or groundwater during redevelopment works are not assessed as part of the CSM. It is considered that risks to workers will be managed as part of any the redevelopment works at the site through the application of health and safety procedures, where required.

3 SITE WALKOVER

The opportunity was taken to inspect the site on 4th March 2025 by Lewis Hillman of Remada Ltd, as recorded in the photographs below. There were no visual or olfactory indicators of contamination.

Photo 1: A view of the access road off Highmoor Park.

Photo 2: A view looking approximately north-west showing the access into the northern field with the tank to the left.

Photo 3: A view of the northern field.

Photo 4: A view of the southern field.

4 ENVIRONMENTAL & GEOTECHNICAL INVESTIGATION METHODOLOGY

4.1 Investigation Strategy

The investigation comprised the drilling of six (6 No) window sample holes (WS1 – WS6), excavation of twelve (12 No) trial pits (TP1 – TP12), execution of eight (8 No) DCP CBR tests and three (3 No) soakaway tests at locations indicated on **Figure 2** between 2nd and 10th April 2025.

All exploratory holes were logged by a suitably qualified Geo-environmental Engineer in general accordance with the recommendations of BS5930:2015+A1:2020. Detailed descriptions, together with relevant comments, are given in the **Exploratory Hole Logs**.

The weather conditions at the site during the fieldwork period were generally warm and dry, with no standing water nor slippery ground conditions being noted.

4.2 Buried Service Clearance

Buried service plans were reviewed prior to any fieldwork activities commencing.

During the intrusive works, a visual check and buried services survey using a Cable Avoidance Tool (CAT) and Signal Generator (Genny) was carried out at each exploratory hole location.

4.3 Intrusive Investigation

4.3.1 Window Sampling

All six (6 No.) window sample boreholes (WS1 – WS6) were advanced to a target depth of 5.0m below existing ground level. The window sampling rig itself is mounted on rubber tracks and is highly manoeuvrable as a result. This, when combined with the relatively diminutive frames of the rigs (the rigs primarily used tend to only weigh in at around 150Kg – 200Kg), makes it ideal for more environmentally sensitive situations whereas minimal disturbance as possible is required.

Sampling is achieved by a percussive method, with a chain-driven drop weight that repeatedly strikes an anvil, driving the rods and sample tubes into the ground. In Window Sampling, the soil sample is simply removed through a "window" in the side of the steel tube. In Windowless Sampling a complete soil profile is retained in a rigid clear plastic liner.

Combined Groundwater and Ground Gas monitoring standpipes were installed in all six window sample boreholes (WS1 – WS6).

4.3.2 Trial Pits

Twelve (12 No.) trial pits (TP1 – TP12) were excavated using a mini excavator on Wednesday 9th and Thursday 10th April 2025. The trial pits were excavated while in full attendance of an experienced geo-environmental consultant. On completion of the trial pits the materials were replaced in approximately the same order as they were excavated and compacted using the excavator.

4.4 In-Situ Testing

4.4.1 Standard Penetration Tests

Standard Penetration Tests (SPTs) in the window samples were carried out at 1.0m intervals as recorded on the borehole logs to assess the relative density and consistency of soils.

SPTs were conducted in accordance with BS EN ISO 22476-3 and the recorded SPT N-values are summarised on the borehole logs.

The SPT N-values have been corrected based on the Energy Ratio of 88% for the SPT hammer on the window sampling rig. The SPT Hammer Energy Test Report, undertaken in accordance with BS EN ISO 22476-3:2005 is presented in **Appendix A.**

4.4.2 Hand Shear Vane

Hand shear vane tests were undertaken using an Impact SL810 and in general accordance with the manufacturer's instructions on selected samples of cohesive soils.

4.4.3 Dynamic Cone Penetrometer (DCP) Tests

Eight (8 No.) DCP tests were conducted in order to determine California Bearing Ratio (CBR) values for near surface soils, at the locations in **Figure 2**. A known mass is dropped through a known distance to drive a cone into the ground. The penetration distance per blow is recorded in order to enable the CBR value to be calculated. Test results are presented in **Appendix B.**

4.4.4 Soakaway Tests

Three (3 No.) soakaway tests were undertaken in general in accordance with BRE Digest DG365, Soakaway Design, 2016, at the locations in **Figure 2**. Test results are presented in **Appendix C.**

4.5 Soil Sampling

4.5.1 Environmental

Made Ground and natural soils were selected by visual and olfactory means for subsequent analysis. Samples for chemical laboratory testing purposes were collected in amber glass jars, amber glass vials and plastic tubs and retained in a cool box for transport to the laboratory.

4.5.2 Geotechnical

Geotechnical samples were collected at depths indicated on the exploratory hole logs with samples retrieved from either the excavator bucked or from within a sleeve line. The disturbed samples were placed in sealed and correctly labelled plastic tubs or bags as appropriate. All geotechnical samples were dispatched to the laboratory for testing with a completed chain of custody.

