Hurst Quarry, Biddulph

Flood Risk Assessment and Drainage Strategy

February 2017

Waterco Ltd, Eden Court, Lon Parcwr Business Park, Ruthin, Denbighshire LL15 1NJ
tel: 01824 702220 email: enquiries@waterco.co.uk web: www.waterco.co.uk

DOCUMENT VERIFICATION RECORD

CLIENT:

Renew Land Developments Ltd

SCHEME:

Flood Risk Assessment and Drainage Strategy for a residential development at Hurst Quarry, Hurst Road, Biddulph, Staffordshire, ST8 7RU. The purpose of this report is to support the Outline Planning Application.

INSTRUCTION:

The instruction to carry out this Flood Risk Assessment and Drainage Strategy was received from Ms Lizzie Smith of Renew Land Developments Ltd.

REPORT FORMAT:

This Flood Risk Assessment and Drainage Strategy report has been prepared in accordance with the National Planning Policy Framework (NPPF) and the associated National Planning Practice Guidance (NPPG) document: Flood Risk and Coastal Change. Reference has also been made to the CIRIA SuDS Manual (C753).

ISSUE HISTORY:

Issue Date	Comment
02/10/2015	Draft issue
22/12/2015	Second Issue
25/02/2016	Third Issue
28/02/2017	Fourth Issue – updated with revised development plans

DOCUMENT REVIEW & APPROVAL

Prepared by Jordan Jones BSc (Hons) MCIWEM

Reviewed by Josh Rigby BSc (Hons)

Approved by Victoria Griffin BSc (Hons) MSc MIEnvSc CEnv

Waterco Document Reference Number..... .w1944-170228-FRA and Drainage Strategy

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Abbreviations

AEP	*Annual Exceedance Probability*
CC	*Climate Change*
EA	*Environment Agency*
LiDAR	*Light Detection and Ranging*
m AOD	*metres Above Ordnance Datum*
NPPF	*National Planning Policy Framework*
PFRA	*Preliminary Flood Risk Assessment*
PPG	*Planning Practice Guidance*
SCC	*Staffordshire County Council*
SFRA	*Strategic Flood Risk Assessment*
SuDS	*Sustainable Drainage Systems*
UU	*United Utilities*

1 Development Description and Location

1.1 This Flood Risk Assessment (FRA) and Drainage Strategy report has been prepared in support of an Outline Planning Application for a proposed residential development at Hurst Quarry, Hurst Road, Biddulph, Staffordshire, ST8 7RU (grid reference: 390196E 359557N). A location plan and an aerial image are included in Appendix A.

Existing Site

1.2 The existing site comprises of a sand quarry and industrial buildings and covers an area of approximately 11.99ha. The site is bordered by agricultural land to the north and east, Hurst Road and a woodland area to the south and residential properties and agricultural land to the west.

1.3 The topography of the site generally slopes from north-east to south-west. Isolated topographical low points are identified and are associated with lagoons associated with the quarrying use.

Development Proposal

1.4 The proposed development is for 27no. new build detached dwellings and the refurbishment of an existing quarry building into a dwelling with associated roads, landscaping and ground re-profiling. An indicative development plan and an Indicative Remediation Contours Plan are included in Appendix B.

1.5 Proposed site levels vary from approximately 260metres Above Ordnance Datum (m AOD) in the northern extent to 205m AOD in the southern extent.

1.6 Site photographs are included in Appendix C.

National Planning Policy Context

1.7 The proposed residential development is considered to be ‘more vulnerable’ in accordance with Table 2 of the National Planning Policy Framework (NPPF) Planning Practice Guidance (PPG) document: Flood Risk and Coastal Change.

1.8 In accordance with NPPF the risk-based ‘Sequential Test’ should be applied to steer new development into areas of lower probabilities of flooding. The site is located within Flood Zone 1 on the Environment Agency (EA) ‘Flood Map for Planning (rivers and sea)’ included in Appendix D - an area considered to have the lowest probability of fluvial and tidal flooding. It

is assessed as having a less than 1 in 1000 annual probability of flooding (<0.1%). Therefore, it is considered that this development passes the Sequential Test and the NPPF Exception Test does not need to be applied.

