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environmental water management

ASSESSMENT OF THE HYDROLOGY OF

YATE FOLD FARM, HORWICH

Report Reference: 3379/HA
Draft version D1
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Report prepared for:

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GENERAL NOTES

Title of report: Assessment of hydrology

Site: Yate Fold Farm, Horwich

Report ref: 3379/HA

Date: August 2022

Version	Date	Issued to
Draft version D1	6th September 2022	The Environment Bank

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DRAWINGS

1 INTRODUCTION

1.1 Background

Options for the future management of land at Yate Fold Farm, Horwich, to increase its habitat value, are being considered by the Environment Bank. The requirement is to improve the area for wildlife within criteria defined by DEFRA. The site will then be used to offset habitat loss at development sites elsewhere. Hafren Water was commissioned to undertake an assessment of the water environment, which is one of the key considerations of future land management options.

1.2 Data sources

The following data sources were used in this assessment:

British Geological Survey (BGS)

- 1:50,000 scale on-line geological mapping
- Borehole logs

Ordnance Survey (OS)

- Current mapping at 1:50,000 and 1:25,000
- Historical mapping at various scales

The Environment Bank

- LiDar data

1.3 Scope of assessment

In order to achieve the objective of the assessment the following input was undertaken:

- Collation of data relating to all aspects of the current, baseline, water environment including geology, hydrology, landform, current drainage provision, land use and vegetation
- Site visit. A site walkover visit was undertaken (17th May 2022) with the landowners and the Environment Bank, to gain a clear understanding of the current land use and plans for future management of the site. The environs of the site were also visited
- The outcomes of the above were used to identify where potential existed to modify the current landform/landuse to enhance its habitat interest
- Actions were then identified to enable the enhancements to be achieved

2 BASELINE CONDITIONS

2.1 Location

Yate Fold Farm landholding (the site) is located approximately 3 kilometres (km) east of Horwich and 6 km west-northwest of the centre of Bolton, Greater Manchester. Chorley Old Road (the B6226) parallels the southern site boundary. Walker Fold Road forms part of the eastern site boundary and is orientated southwest to northeast.

2.2 Landform

The site is located on the southern flanks of Winter Hill, the summit of which attains 456 metres Above Ordnance Datum (mAOD), approximately 4 km to its northwest. Ground elevations decrease steadily southwards from the site to the Middle Broad watercourse, which is situated at an elevation of approximately 105 mAOD.

Ground elevations within the site decrease from 315 mAOD in the northwest to 235 mAOD at its southeastern extremity. Detailed ground contours have been derived from LiDAR data and are shown on *Drawing 3379/HA/01*. The gradient across most of the site is relatively constant, the exception being in the southeast, where lower gradients occur.

Ground elevations along much of the northern boundary of the site are influenced locally by the presence of a small, west-east orientated valley.

2.3 Hydrology

2.3.1 Rainfall

Monthly average data for the period 2013-2015 are shown in *Table 3379/HA/T1* below.

3379/HA/T1: Monthly average rainfall data (mm)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
169	145	87	87	42	39	66	96	104	71	177	154

2.3.2 Watercourses

The site is located within the catchment of the Middle Brook, which is a tributary of the River Croal. The Middle Brook is situated approximately 2 km to the south of the site, at its closest approach.

The headwaters of the Dakin Brook flow in an east-west orientated channel along the northern site boundary. Downstream, the watercourse becomes the Dean Brook, which ultimately discharges into the River Tonge, in northern Bolton.

There are no defined natural watercourses within the site boundary. However, there are several ditches: all surface water features in the vicinity of the site are shown on *Drawing 3379/HA/02* and those within the site on *Drawing 3379/HA/03*.

2.3.3 Waterbodies

Four small ponds/former ponds exist within the curtilage of the site. They are all located in its northwest, close to its highest elevations. They appear to be spring-sourced and man-made. Three of the features are overgrown, but the largest possesses open water, and has an egress to its south, which supports it being spring-sourced.

A larger waterbody is present immediately to the southwest of the site, adjacent to Ivy Model Farm. It is situated at approximately 245 mAOD and is located within a former quarry.

The largest waterbody within a 1 km radius of the site is High Rid Reservoir; it is located at an elevation of approximately 175 mAOD and is located 800 m to the south of the southern site boundary.

2.3.4 Drainage

The current drainage characteristics of the site are governed by ground slope, near surface geology and man-made drainage provision.

Historically installed drainage exists within the site: several stone-lined conduits were constructed to collect surface water and convey it southwards to the former High Rid Reservoir, which was constructed in 1892. It is assumed that the conduits were installed at the same time. It is understood (pers comm with site landowners) that the reservoir is not now used for water supply. However, the conduits continue to function and remove water effectively from the land, leading to a reduction in the volume of water available for ecological enhancement.

At times of high rainfall hardstanding areas in the south of the site discharge surface water directly onto the Chorley Old Road.