4.6 Gas & Groundwater

4.6.1 Installations

Combined ground gas and groundwater monitoring standpipes were installed within six of the window sample boreholes across the site. The standpipes consisted of 50mm internal diameter high-density polyethylene (HDPE) pipe. A bentonite seal was made around the plain pipe and a clean gravel pack was placed around the slotted pipe,

4.6.2 Monitoring

Ground gas monitoring was undertaken using a GFM 436 gas analyser for the parameters reported below. Groundwater levels were measured with a GeoSense OWP30 oil water interface probe.

Permanent ground gas monitoring involved the measurement of the following in the prescribed order:

- Pressure difference between the monitoring well and the atmosphere.
- Peak and steady flow rates of gas into or out of the monitoring well.
- Peak and steady concentrations of carbon dioxide, methane, oxygen (minimum and steady recorded), carbon monoxide, hydrogen sulphide; and
- Depth to groundwater.

The ground gas monitoring programme is ongoing, with six (6 No.) ground gas monitoring visits scheduled to be undertaken as a minimum required for a residential development in accordance with CIRIA C665.

Ground gas concentrations have so far been recorded on 8th and 24th April and 14th May 2025 at WS1 – WS6. These interim monitoring results are presented in **Table 2.** The corresponding Calibration Certificate for the GFM436 gas analyser is presented as **Appendix D**.

4.7 Quality Assurance and Quality Control

All samples were submitted to a United Kingdom Accredited Laboratory (UKAS) under a completed chain of custody. The laboratory carried out its own QA/QC programme to ensure that the quality of the analytical data conformed to the appropriate test method protocols.

4.8 Laboratory Analysis & Testing

4.8.1 Chemical Analysis – Soil

Eight (8 No) soil samples were scheduled for the analysis of asbestos, arsenic, barium, beryllium, cadmium, chromium (III & VI), copper, mercury, nickel, lead, selenium, zinc, fraction of organic carbon, Total Petroleum Hydrocarbons (TPHCWG), Polyaromatic Hydrocarbons (PAH), BTEX compounds (benzene, toluene, ethylbenzene and xylene) and phenols.

Three (3 No.) soil samples were also scheduled for Waste Acceptance Criteria (WAC) analysis.

The results of laboratory chemical analyses are presented at **Appendix E.**

4.8.2 Geotechnical

Samples recovered from the boreholes were submitted to an accredited laboratory for the following tests in general accordance with BS1377:1990:

- 8 No Natural Moisture Contents.
- 8 No Plasticity Indices.
- 2 No Particle Size Distribution (PSD) tests; and
- 4 No BRE SD1 suites.

The results of the geotechnical testing are presented at **Appendix F.**

5 GEOTECHNICAL & ENVIRONMENTAL INVESTIGATION FINDINGS

5.1 Ground Conditions

A brief description of the published geology is provided together with a summary of the ground conditions encountered during the intrusive investigation. Exploratory logs are presented at the end of the report.

5.1.1 Published Geology

The superficial deposits underlying the site are indicated to comprise Devensian Till. The BGS describe these as typically comprising 'a heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape'.

The bedrock directly underlying the site is formed of the Clitheroe Limestone Formation and Hodder Mudstone Formation (Undifferentiated).

The BGS describes the Clitheroe Limestone Formation as typically comprising *'predominantly pale grey and commonly coarsely crinoidal, packstones, wackestones and subordinate grainstones and mudstones with Waulsortian mudmound reef limestones present at two levels'.*

The BGS describes the Hodder Mudstone Formation as typically comprising '*predominantly grey to dark grey mudstone, with subordinate and variable detrital limestone, siltstone and sandstone. Mudmound reef (Waulsortian) limestones, limestone boulder conglomerates and breccias locally, near the base'.*

5.1.2 Made Ground

Made Ground was encountered in one location (WS1) to 0.45m bgl. The Made Ground comprised slightly clayey slightly sandy gravel, with the gravel comprising sandstone, mudstone, tile and brick fragments.

5.1.3 Topsoil

Topsoil was encountered within all other exploratory hole locations at depths of between 0.05 and 0.3m bgl. The topsoil comprised brown slightly clayey sand. For the purpose of this assessment, topsoil is defined as the upper darker and more fertile layer of the soil profile which is a product of natural chemical, physical, biological and environmental processes. This does not imply compliance with BS 3882:2015.

5.1.4 Superficial Deposits

Superficial Till deposits were encountered within all exploratory hole locations. The material recovered comprised brown locally slightly sandy slightly gravelly CLAY overlying stiff brownish grey gravelly locally very gravelly CLAY. The gravel comprised mudstone, sandstone and locally limestone.

GRAVEL deposits were encountered in WS5 from 2.0 to at least 3.5m bgl where it was not fully penetrated and in WS6 between 1.0 and 1.2m bgl, in the south-western and south-eastern areas of the site respectively.

5.1.5 Bedrock

Bedrock was not recovered within any of Remada's exploratory locations.