Natural England Commissioned Report NECR141

# New Forest SSSI Ecohydrological Survey Overview

## Annex A: Holmhill Bog, Silver Stream, Redhill Bog, White Moor, North Weir, Trenley Lawn and Hincheslea Bog

First published 06 March 2014

www.naturalengland.org.uk

NATURAL ENGLAND

# Contents

# 1 Holmhill Bog, Silver Stream, Redhill Bog, White Moor, North Weir, Trenley Lawn and Hincheslea Bog

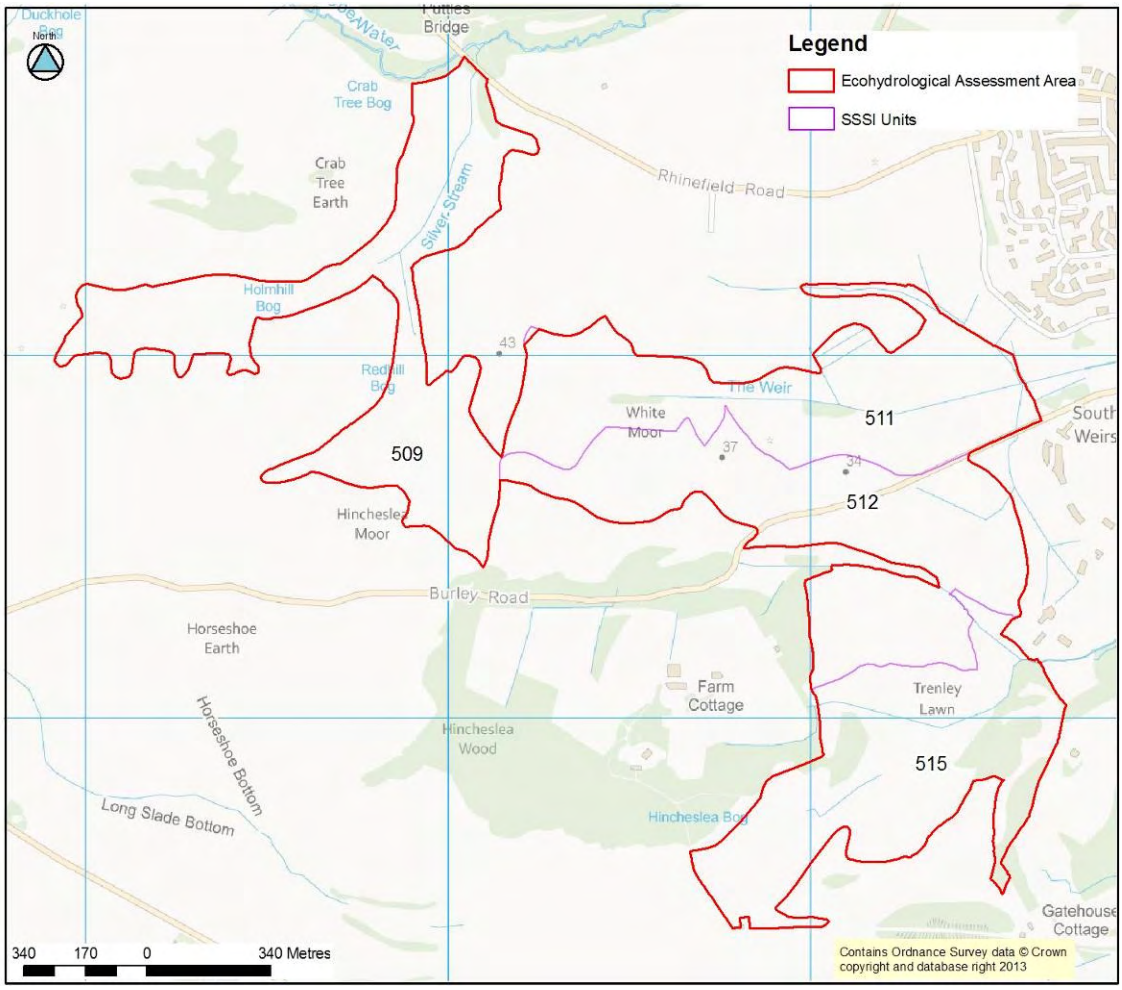
## 1.1 Introduction

This Ecohydrological Assessment Area (EcoHAA) covers 174ha and is contained within SSSI Unit 509, 511, 512 and 515 with its centre at National Grid Reference (NGR) 427834, 101783 (see Figure 1-1).

Within this report the assessment area will be split into three main areas:

- Unit 509 - Silver Stream, Redhill Bog and Holmhill Bog,
- Unit 511 and the northern part of Unit 512 - White Moor and North Weir,
- Unit 515 and the smaller southern part of Unit 512 - Trenley Lawn and Hincheslea Bog.

**Figure 1-1: Location Map**




The site encompasses a wide range of habitats from valley mires with significant domed peat deposits to areas of extensive lawns.