1.9 In accordance with NPPF a FRA is required as the development site is greater than 1ha. The focus of a FRA for development sites greater than 1ha and in Flood Zone 1 is to demonstrate that the development will not increase flood risk elsewhere, through inclusion of a sustainable surface water drainage scheme.

2 Scope of Site Specific Flood Risk Assessment

2.1 The potential sources of flooding considered in the following sections are: Fluvial - from rivers and streams; Tidal; Pluvial – from rainfall on the surface; Rising Groundwater; Overwhelmed Sewers and Drainage Systems; Reservoirs, Canals, Lakes and Artificial sources.

2.2 Historical research has been undertaken and the Staffordshire Moorlands Strategic Flood Risk Assessment Update (SFRA) (October 2015) and the Staffordshire County Council (SCC) Preliminary Flood Risk Assessment (PFRA) (March 2011) have been reviewed for site specific information.

2.3 A pre-application enquiry was submitted to SCC in September 2015 to check on any site specific requirements for surface water drainage. A response was received on 15th October 2015 and is included in Appendix E. In relation to flood risk, SCC have stated that there is a surface water flow path which goes through the site and across Hurst Road. This issue will need to be addressed in the FRA. There is also a potential for water being shed off higher slopes to the east into the quarry. The FRA will need to detail how any potential overland flows will be dealt with.

2.4 A surface water drainage strategy is included in Section 9 of this report. In relation to drainage, SCC have stated that any development proposal should aim to hold water on site and control discharge at the greenfield rates through the use of a Sustainable Drainage System. The SCC Sustainable Drainage Systems (SuDS) Handbook (February 2017) has been also reviewed and referred to within Section 9 of this report.

3 Fluvial and Tidal Risk

3.1 The nearest watercourse is an unnamed watercourse located approximately 30m south-west of the site. This watercourse is an overspill from a larger unnamed watercourse located approximately 65m south-west of the site. The unnamed watercourse, located 65m south-west of the site, flows west in this location to its confluence with Biddulph Brook approximately 1km from site. Other watercourses in the vicinity of the site include an unnamed watercourse located approximately 240m north of the site. This watercourse flows west to its confluence with Biddulph Brook approximately 1.2km north-west of the site.

3.2 The SFRA and PFRA contain no records of fluvial flooding at or near to the site. The site is situated a minimum of 5m above the unnamed watercourses to the south and would therefore not be affected during a flood event of these watercourses. The unnamed watercourse to the north flows south-west, away from the site, within a steep catchment. Any potential flooding from this watercourse would follow the steep catchment topography and would not reach the site.

3.3 The site is located within Flood Zone 1 on the EA 'Flood Map for Planning (rivers and sea)' (Appendix D) and therefore has a less than 0.1% annual probability of flooding from rivers and the sea.

3.4 The site is situated in an area above 200m AOD and is significantly above sea level. It can therefore be concluded that the site is not at risk of tidal flooding.

4 Pluvial Risk

4.1 Pluvial flooding is defined as local flooding in areas not normally associated with natural or manmade watercourses that results from rainfall generated overland flow, before the runoff enters any watercourse or sewer. It is usually associated with high intensity rainfall events, but can also occur with lower intensity rainfall or melting snow, where the ground is saturated, frozen or developed resulting in overland flow and ponding in depressions in the topography. Pluvial flooding is unpredictable, to the extent that localised heavy rainfall can occur anywhere without warning. However, flow paths and depths can be determined by consideration of contours and relative levels.

4.2 The EA 'Flood Risk from Surface Water' map (Appendix D) shows that there is a surface water flow route crossing the western extent of the site from north to south-west. The risk of flooding along the majority of the flow route is low, meaning it has between a 1% and 0.1% annual probability of occurrence. An area of high risk (greater than a 3.3% annual probability of flooding) is identified in the south-western extent of the site. The high risk is associated with lagoons and man-made low points associated with the quarrying use. The remainder of the site is at very low risk, meaning it has a less than 0.1% annual probability of flooding.