2.4 Geology

2.4.1 Regional

The bedrock in the locality of the site comprises Carboniferous-age Pennine Lower Coal Measures, with the Ousel Nest Grit being the most significant component of the sequence. It is a coarse-grained, well-cemented sandstone, proven locally to be up to 55 m thick and generally dips 5° southwestwards. The Ousel Nest Grit sandstone is locally interbedded with shales and coal seams.

The most widely developed superficial deposits within the region comprise laterally extensive, Quaternary-age Peat, Glaciofluvial Deposits and Till. Alluvium also occurs locally but is not laterally extensive. Recent Alluvium associated with the River Douglas and Dean Brook occurs to the west and east of the site.

Bedrock and superficial deposits in the vicinity of the site are shown on *Drawing 3379/HA/04* and the stratigraphical sequence is summarised in *Table 3379/HA/T2*.

3379/HA/T2: Regional stratigraphy				
	Group	**Formation**		**Lithology [A]**
Superficial Deposits			Peat	Dense organic matter
			Alluvium	Clay, silt, sand and gravel
			Glaciofluvial Deposits - Devensian	Sand and gravel
			Till (mictite) Devensian	Clay, silt, sand and gravel
Bedrock	Pennines Lower Coal Measures		*Ousel Nest Grit*	Coarse-grained, well-cemented sandstone (55 m thick)
			Margery Mine	Coal seam (0.5 m thick)
			Intermediate Beds	Mainly shales (14.5 m thick)
			Margery Flags	Fine and medium grained – flaggy sandstone (10–12 m thick)
			Intermediate beds	Mainly shales (18 m thick)
[A] BGS notes on Map sheet 66 and BGS Lexicon				

a) Bedrock

The Ousel Nest Grit forms the bedrock beneath the site.

b) Superficial

Most of the site is devoid of superficial deposits, with only topsoil present above the bedrock. However, spreads of superficial deposits exist within the southeast of the site, on areas of gentle gradient.

2.5 Overview of the water environment

The characteristics of the water environment at the site are governed by several factors. These are inter-related and an understanding of them allows measures to be identified that will lead to an increase in the habitat value of the site.

In terms of water issues the site can be broadly sub-divided in two, based on the landform and underlying geology. The latter has a strong influence on the drainage characteristics/ hydrology of the site and comprises:

a) Areas underlain by Carboniferous deposits

This area comprises most of the site and its extent can be seen on the geological map (*Drawing 3379/HA/04*).

The natural drainage characteristics of this area are dictated by the presence of siltstones/ sandstones interbedded with clays. Groundwater egresses occur, predominantly diffusely, presumably from the coarser units within the sequence. Several springs, including one which supports the largest pond in the northwest of the site, are considered to be located where particularly coarse sections of the bedrock and/or fractures occur.

b) Areas underlain by glacial till

The southeastern section of the site is underlain by glacial till. This extends to approximately a third of the total area of the site and occurs at its lowermost elevations, where ground elevations are subdued.

Based on comparison with similar deposits at broadly equivalent sites, and observations made during the site visit, the drainage of this area differs from the rest of the site, being impeded. The 'wetter' nature of the ground and vegetation is an expression of its poorer drainage characteristics.

3 POTENTIAL FOR ENHANCEMENT

3.1 Overview

The extant water environment is influenced by both natural and anthropogenic factors. Ground slope and near-surface geology are the primary controls of water distribution, upon which is superimposed the effects of man-made drainage.

Options for modifying current water features to enhance the habitat value of the site have been considered. The measures proposed have been designed to increase habitat interest, but within the DEFRA criteria. For the sake of expediency, measures that require the involvement of the Environment Agency or Local Lead Flood Authority (LLFA) have been avoided. Similarly, the proposed measures will not affect the drainability of the site to such an extent that there is potential for impact upon downstream landholdings.

3.2 Potential for enhancements

The various ways in which water can potentially be managed to enhance ecological interest are by:

a) Management of existing ponds

Four ponds currently exist at relatively high elevations in the northwest of the site, three of which are overgrown such that no open water now exists. (Labelled A on *Drawing 3379/HA/05)*. Subject to the confirmation of benefit by an ecologist, the three ponds could be dug out to create areas of open water.

b) Creation of additional small ponds

The existence of ponds on the upper slopes in the northwest of the site proves that sustainable features can be created; it is considered highly likely that they are sourced from groundwater egress from sandstone/siltstone bands within the underlying bedrock. Additional small ponds could be created in the same area of the site; delineated as area C shown on *Drawing 3379/HA/05*.

c) Emplacement of berms in the current drainage system

The ditch in the centre of the site (labelled B on *Drawing 3379/HA/05*) can be modified by the emplacement of low 'check dams' at 20 m intervals. The placement of in-situ material within the ditch will impede flow, leading to the creation of a linear ephemeral waterbody. It is anticipated that the ditch will retain moisture, thereby promoting water-supported flora

and fauna. Sufficient flow within the ditch should be maintained to adequately supply the proposed waterbody to the southwest (Feature G).