**Table 1-1: 1 Holmhill, Silver Stream, Redhill Bog, White Moor, North Weir, Trenley Lawn and Hincheslea Bog Ecohydrological Assessment Area Summary Table**

| **Eco-hydrological Assessment Area** | | **A** | | | | |
|---|---|---|---|---|---|---|
| Name | | North Weirs Mire ***et al***. | | | | |
| Relative Geomorphology Assessment | | | | | | |
| Size (ha) | | 173.9 | | | | |
| SSSI Units | | 509, 511, 512 and 515 | Holmhill and Red Hill Bogs | Silver Stream | White Moor | Hincheslea Bog and Trenley Lawn |
| Valley Side Wetland | Present | Y | Y | Y | Y | Y |
| | Wetland Type | Flush Dominated Wetland | | | | |
| | Main Source of water | Seepage from junction with Becton Sand (aquifer) and Bunny Member (aquitard) | | | | |
| | Indicative NVC communities | | M25a M29 W23 | M25a M21a H9 M16a | M21a H2 M16a W23 | W23 W10 H9 M25a M16a M16c W25 |
| | Wetland Types | Mire, wet heath, wet grassland | Mire, wet heath | Mire, wet heath | Mire, wet heath | Wet heath |
| | Drainage Damage | | Y - historic choked drainage (Minor) | N | Y - active drains (Moderate) | N |
| | Scrub/Tree Encroachment Damage | | Y - along choked Drain (Minor) | N | N | N |
| | Poaching and Grazing Pressures Damage | | N | N | N | N |
| Valley Basin Wetland | Present | Y | Y | Y | Y | Y |
| | Wetland Type | | Flush Dominated Wetland | | | |
| | Main Source of water | | Seepage from junction with Becton Sand (aquifer) and Bunny Member (aquitard) | | | |
| | Indicative NVC communities | | S4 M21a | M25a M21a | M25a M29 M24 M21a | S4 M21a M25a M23a M16b M29 M21a |
| | Wetland Types | Mire, wet heath, wet grassland | Mire | Mire | Mire, wet grassland (lawn) | Mire, wet grassland (lawn) |
| | Drainage | | N | Y - large valley side drain and concentration of flows at bridge location (Major) | Y - large central drain (Major); lawn creation (Minor/ Moderate) | Y - large central drain (Major); lawn creation (Minor/ Moderate); concentration of flows at bridge location (Minor/ Moderate) |
| | Scrub/Tree Encroachment Damage | | N | N | Y - along central drain (moderate) | Y - along central drain (moderate) |
| | Poaching and Grazing Pressures | | N | Y - at path fording location | N | N |

| | | | | | |
|---|---|---|---|---|---|
| Additional Comments | Valleys within the Ecohydrological Assessment Areas have similar geology and water but the degree and type of damage within them varies - hence splitting them within this table | Upper valley feeding Silver Stream - limited damage in each of these areas | Large valley side drain is causing significant damage and peat wastage of valley basin mire | Large central drain with scrub encroachment is causing damage to the mire. This drain continues off the valley head slopes. In the lower sections, drainage has lead to the creation of extensive lawn areas where there once was mire | Similar issues to white moor - central drains (in sections) and lawn creation in certain areas. |

It should be noted that although this is a standalone report, it is strongly reliant upon the background information provided in section 3 of the JBA (2013) Ecohydrology Survey Overview report, which provides general geology, hydrogeology, ecology, wetland mechanisms and restoration information for the New Forest wetlands surveyed. At the end of the report is a series of maps which support the assessment and indicate the spatial distribution of the features described.

## 1.2 Topography and Wetland Distribution

The site lies in a series of valleys to the west of Brockenhurst.

### Unit 509 - Silver Stream, Redhill Bog and Holmhill Bog

This area forms a Y shaped valley. Within the upper western arm is Holmhill Bog which consists of a main valley bottom wetland with a slightly domed thick peat base. The main valley bottom is surrounded by a valley side wetland which within it has four small trough valleys with peat bases.

**Figure 1-2: Valley bottom mire with dome in Holmhill Bog (NGR 426480, 102150)**

**Figure 1-3: Trough in valley side supporting a wetland in Holmhill Bog (NGR 426435, 102010)**

Redhill bog forms the upper eastern arm. It is at a slightly higher elevation than Holmhill bog and, therefore, the seepage faces that support the wetlands occur closer to the valley bottom.

**Figure 1-4: Redhill bog looking down the valley (note: the mire does not cover the upper reaches of the valley bottom) (NGR 426850, 101850)**

Silver Stream forms the lower limb of the Y shaped valley, like Holmhill, it contains significant peat deposits in the base of the valley, however, a large drain has been cut along the eastern base of the valley edge. This has severely degraded the bog and led to the loss of the domed surface. This drainage continues into the lower parts of Holmhill and Redhill Bog, although the drain appears to have been blocked in these reaches. At the junction of these limbs is a causeway (with bridged sections) this has caused the removal of the bog in these areas through erosion.

**Figure 1-5: Drainage ditch down the side of Silver Stream (NGR 426885, 102390)**

**Figure 1-6: Photo from bridge at junction of the valleys- scrub shows evidence of drainage in lower part of Holmhill Bog - the foreground shows that erosion has removed the peat deposits around the causeway (NGR 426770, 102240)**

## Unit 511 and the northern part of Unit 512 - White Moor and North Weir

This area forms one long valley which is joined by two smaller valleys at its lower end. At the head of the valley is a large area of valley side mire, in some areas there are significant areas of peat with a quaking surface. The valley bottom wetland has been severely degraded in its upper reach and completely removed in its lower reaches by a large central drain and lawn creating drains. In this area the mire has been replaced by wet grassland and scrub woodland. The lawn-creating drainage has, in many places, extended up the valley sides drying-out these areas.

**Figure 1-7: Valley head wetland at White Moor - woodland in distance surrounds the valley bottom drain (NGR 427390, 101870)**

**Figure 1-8: Lawn area downstream of White Moor (NGR 428320, 101800)**

Within Unit 511 is another valley next to North Weirs Road. Very effective lawn drainage has replaced mire habitat with marshy grassland. Around the edges and upper reaches the drainage is less effective and has led to the creation of dry heath.