4.3 The surface water flow route from north to south-west is also shown on the SCC 'Surface Water Flood Map' included in Appendix D.

4.4 The development proposal includes re-profiling of the site to enable residential development. As part of the re-profiling, low points such as lagoons will be removed, mitigating the associated surface water flood risk. The site will be profiled in a way that no properties will be located within isolated topographical depressions.

4.5 Taking account of the re-profiling, any potential overland flows would be directed onto proposed roads and into the site's drainage system.

4.6 The EA 'Flood Risk from Surface Water' map (Appendix D) confirms that there are no off-site flow routes which would direct surface water flooding towards the site.

4.7 There are no records of surface water flooding at the site. When accounting for the proposed re-profiling it can be concluded that the proposed properties are at low risk of surface water flooding.

5 Risk of Rising Groundwater

5.1 Groundwater flooding occurs when water levels underneath the ground rise above normal levels. Prolonged heavy rainfall soaks into the ground and can cause the ground to become saturated. This results in rising groundwater levels which leads to flooding above ground.

5.2 The SFRA states that '*there is currently no evidence to suggest that groundwater flooding is a major problem within Staffordshire…No records of groundwater flooding have been provided by the Environment Agency*.'

5.3 Intrusive site investigations were undertaken by E3P in October 2015. Trial pit logs included in Appendix F show that no groundwater was encountered across the majority of the site. Water strike was recorded at approximately 2.8m below ground level (m. bgl) in the location of trial pit 109 in the southern extent of the site.

5.4 There are no records of groundwater flooding at or near to the site. It can therefore be concluded that the risk of groundwater flooding is low.

6 Sewer Flooding

6.1 Flooding from sewers can occur when a sewer is overwhelmed by heavy rainfall, becomes blocked, is damaged or is of inadequate capacity. This is mostly applicable to combined and surface water sewers.

6.2 The United Utilities (UU) sewer plan (Appendix G) indicates that there are no public sewers crossing through the site. There is a 150mm public foul sewer located immediately south-west of the site in Hurst Road. The SFRA and PFRA contain no records of sewer flooding at or near to the site. SCC correspondence (Appendix E) states that 'we have records of a flooding incident at Hurst Road. This was reported by United Utilities…..The record describes flooding of gardens and a drive on Hurst Road.' There are no records of this flooding event affecting the site.

6.3 As shown on the Indicative Contour Remediation Plan (Appendix B) site levels will be above adjacent road levels, ensuring that any potential sewer flooding arising in Hurst Road would not reach the site. Any potential flooding arising from the foul sewer in Hurst Road would be directed south-west, away from the site, following the local topography. It can therefore be concluded that the risk of sewer flooding is low.

7 Risk from Reservoirs, Canals, Lakes and Artificial Sources

7.1 The site is not shown to be at risk of flooding from reservoirs on the EA 'Flood Risk from Reservoirs' map included in Appendix D. There are no canals within the vicinity of the site.

7.2 There are a number of ponds and lagoons associated with the quarrying use on site. The ponds and lagoons will be removed as part of the development. Therefore, the probability of flooding from artificial sources can be considered to be low.

8 Flood Risk Management Measures

8.1 From the preceding sections, it can be concluded that the main source of flood risk to the site is surface water flooding.

8.2 The surface water flood risk will be mitigated through the proposed ground re-profiling works. The site will be profiled to ensure that no properties are located within topographical depressions and that no distinct flow routes are formed. Surface runoff would be directed onto highways and into the site's drainage system, ensuring no flooding to properties.

8.3 In accordance with Building Regulations, finished floor levels of the properties should be set 150mm above surrounding ground levels.

9 Surface Water Management

9.1 Surface water from the quarry is infiltrating into the ground and is also contained within lagoons. Surface water from the existing industrial buildings on site is discharging onto the surrounding hard standing ground and eventually infiltrating.