d) Works in the headwaters of the Deakin Brook

It is not proposed to undertake any works within the headwaters of the Deakin Brook, which parallels the northern site boundary. This will ensure that water flow off-site is not impeded.

e) Emplacement of low berms

Low berms at 20 m centres could be emplaced within ditches labelled E on *Drawing 3379/HA/05*, as per c) above.

f) Channelling of water from springs

Several small springs occur within the site which discharge diffusely to ground. It is understood that it would be preferable to prevent such seepages so that the vegetation in their proximity becomes 'drier'. Channels or pipes could be readily installed to convey water from the springs to specific areas within the site.

g) Creation of a waterbody in an existing depression

Works can be undertaken in an existing depression (labelled G on *Drawing 3379/HA/05*) to create a permanent waterbody. The original purpose of this feature is not known but could have been a pond for stock watering, or a 'borrow pit', to generate aggregate for use on the farm.

Water does not currently accumulate within the depression as a drain exists close to its base from which water egresses. It is considered likely that this drain comprises a part of the historical collection system, which was constructed to convey water southwards.

The feature can be enhanced by raising the elevation of the outfall. The way in which this could be achieved is shown on *Drawing 3379/HA/06*.

h) Creation of low bunds

The creation of low bunds ('sleeping policemen') and/or heavy-duty, cast-iron cross-drains on the farm access road could be installed to convey water laterally to the adjacent farmland. The creation of shallow swales would allow the collection and dissipation of water and prevent the run-off of surface water onto Chorley Old Road.

i) Micro contouring and creation of low berms

The presence of extensive clays on low gradient ground in the southeast of the site provides the opportunity to create areas of 'wet' grassland (labelled 'I' on *Drawing 3379/HA/05*). The small-scale re-contouring of ground, to further reduce gradients, and the creation of low bunds, following ground contours, would be relatively straightforward to achieve. The optimum landform would be guided by ecological advice, however the creation of level ground by 'micro contouring' would greatly increase the ability to retain water in this area of low permeability.

4 SUMMARY

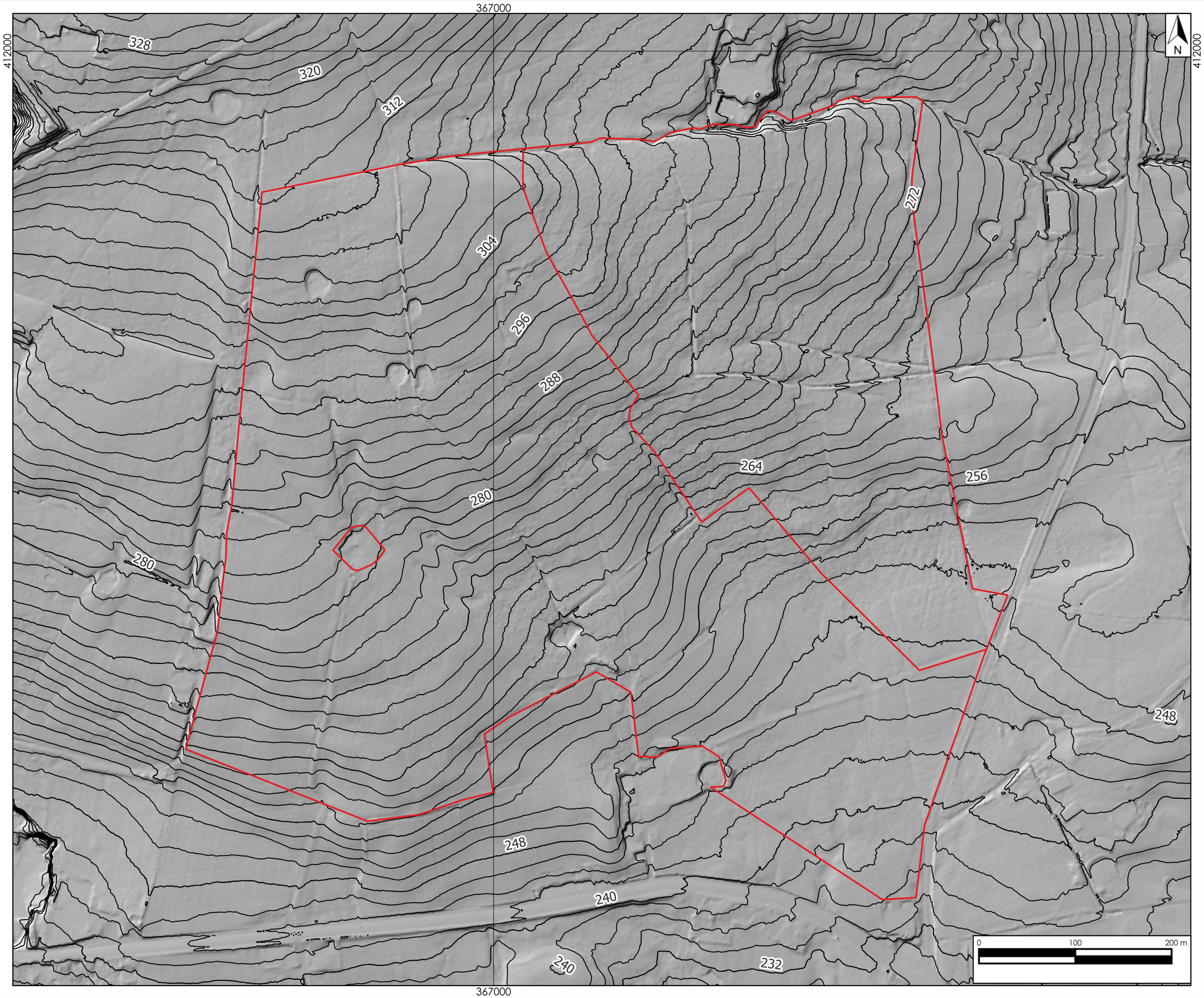
An assessment of the existing water environment at Yate Fold Farm has been undertaken. The physical characteristics of the site were determined, and the mechanisms of water distribution investigated. The assessment was undertaken by a combination of data collation, a walkover survey and discussions with the landowners, who have prolonged site experience.