Another valley joins Unit 511 at the southern end of the site next to South Weirs Road. This valley has also been subjected to lawn drainage. The SSSI Unit boundary lies along the divide between where lawn drainage has been effective and created marshy grassland (outside the SSSI) and the higher part of the valley were the drainage is less effective and dry heath is present.

**Figure 1-9: Lawn Drainage at South Weirs Road (Unit 511 boundary: note right of picture where grassland is replaced by wet heath (NGR 428565, 101585)**

## Unit 515 and the smaller southern part of Unit 512 - Trenley Lawn and Hincheslea Bog

Hincheslea Bog forms the most southerly valley of the assessment area. The upper parts of the valley are outside the assessment area. The valley is long and thin and within the bottom is a valley mire with significant peat deposits which, like Holmhill bog, has a slight dome to its profile. There are two raised causeway paths (incorporating bridges) across the valley mire. At these points there has been some limited drainage and damage to the mires caused by causeways.

**Figure 1-10: Causeway across Hincheslea Bog (NGR 427770, 100435)**

Trenley Lawn is a smaller valley just to the north of Hincheslea Bog. There is only a very low watershed between the two. More extensive drainage has occurred in this valley with a straight centre drain cut through its length. The upper parts of the area have turned into grassland as a result of the drainage.

**Figure 1-11: Centre Drain in upper part of Trenley Lawn (NGR 428170, 101015)**

**Figure 1-12: Centre Drain in lower part of Trenley Lawn (NGR 428485, 101005)**

In the south east corner of the assessment area (NGR centre point 428570, 100820) is another smaller valley, this has been subjected to small scale drainage and contains a lawn.

**Figure 1-13: Lawn covered valley in South East of Assessment Area (note small surface drain in left of picture) (NGR 428640, 100978)**

## 1.3 Ecology

### *Holmhill Bog*

The area shown on OS maps as Holmhill Bog (Unit 509) is a fairly pristine area of valley mire with a Purple Moor-grass ***Molinia caerulea*/*Sphagnum*** dominated flora beneath a sharp topographical scarp which delineates the change from the tussocky wet heath above. Above the wet heath, there is again another sharp change in topography and here dry heath with Gorse ***Ulex europaeus*** and Heather ***Calluna vulgaris*** is present. This valley is notable for the presence of Greater Tussock-sedge ***Carex paniculata*** in a few locations.

The headwaters of the feeding streams have anastomised channels and a very sharp ecotone between the wet heath and floating vegetation, of usually less than 1 metre. At the downstream end of Holmhill Bog there is a cut drain, although this now appears to have silted up. Here this can be picked out by the dead birch and the flow itself now appears to have diverted around this area. This flow is blocked by a path with numerous pipes through it which is causing some erosion of the peat mass on the upstream side. This bridge is a higher level replacement for the previous one which is still extant and can be seen submerged on the upstream side of the new bridge.

Downstream of the bridge there is a pool and a series of channels after which the 'Silver Stream' discharges into an artificial channel that diverts the water away from the former bog complex on the left bank of the stream, that has now dried out into relatively ungrazed hummocky Purple Moor-grass grassland. The slope behind this is wet and more heavily grazed and dominated by Purple Moor-grass and Deergrass ***Trichosporum germanicum***. The eastern side is similar but a little drier and here Heather management has been undertaken.

Eventually the stream reaches Puttles Bridge where again it is controlled by the bridge itself and it broadens out into a matrix of pools and Willow ***Salix spp.*** carr woodland.

### *Redhill Bog*

Redhill Bog is composed of an extensive area of Purple Moor-grass dominated wet heath, and the water from this is right on the watershed and discharges in both directions. The water that discharges east arrives at the public footpath crossing the moor at its eastern end and discharges into White Moor via a series of ridges and depressions that are clearly man made and resemble medieval ridges and furrows. The flow of water is large across here and many of the 'furrows' are now quite deeply eroded. To the north-west there is an extensive area of Gorse that the straddles the area between the two stream systems. Here some of the Gorse has been burned in an attempt to control it and, along the Redhill Bog valley, this has been successful. Here the valley, which is normally dry, was very wet and the water flowing down it was following in the quad bike tracks as the valley is clearly frequently used as an access point to the valley system by the land managers. At Redhill Bog itself there is an extensive area of Purple Moor-grass and floating ***Sphagnum*** carpets that are dangerous to cross and, further downstream a dome has developed which again has been colonised by Common Reed ***Phragmites australis***. Water is also directed into the area by the prehistoric earthworks at Redhill. The northern end of this valley is crossed by a bridge which in reality is a causeway across the valley which blocks the flow and channels it through a series of pipes, after which it turns into a series of anastomised channels before joining the Silver Stream.

### *White Moor*

At White Moor, the area consists of a large expanse of wet heathland dominated by Purple Moor-grass and Heather with an understorey of sedges and occasional patches of ***Sphagnum*** and Bog Asphodel ***Narthecium ossifragum***. There is a large drain here that runs south-west to north-east and this has had an influence on the vegetation and hydrology of the area. To the north-west of this the ground is solid, but immediately south-east of it, the ground is dominated by floating mats of ***Sphagnum*** and patch of Common Reed. This is only relieved from the south by a sharp rise in height onto drier areas, similar to those to the north-west of the drain.

This drain connects up with a main drain that has been cut the full length of the valley and this has promoted the growth of two small areas of Willow carr woodland with Bog Myrtle ***Myrica gale*** alongside it. Lawns have developed downstream of the first of these on the northern side of the stream/ditch and were probably created by the draining of the original mire. Further downstream there is a second woodland and from here on the stream is lined by large Alders ***Alnus glutinosa***, some of which are multi-stemmed and very mature. To the south of this, there is a lawn with large numbers of residual hummocks and south of this an extensive area on the slope of Purple Moor-grass and Heather tussocky vegetation. This is eventually cut by a drain just outside the village of Brockenhurst.