9.2 In accordance with Staffordshire County Council requirements, the development should aim to achieve greenfield runoff rates. Existing greenfield runoff rates have been estimated using the Flood Estimation Handbook (FEH) Method within MicroDrainage (see Appendix H). The existing QMED (equivalent to the 1 in 2 year event) greenfield rate for the 7.46ha development site is 36.5 l/s. It should be noted that the proposed development plans have been provided in PDF format only and therefore the accuracy of the scale and any measurements derived from them are estimates only.

9.3 In order to ensure no increase in surface water discharge post-development, the runoff should be restricted to greenfield rates by using appropriate sustainable drainage techniques.

Review of Surface Water Disposal Options

9.4 Paragraph 080 of the NPPG: Flood Risk and Coastal Change sets out the following hierarchy of drainage options: into the ground (infiltration); to a surface water body; to a surface water sewer, highway drain or another drainage system; to a combined sewer.

Disposal via Infiltration Techniques

9.5 The Cranfield University 'Soilscapes' map shows that the majority of the site is underlain by 'freely draining sandy and loamy soils'.

9.6 Intrusive site investigations (for the southern half of the site) have been undertaken by E3P in October 2015 with trial pit logs included in Appendix F. The site is generally underlain by sands and gravels, however made ground comprising of gravelly clays are identified in areas of past landfill use. The depth of sand varies across the site and is subject to the extent of past quarrying. The site is underlain by firm grey red sandstone and halitestone.

9.7 The use of soakaways may be possible for this site. Infiltration testing will be undertaken in support of a full planning application to determine soakaway suitability.

9.8 Additional soil coverage to enable soakaway use could be provided as part of the proposed remediation contouring. Soakaways would be placed within private gardens. The areas of past landfill, which are designated as areas of public open space, are not suitable for the use of communal soakaways due to contamination issues. The site is identified within groundwater source protection zone 3 on EA mapping.

9.9 Soakaways must be placed a minimum of 5m from building foundations.

9.10 The ground conditions appear suitable for the use of permeable surfaces for driveways and roads.

Discharge to Watercourse

9.11 Where soakaways are not suitable, discharge to watercourse is the preferred option. The nearest watercourse is an unnamed watercourse located approximately 30m south-west of the site, which is an overspill from a larger unnamed watercourse located approximately 65m south-west of the site. A connection to either watercourse would require crossing third party land and a wooded area and may therefore not be feasible. The possibility of requisitioning a sewer connection to these watercourses will be established with UU.

9.12 An alternative is a connection to the watercourse to the north of the site via a pumped connection. The land between the site and the watercourse to the north is in the ownership of the client.

9.13 In order to ensure no increase in flood risk elsewhere, surface water discharge to watercourse should be restricted to the greenfield QMED rate of 36.5 l/s.

Discharge to the Public Sewer

9.14 The final consideration is a connection to the public sewer. As shown on the UU sewer plan (Appendix G) there is a public foul sewer in Hurst Road to the south of the site. There are no public surface water sewers within the vicinity of the site. As stated in the UU developer enquiry response (Appendix G), surface water runoff from the site should drain to soakaways or watercourse. A surface water connection to the public foul sewer is not a permitted option.

Surface Water Storage

9.15 In order to achieve a limited greenfield discharge rate of 36.5 l/s (where connection to watercourse is proposed), attenuation storage will be required. In accordance with SCC requirements, and the latest climate change guidance, attenuation storage should be provided for the 1 in 100 year plus 40% Climate Change (CC) storm event.

9.16 An attenuation storage estimate has been provided using MicroDrainage and is included in Appendix H. An estimated storage volume of 683m³ will be required for the 1 in 100 year plus 40% Climate Change (CC) event. The storage estimate is based on a flow rate of 36.5 l/s, storage within a tank or pond structure, an impermeable drainage area of 14,044m² (based on the latest development plans included in Appendix B), a design head of 1m and hydro-brake flow control.

9.17 Consideration should be given to upsizing the storage requirement i.e. by 10%, to accommodate any potential overland flow from the re-contoured quarry slopes.

9.18 The attenuation volume is provided for indicative purposes only and should be verified at the detailed design stage.