The understanding of the water environment gained from the baseline assessment has allowed the identification of works that can be undertaken to increase the habitat/ ecological interest of the site.

The measures proposed are all 'low key' and have been defined to minimise impact on downstream landholdings and to not require dialogue with the regulators. They include both small-scale interventions, such as the emplacement of low berms in existing ditches to larger-scale measures. The latter include minor re-contouring of ground elevations and the creation of contour berms, in areas underlain by clay, in the southeast of the site.

The merits of each proposal should be considered in the light of their impact upon the existing habitats and DEFRA scoring criteria. Some of the measures, such as the creation of additional ponds in the northwest of the site, may not assist greatly with DEFRA scoring but could, with relatively small cost and effort, lead to habitat and ecological benefits, which it is understood are compatible with the overall approach to works at Yate Fold Farm.

DRAWINGS



Legend

- Site Boundary
- Contours 2m

Scale correct at A3

Client	Environment Bank
Title	Ground Surface Contours
Project	Yate Fold Farm
Drawing	3353/HIA/01
Version	1
Date	Aug 22
Scale	1:3,750

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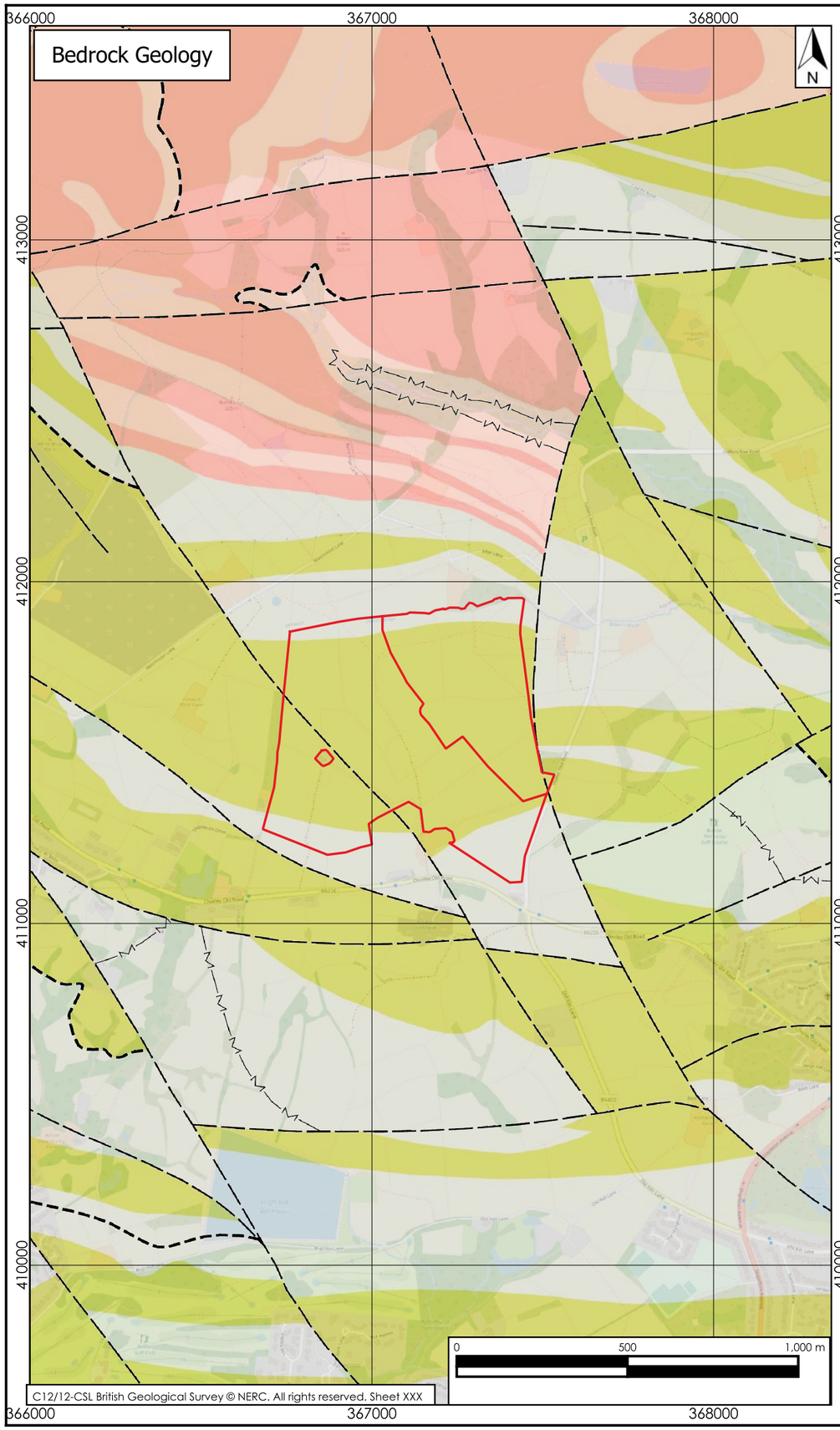