North of the valley-bottom stream there is a large area of this wet heath habitat with lawns near the houses at the east end of the common land. Here a small stream joins the 'weir' and this has a floating area of Deergrass and Purple Moor-grass associated with it.

### *Hincheslea Bog*

Hincheslea Bog is generally an open area with a substantial patch of wet heath dominated crowned by drier Gorse and Heather heathland at its core. In all directions from the here the land falls away to a series of streams and ditches that drain the area and its surroundings.

Immediately to the south of this area and Trenley Lawn there is a ditch that arises from the Farm Cottage Inclosure. The drain is slightly embanked, creating poached areas either side of it where water cannot enter the stream/ditch. As a result, in a number of places the embankments have been broken through allowing the ponded areas, with ***Sphagnum cuspidatum*** and Purple Moor-grass in them, to drain into the ditch. Upstream the drain is contiguous with that on the southern side of the Inclosure and here the ditch is blocked by a debris dam in a small area of ancient woodland. The main drain itself is obviously of considerable antiquity as there are 200 year old Oaks ***Quercus robur.*** growing on the embanked sides.

The woodland at the south-east corner of Farm Cottage Inclosure is made up chiefly of 150 year old Oaks with some 100 year old plantings of Pine ***Pinus sylvestris.*** Within the wood there are small excavations, probably for sand, a Badger ***Meles meles*** sett and a number of ancient pollarded trees, including a large Beech ***Fagus sylvatica*** well in excess of 300 years of age.

Further south-west there is an extensive area of valley mire, dominated by Purple Moor-grass, with a mixture of other species, including a depauperate reedbed in the centre. Much of this area is raised and probably is an active growing surface, as it is quaking. The south-east side of this area, near the sub-station, has a lawn that is very heavily grazed and contains areas of Purple Moor-grass and Heather that have been burned, with Bracken ***Pteridium aquilinum*** on the knoll.

Crossing the bridge into Hincheslea Bog proper, there is a wide area of Purple Moor-grass mixed with ***Sphagna*** that also appears to be an active growing surface. Through this a drain has been cut and, where this ends, there is a very large area of Common Reed, although again this is depauperate. Gorse control through burning has also been undertaken on the drier ground to the south-east, although there are still large patches of this just outside the study area.

In the far east of this location there is Blackhamsley Hammock. This begins with a stream entering the area from the south and winding its way between the Gorse and Bracken to the west and the Oak woodland to the east. At one point this ephemeral stream is joined by the flow from the drain which separates the Hammock from the neighbouring golf course and from here the water discharges across the ground into an enclosed lawn to the west of Blackhamsley House, where it spreads out across the hummocky ground until it is interrupted by a east-west running drain that takes all the water into the drain on the eastern side of the lawn that marks the boundary of the site. This drain is responsible for the prevention of mire formation in the area and is restricting the flow of water to the remaining area of Bog Myrtle ***Myrica gale*** in the north-east corner of the area.

North of here the Trenley Lawn is cut by a series of drains that prevent the further northward colonisation of the valley bottom by Common Reed.

Furzy Hill is cut by a series of south-west - north-east cut drains and one north-west - south-east drain and these funnel all the water falling here into the channel and its associated drainage system that runs northward just outside the study area.

Observations

Gorse control in the furzes at the tops of the braes appears to be an ongoing process. Although it is pursued with some gusto, there does not appear to be any evidence that the furzes are being cut for forage or badding as was practiced in the past so the burning of the furzes may constitute a change in the management regime in this area and this should be looked at in more detail.

In general the wetlands are in good condition, this being especially true of the those higher up in the units. Lower down there is evidence of overgrazing and drainage activities that have led to a decrease in the valley bottom mire areas and their replacement with lawns. One interesting feature of a number of the valley mires is the presence of small raised domes in their centres with a covering of depauperate common reed on them. These typically are separated from the surrounding M21a mire by M29 soakways which make them difficult to access, especially at the time of the visit when the ground conditions were extremely wet. It is interesting to speculate about these reedbeds, as well as the raised dome they are growing on, and whether in fact they are nascent raised bogs, with the soakways around them being the first stage in the formation of lagg fen areas.

## 1.4 Geology and Hydrogeology

Table 1-2 shows the geology at the site. The BGS bedrock mapping for the area is only mapped to group level and does not distinguish between the different formations within the Barton Group. This makes identifying the exact geological junctions that seepages occur from more difficult.