Sustainable Drainage Systems

9.19 In the event that soakaways and permeable surfaces are not suitable (subject to infiltration testing), Sustainable Drainage Systems (SuDS) should be used to provide attenuation storage, volume reduction and surface water treatment.

9.20 The potential for the use of Sustainable Drainage Systems (SuDS) for surface water storage has been considered at this stage.

Swales, detention basins and ponds

9.21 An open surface water attenuation feature such as a pond or a swale in an urban area presents a safety risk, the hazards and appropriate mitigation should be considered at the

detailed design stage. There is potential to provide an above ground drainage feature within public open space. The proposed areas of public open space overlay previous land fill areas and, as such, have contamination issues. Any storage features, either above or below ground, would therefore need to be lined to ensure no surface water seepage to the underlying aquifer. An above ground storage feature should be located within the topographically lower southern extent of the site.

Rainwater Harvesting

9.22 The attenuation benefits provided through the use of rainwater harvesting are considered to be limited, and would only be realised when the tanks were not full. However, rainwater harvesting techniques could be incorporated within the final design.

Green Roofs

9.23 The proposed development comprises construction of residential dwellings. The proposed development plans do not identify green roofs for the buildings on the site.

Porous / Permeable Paving

9.24 Permeable paving could be incorporated within private roads and driveways. Storage could be provided within the sub-grade material prior to controlled release to the receiving watercourse.

9.25 The provision of storage within the sub-grade material would only be feasible in areas with a proposed gradient of <1 in 20 as detailed within CIRIA RP992/28 (Design Assessment Checklists for Permeable/Porous Pavement). Site gradients should be confirmed at the detailed design stage. The amount of storage provided within permeable paving is subject to sub-grade depth and gradient.

Underground Attenuation (Cellular, oversized pipes)

9.26 Storage could be provided within underground attenuation tanks or oversized pipes within public open space or highways.

Preferred Option

9.27 At this stage the use of private soakaways for roof drainage; and permeable paving for all hard surfaces is the preferred option. This option is subject to the findings of infiltration tests.

9.28 The alternative drainage method is discharge to watercourse. This will either comprise a gravity connection to watercourse to the south of the site, subject to crossing third party land, or a pumped connection to watercourse to the north of the site. Discharge would be restricted to greenfield rates and storage provided to accommodate runoff during storm events up to and including the 1 in 100 plus climate change event.

Exceedance Flooding

9.29 The proposed indicative surface water drainage concept provides storage up to the 1 in 100 year plus 40% climate change event. Exceedance events of the surface water drainage system in excess of the 1 in 100 year plus 40% climate change storm event should be permitted to produce shallow depth flooding within highway areas or within public open space. Site levels should be designed to ensure that temporary shallow flooding is contained on site and will eventually drain back into the drainage system.

Management of SuDS

9.30 The surface water drainage system will be privately owned and maintained. Maintenance of soakaways within private gardens and private permeable paved driveways will be the responsibility of property owners. Permeable paving for shared surfaces will be maintained by a site management company.

9.31 Any shared surface water storage features (required where discharge to watercourse is proposed) will be maintained by a site management company.

9.32 Any shared attenuation storage features should be located in an easily accessible location for ease of maintenance.

9.33 Maintenance schedules for an attenuation tank, soakaway, pond and permeable paving are included in Appendix I.

10 Surface Water Treatment

10.1 In accordance with the CIRIA C753 publication ‘The SuDS Manual’ (2015), residential roofs have a ‘very low’ pollution hazard level, with individual property driveways and low traffic roads classified as having a ‘low’ pollution hazard level. Table 1 overleaf shows the pollution hazard indices for each land use.

Table 1 – Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Individual Property Driveways, Low Traffic Roads	Low	0.5	0.4	0.4

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.2

** Indices values range from 0-1.*

10.2 Where practical, runoff from roofs and roads will be directed to soakaways and permeable paving (where infiltration is feasible). Where discharge to watercourse is required, treatment could be provided through the use of open water storage features i.e. an attenuation pond Table 2 below demonstrates that permeable paving and an attenuation pond provide sufficient surface water treatment.