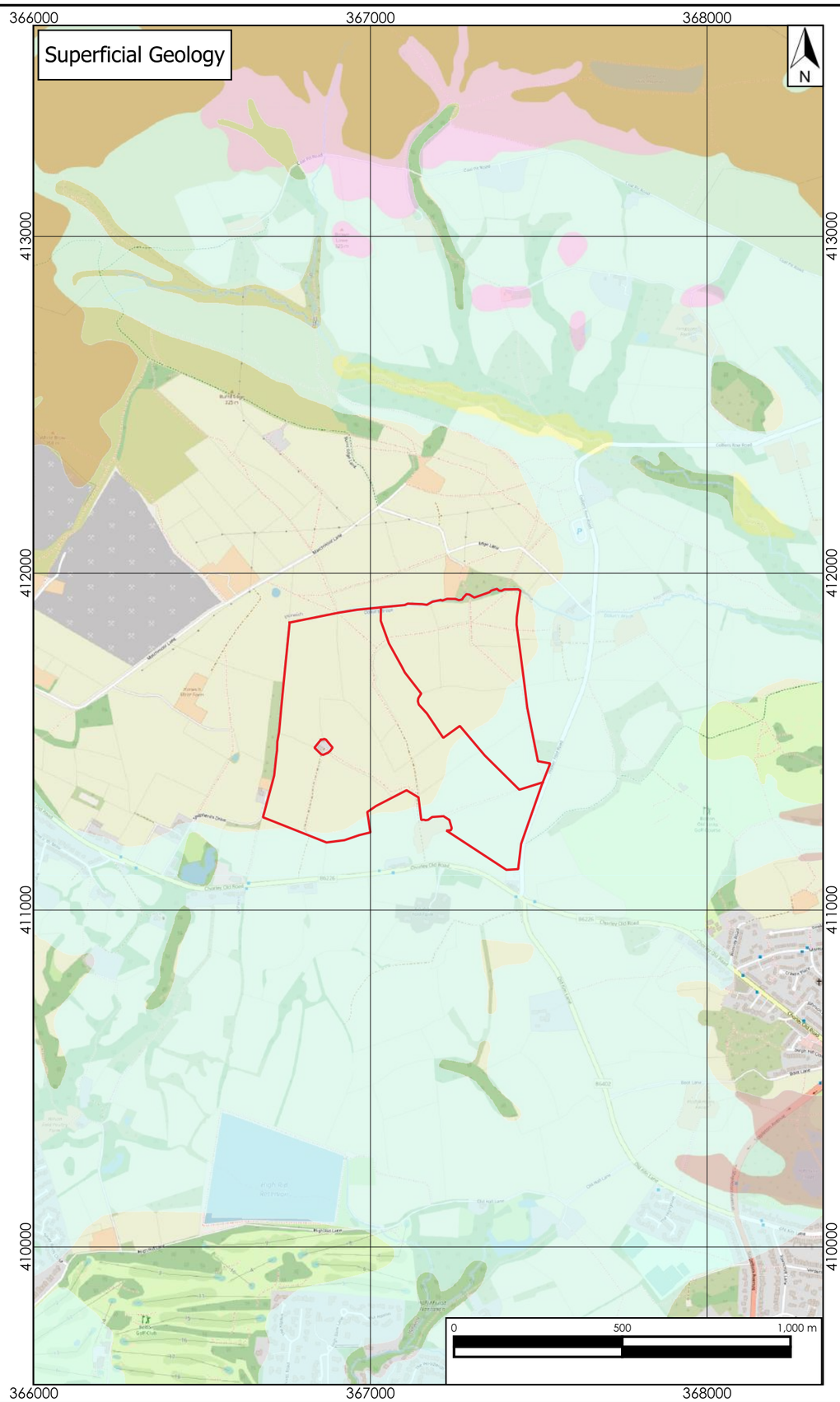

Key

- Site Boundary

Bedrock Geology

- Linear Feature
- Ousel Nest Grit - Sandstone
- Pennine Middle Coal Measures Formation - Mudstone, Siltstone and Sandstone
- Rossendale Formation - Mudstone, Siltstone and Sandstone
- Pennine Lower Coal Measures Formation - Mudstone, Siltstone and Sandstone
- Rough Rock - Sandstone