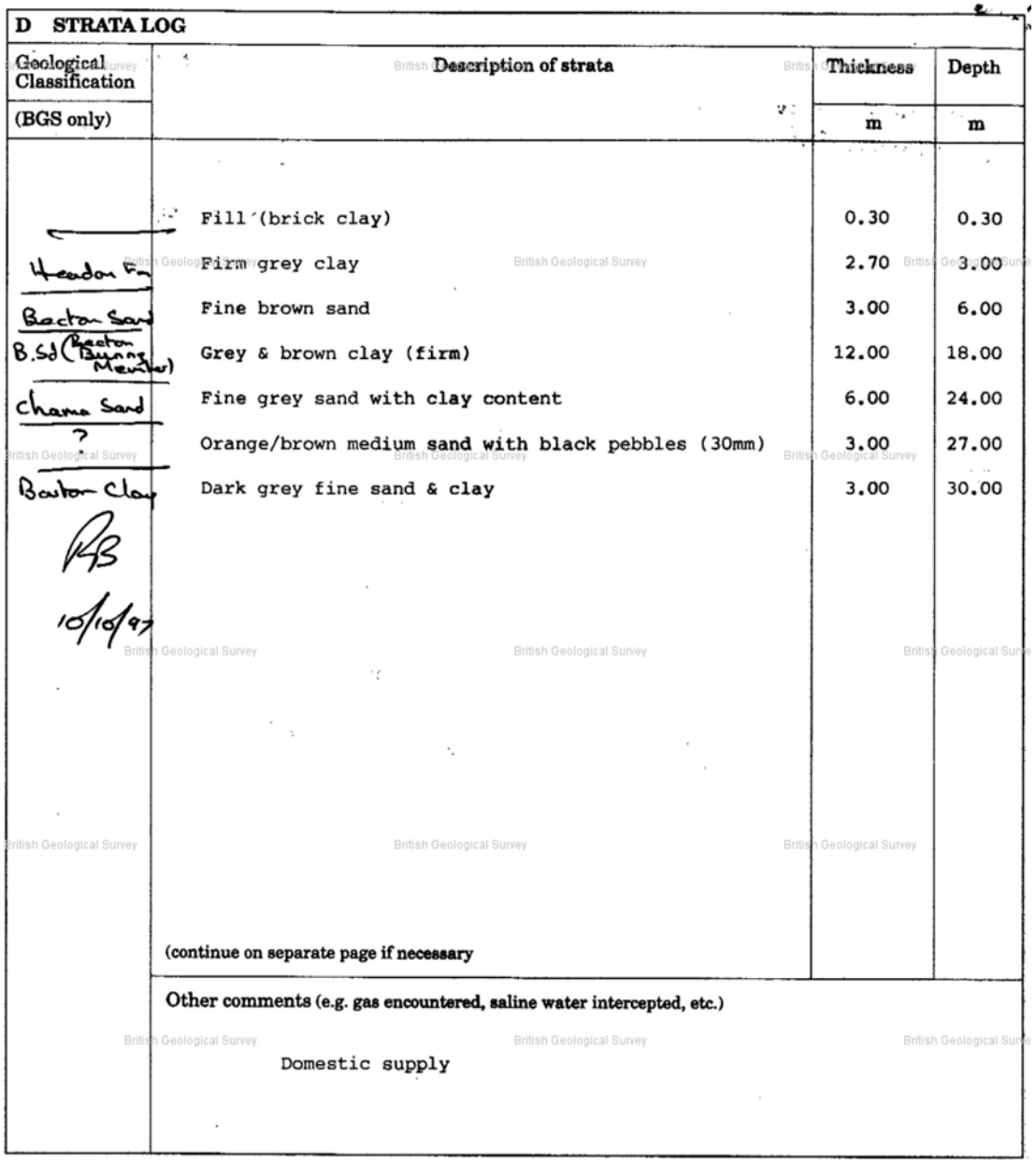
**Table 1-2: Geology and Hydrogeology**

| Age | Group | Formation - member | Description | Thickness | Hydrogeological Role | Water Resources |
|---|---|---|---|---|---|---|
| Quater-nary | | Alluvium | | Up to 10 m | Aquifer / Aquitard | Yields from alluvium and terrace gravels are often obtained from the adjacent |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | rivers. |
| | | Peat | Peat | | Aquifer / Aquitard | |
| | | River terrace deposits | CLAY, SILT, SAND and GRAVEL. | | Aquifer / Aquitard - Spring lines may be present at the base of high level river terraces. | |
| Tertiary (Eocene) | Barton Group | Becton Sand Formation | Yellow/buff fine- to very fine-grained well sorted SAND. | 6 – 70 m | Aquifer - The most permeable and reliable aquifer within the Barton Group. | Yields up to 600 $m^3$/d in the south; in the north they rarely exceed 200 $m^3$/d. |
| | | Becton Sand Formation - Becton Bunny Member | Grey/brown shelly CLAY. | 0 – 8 m | Aquitard | Little useable groundwater |
| | | Chama Sand Formation | Greenish grey fine- to very fine-grained and rather clayey/silty SAND; slightly glauconitic. Also sandy CLAY. | 6 – 15 m | Aquifer | May yield small supplies |
| | | Barton Clay Formation | Greenish grey to olive grey, glauconitic CLAY; may contain fine-grained sand and shells (mainly bivalves and gastropods). | 26 – 80 m | Aquitard | Little useable groundwater |

A local BGS borehole log (available at http://www.bgs.ac.uk/GeoIndex/) from 200 m south of Farm Cottage (approx.) just north of Hincheslea Bog is shown in Figure 1-14. It allows for some description of the geology beneath the site. The Headon Clays lies on top of the hills around the south of the site. This is underlain by the Becton Sands (an aquifer), which is in turn underlain by the Bunny Member (an aquitard) and then in turn underlain by the Chama Sands Formation.

**Figure 1-14: BGS borehole log (NGR 427600,100900)**



D STRATA LOG

| Geological Classification (BGS only) | Description of strata | Thickness m | Depth m |
|---|---|---|---|
| | Fill (brick clay) | 0.30 | 0.30 |
| Headon Fm | Firm grey clay | 2.70 | 3.00 |
| Becton Sand | Fine brown sand | 3.00 | 6.00 |
| B.Sd (Becton Bunny Member) | Grey & brown clay (firm) | 12.00 | 18.00 |
| Chama Sand ? | Fine grey sand with clay content | 6.00 | 24.00 |
| | Orange/brown medium sand with black pebbles (30mm) | 3.00 | 27.00 |
| Barton Clay | Dark grey fine sand & clay | 3.00 | 30.00 |

RB
10/10/97

(continue on separate page if necessary

Other comments (e.g. gas encountered, saline water intercepted, etc.)