Table 2 – SuDS Mitigation Indices

	Mitigation Indices		
Type of SuDS	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Pavement	0.7	0.6	0.7
Pond	0.7	0.7	0.5

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.3

10.3 It can be concluded that the inclusion of a pond and/or permeable paving will provide sufficient treatment. Where attenuation is provided in a below ground system (tank storage), treatment will need to be provided by a suitably sized separator.

11 Foul Water Drainage

11.1 The UU sewer plan (Appendix G) shows that there is a 150mm public foul sewer located immediately south of the site in Hurst Road. A connection to this sewer appears to be a

feasible option. Correspondence with UU (Appendix G) confirms that 'foul will be allowed to drain to the public combined / foul sewer network. Our preferred point of discharge would be to the 150mm combined / foul sewer on Hurst Road at an unrestricted rate.'

11.2 Accounting for the proposed remediation re-profiling, a gravity connection to the public sewer will be feasible.

12 Other Considerations

12.1 A potential option for surface water drainage is a pumped solution to watercourse to the north of the site. A pumped solution may require additional on-site storage to account for pump or power failure. Sufficient open space is available to accommodate additional storage.

13 Summary and Conclusions

13.1 The proposal is for 27no. new build detached dwellings and the refurbishment of an existing quarry building into a dwelling with associated roads, landscaping and ground re-profiling at Hurst Quarry, Hurst Road, Biddulph.

13.2 The site is located in Flood Zone 1 on the Environment Agency 'Flood Map for Planning (rivers and sea)' – an area considered to have the lowest probability of fluvial and tidal flooding.

13.3 A surface water flow route has been identified on Environment Agency and Staffordshire County Council surface water flood risk mapping. The flow route crosses the western extent of the site from north to south-west. The risk of surface water flooding will be mitigated through re-profiling of site levels, ensuring that all properties will not be located within a topographical depression or a flow path. Any potential surface water runoff will be directed onto highway areas and into the site's drainage system.

13.4 The proposed development will increase the impermeable drainage area through the introduction of buildings and roads. As a result, surface water runoff rates and volumes will increase. Flow control will be used and attenuation provided on site to accommodate storm events up to and including the 1 in 100 year plus 40% climate change event.

13.5 All methods of surface water discharge have been assessed. Soakaways and permeable paving will be used subject to infiltration testing. Where soakaways are not feasible, an alternative is to discharge surface water runoff to watercourse. Discharge can either be made by gravity to the watercourse to the south of the site, subject to crossing third party land, or alternatively to an unnamed watercourse to the north of the site (within the clients land) via a pumped connection.

13.6 In order to ensure the development does not increase flood risk elsewhere, surface water discharge from the site will be restricted to greenfield rates.

13.7 Where flow restriction is required attenuation storage will be provided to accommodate the 1 in 100 year plus 40% climate change event on site.

13.8 Foul flows will be permitted to discharge into the public foul sewer in Hurst Road as agreed in principal with United Utilities. The proposed ground re-profiling enables a gravity connection.