Superficial Geology

- Clay, Silt, Sand and Gravel
- Till
- Sand and Gravel
- Sand and Gravel
- Peat

Scale correct at A3

Client	Environment Bank
Title	Regional Geology
Project	Yate Fold Farm
Drawing	3353/HIA/02
Version	1
Date	Aug 22
Scale	1:15,000

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412000
367000
N
Dakin's Brook
Chorley Old Road
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
0
100
200 m
411000
367000

Legend

Watercourse

Water Feature

- (1) Pond with open water and egress
- (2)-(4) Vegetated ponds
- (5) Headwaters of the Dakin's Brook
- (6)-(7) Ditches
- (8) Spring discharging to ground - waterlogged area to its South
- (9) and (14) ditch
- (10) Excavated area- egress via a pipe formerly part of the Collector system for High Rid Reservoir
- (11) Stone lined culvert at side of track associated with High Rid Reservoir
- (12) Surface water egresses site at times of high rainfall, directly onto Chorley Old Road
- (13) Spring shown on OS mapping
- (15) Chamber/stone lined culvert. Associated with High Rid Resevoir

Scale correct at A3

Client	Environment Bank		
Title	Water Features Within The Site		
Project	Yate Fold Farm		
Drawing	3353/HA/03	Version	1
Date	Aug 22	Scale	1:3,750

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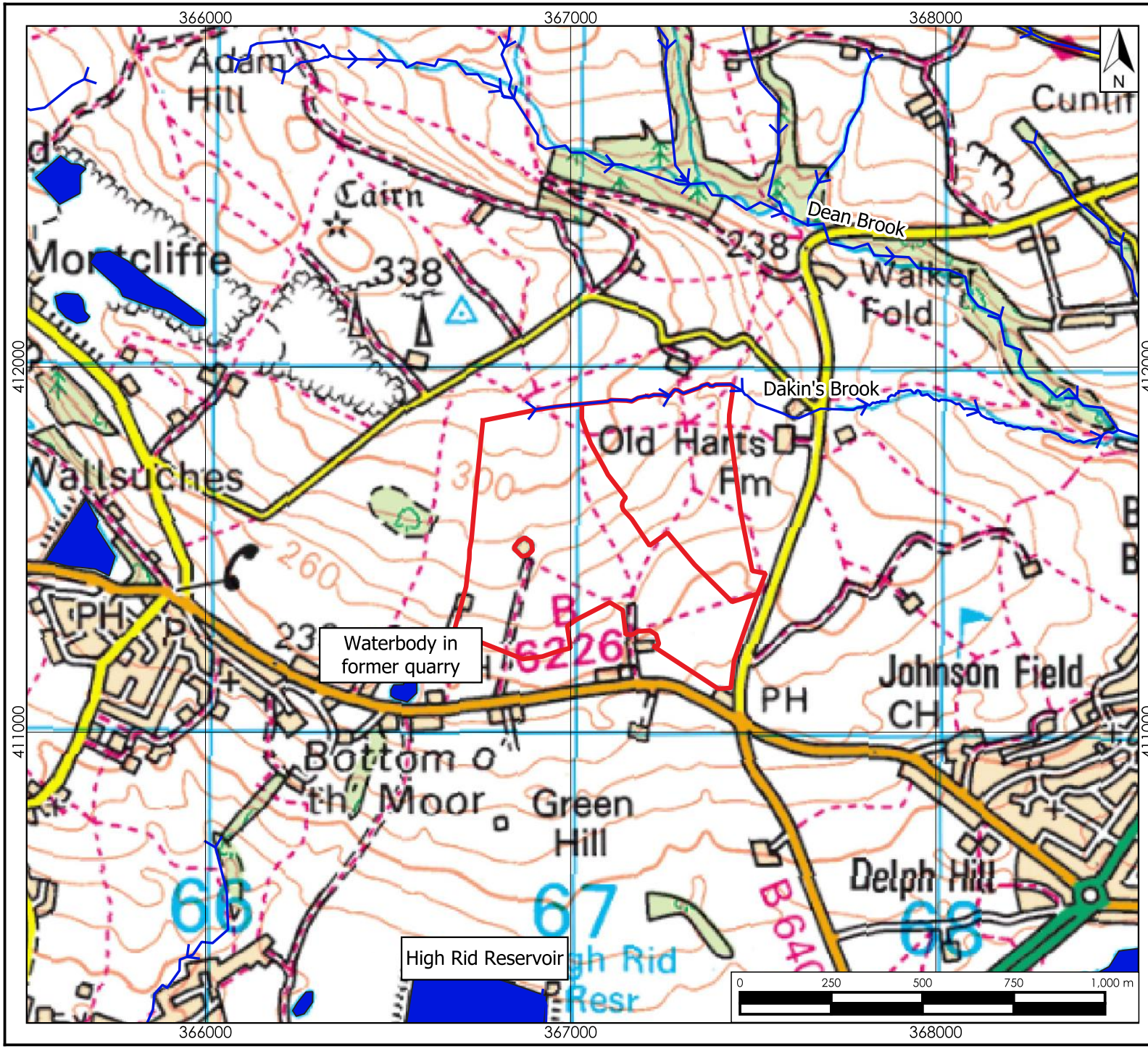