Domestic supply

The strong seepage junctions observed across the site might be formed at the junction between the Becton Sands and the Bunny Member. These junctions support the wetlands beneath. The variety in drainage and topography changes the nature and distribution of the wetlands across the site:

- Holmhill Bog - the seepage face is high up the valley side and so there is a long wide seepage face. Within the valley side are a four small troughs which effectively collect the flush water;
- Redhill Bog - this valley is slightly higher than Holmhill. The seepage face only appears halfway down the valley and cuts through the bottom of the valley. This limits the size of the valley side wetland and flushed slopes compared to Holmhill;
- Silver Stream - the valley bottom mire in Silver Stream is a continuation of the Holmhill and Redhill Bog. At some point down the valley the bedrock beneath these bogs changes from the Bunny Member to the underlying Chama Sands. On other sites through-out the New Forest it has been observed that layers within the Chama Sands act as a weak aquifer or aquitard so there is the possibility that it might supply additional water to the wetlands here;

- White Moor - similar situation to Holmhill, however drainage has limited the area of valley side and valley bottom wetlands;
- Trenley Lawn and Hincheslea Bog - the proximity of the borehole (see Figure 1-14) gives further confidence in suggesting that these valley bottom wetlands are underlain by the Bunny Member and receive water from the junction between the Becton Sands and the Bunny Member.

## 1.5 Water Supply Mechanisms

It appears that all the wetlands are flush dominated, however, the quality of the geological mapping makes this harder to confirm this here than at other sites in the New Forest. The fact that the wetland at Redhill only appears suddenly at a distinct point down the valley gives some confidence to the assumption that the seepage arises from a geological junction between the Becton Sands and the Bunny Member. Two Conceptual Model diagrams are presented for the site below.

**Figure 1-15: Conceptual Model Diagram - Holmhill Bog, Silver Stream, Redhill and Hincheslea Bog**

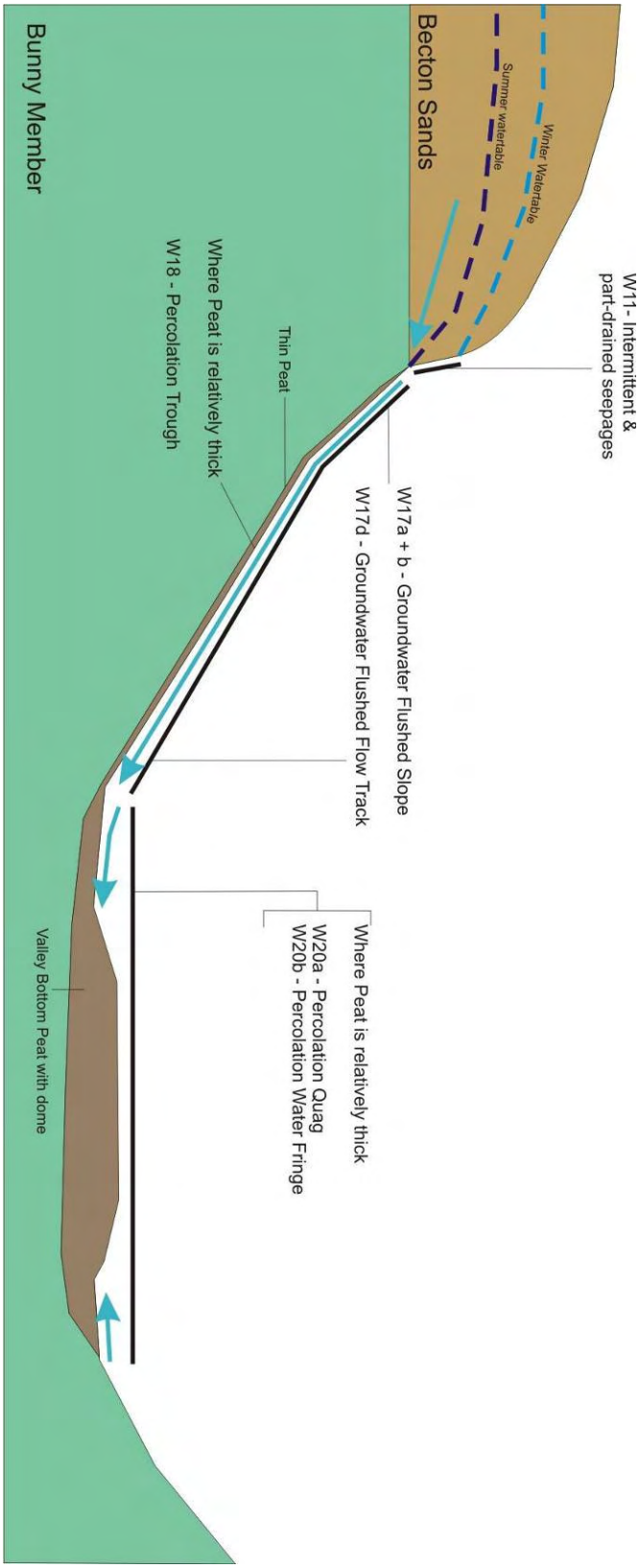
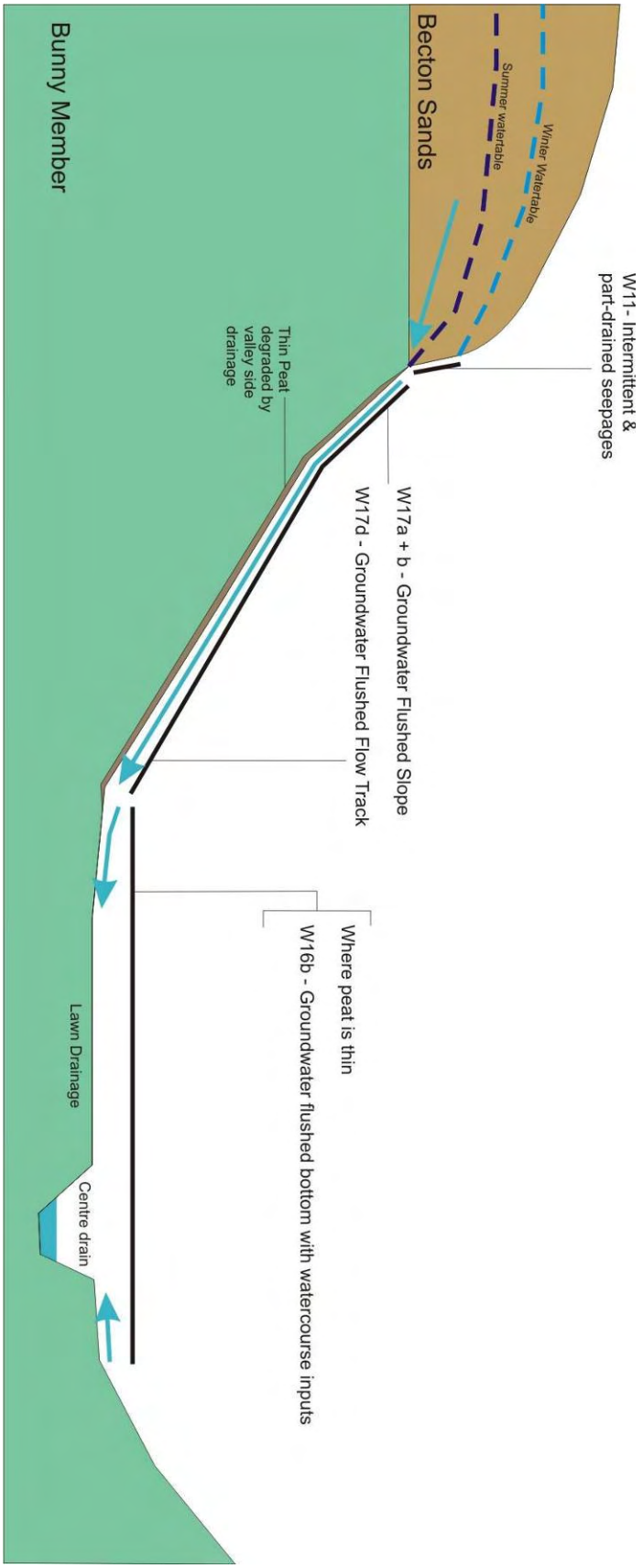