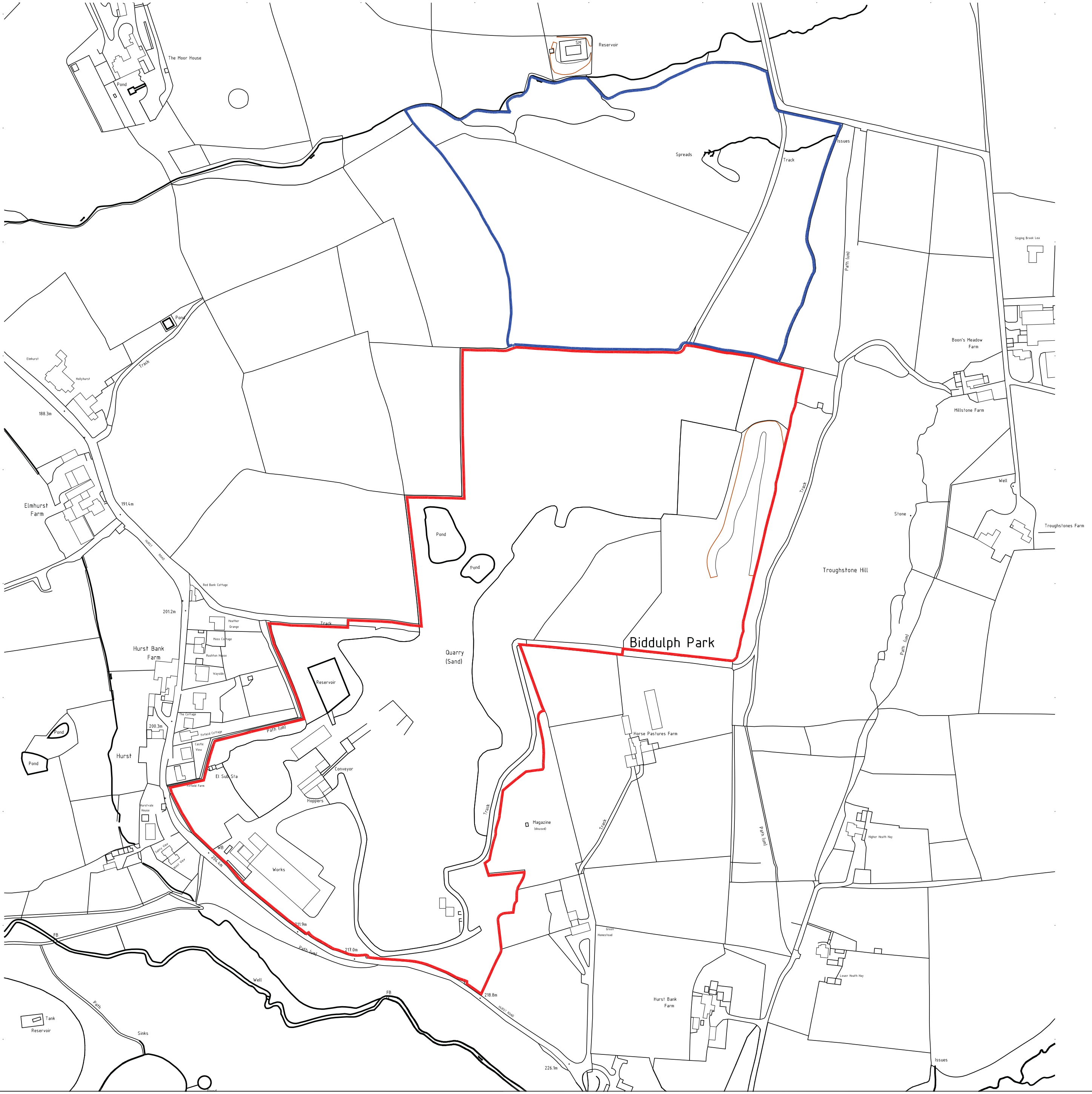
14 Recommendations

14.1 Set finished floor levels 150mm above surrounding ground levels.

14.2 Undertake infiltration tests in accordance with the BRE 365 specification to determine the feasibility of soakaways.

14.3 Submit this Flood Risk Assessment and Drainage Strategy to the Planning Authority in support of the outline Planning Application.

Appendix A – Location Plan and Aerial Image



This drawing must not be scaled, and all dimensions to be checked on site, with all anomalies brought to the attention of the Architects. IF IN DOUBT, ASK!

PROJECT NO	DWG NO	REVISION
1930 -	101	*

DRAWING TITLE
LOCATION PLAN
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PROJECT
HURST QUARRY
BIDDULPH

SCALE	DATE	DWN	CHK
1:2500@A2 xx@A3	09-15	--	--

REVISION/ISSUE
ISSUE

rev	date	description
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barrie newcombe ASSOCIATES

winnington hall, winnington,
northwich, cheshire, CW8 4DU
Tel: (01606) 782 500

Aerial Photograph

(Source: Google Earth)