Legend

- Site Boundary
- Watercourse
- Waterbody

Scale correct at A4

Client	Environment Bank		
Title	Water Features Around The Site		
Project	Yate Fold Farm		
Drawing	3353/HIA/04	Version	1
Date	Aug 22	Scale	1:15,000

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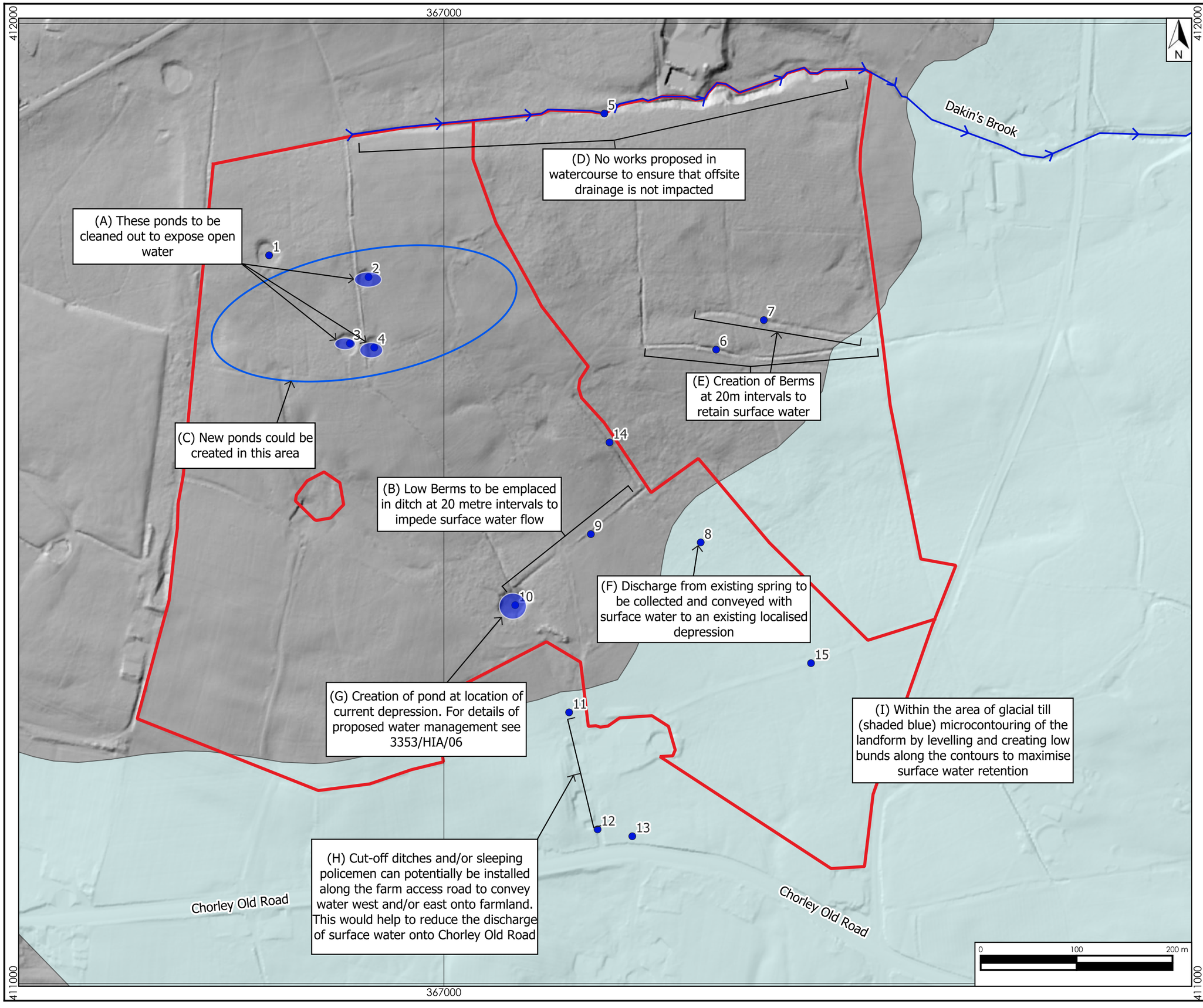