**Figure 1-16: Conceptual Model Diagram - White Moor and other lawn areas**



### 1.5.1 WETMECS identified

WETMECs are ecohydrological classifications of how water can be supplied to a wetland to create distinguishable habitats WETMECS were developed in partnership between the Wetland Research Group at the University of Sheffield, the Environment Agency, English Nature (now Natural England) and Countryside Council for Wales (now Natural Resources Wales). For each Ecohydrological Assessment Area WETMECS have been identified.

The WETMECS identified include:

Valley Side Wetlands - W17 and W17d

Holmhill Bog, Redhill, Hincheslea and Silver Stream Valley Bottoms - W18, W20a, W20b and W19

White Moor, Trenley Lawn and other drained valley bottoms - W16

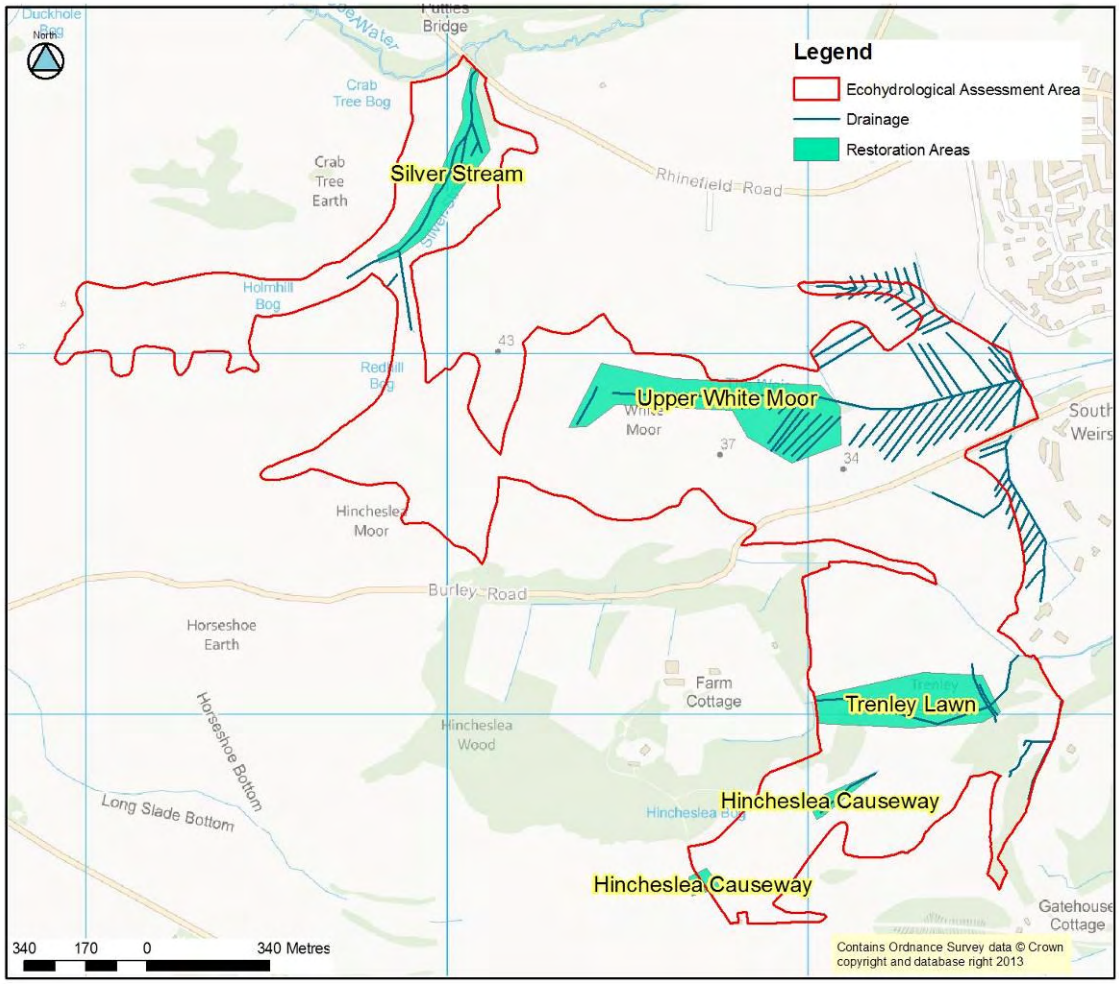
## 1.6 Damage and Restoration

### 1.6.1 Damage

There are four areas of significant damage (see Figure 1-17):

- Silver Stream
    - A large drain has been cut down the side of a valley bottom wetland with significant peat deposits. The drain appears to be eroding its bed into the underlying bedrock. Naturally, the valley bottom would have contained a slight dome of peat with water slowly draining around the outside edges of the dome (as it does currently on Holmhill Bog) but now contains a dry, very degraded bog. At the top of the area is a causeway which is damaging the mire;
- Upper White Moor
    - Drainage has occurred over the majority of White Moor, however in the upper valley this has only produced degraded heath rather than lawn habitat. There is a large central drain and valley side lawn drains that are draining the wetlands;
    - At the very top of the valley where it grades into Redhill Bog, the entire valley is crossed by a complex of anastomosed paths/tracks. These have severely impacted the natural drainage and the vegetation cover.
- Trenley Lawn
    - A large central drain has caused the upper part of Trenley Lawn to convert to wet grassland, the lower part resembles drained mire;
- Hincheslea Causeways
    - There are two pathways on causeways (with bridge sections) across Hincheslea Bog. These interrupt and change the flow of the water down the mire. The mire is dome-shaped and flow is concentrated along the edges, across the bog surface (rather than in distinct channels). The causeways channel this flow into the centre of the valley and have caused small areas of the peat to erode away.

**Figure 1-17: Restoration Areas Map**




### 1.6.2 Restoration

The following restoration measures are recommended for the areas of damage:

- Silver Stream,
  - Given the size and power of the drain that has been cut through Silver Stream a full restoration plan should be developed. The difficulty is that blocking the drain and diverting flow back onto the remaining valley mire might lead to significant erosional problems, especially for the remaining valley mire peat;