Legend

- Watercourse
- Approximate Limit of Glacial Till Deposits

Water Feature

- (1) Pond with open water and egress
- (2)-(4) Vegetated ponds
- (5) Headwaters of the Dakin's Brook
- (6)-(7) Ditches
- (8) Spring discharging to ground - waterlogged area to its South
- (9) and (14) ditch
- (10) Excavated area- egress via a pipe formerly part of the Collector system for High Rid Reservoir
- (11) Stone lined culvert at side of track associated with High Rid Reservoir
- (12) Surface water egresses site at times of high rainfall, directly onto Chorley Old Road
- (13) Spring shown on OS mapping
- (15) Chamber/stone lined culvert. Associated with High Rid Resevoir

Scale correct at A3

Client	Environment Bank		
Title	Potential Enhancements to Water Features		
Project	Yate Fold Farm		
Drawing	3353/HIA/05	Version	1
Date	Aug 22	Scale	1:3,750

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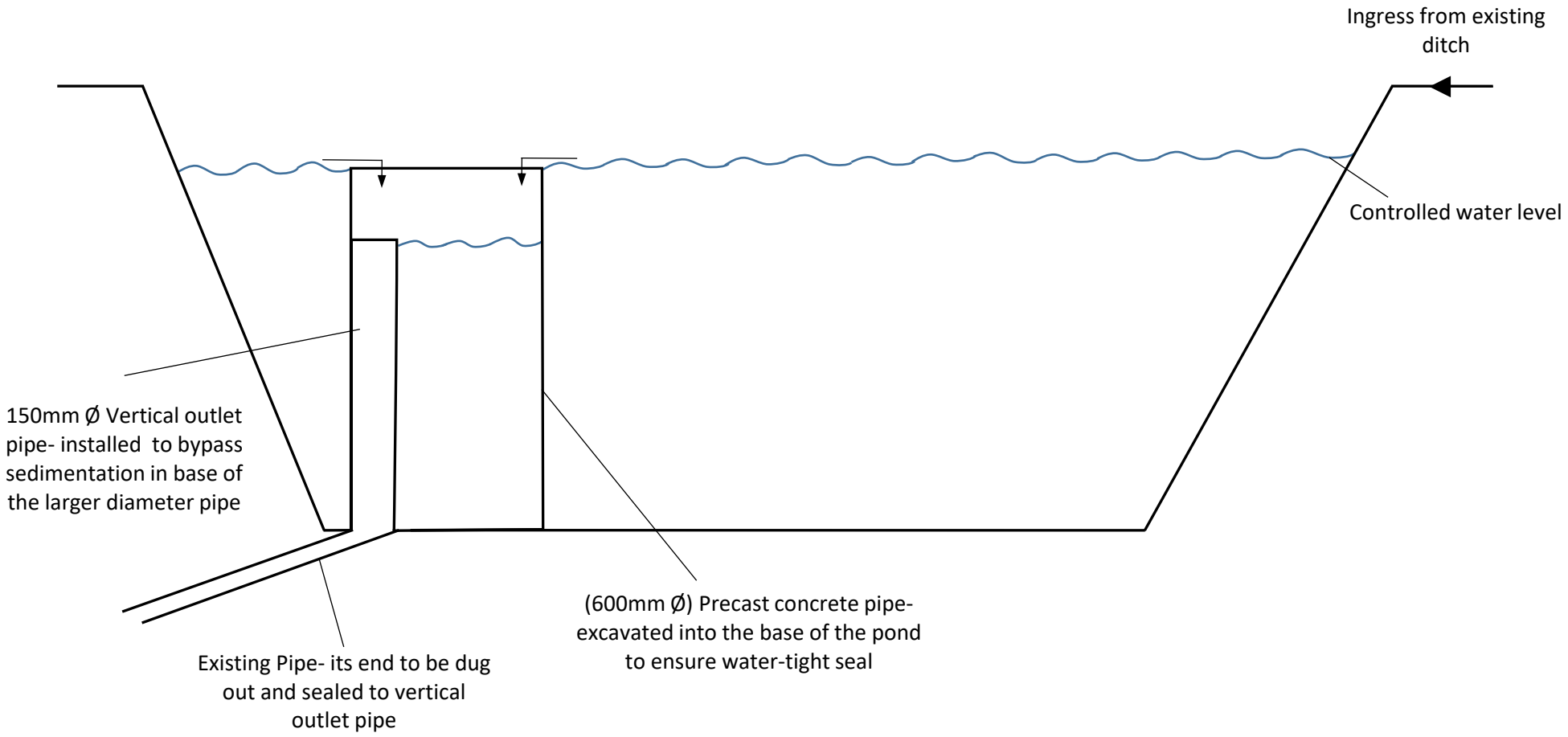

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Client	The Environment Bank		
Title	Schematic of water control method of pond		
Project	Yate Fold Farm		
Drawing	3353/HIA/06	Version	1
Date	Aug-22	Scale	