  - Options for restoration could include:
    - Infilling of the ditch along its whole length,
      - It is unlikely that there was a watercourse along the base of this valley so infilling the drain might restore the site to something close to the original system;
    - Regular blocking of the ditch with steel pile dams,
      - There is a 5m fall (banktop level from LIDAR from the drain and the top to the bottom. If a dam was to be installed every 0.5m, 10 weirs would be required along the length of the drain;
  - Full restoration designs for the site would require a geomorphological assessment due to the erosional power of the existing drain.
- Upper White Moor,

- Restoration objectives should be developed for the whole of Upper White Moor to identify areas for specific target habitats. In areas of degraded mire it is recommended that:
  - The valley side grips be regularly blocked with earth plugs;
  - The centre drain should be blocked with steel weirs. The number will be dependant on the length of centre drain that the restoration objectives require to be blocked;
  - The path/track network crossing the valley at its top end should be rationalised into a single path with an aggregate bed. This will allow the area currently suffering severe erosion to re-vegetate and recover. As this does not constitute wetland restoration it is not marked on the restoration map.

- Trenley Lawn,
  - Restoration objectives should be developed for this area to determine target habitats.
- Hincheslea Causeways,
  - It is likely to be best to keep the causeways as they are. However, the slight gulleying that has occurred where water is channelled from the edge mires through the bridged sections, should be protected with wooden plank dams.

**Table 1-3: Restoration Area Summary Table**

| Restoration Area | Damage Type | Restoration Proposals | Improvement | Constraints and Issues |
|---|---|---|---|---|
| Silver Stream | Large valley bottom drain and erosion | Detailed restoration design of including geomorphology survey | Restoration of severely damaged valley bottom mire | Detailed design required, potential erosion issues due to power of the stream |
| Upper White Moor | Large Valley bottom drain, Valley side drains | Steel weirs on valley bottom drain<br>Earth plugs on valley side drains | Rewetting of degraded mire/ heath | Clear restoration objectives are needed for this site<br>Steel weirs will need formal engineering. |
| Upper White Moor | Gulleying on footpath | Create single footpath | Revegetation of damaged surface | Expense |
| Hincheslea Causeways | Gulleying around causeway | Wooden plank dams | Stop gulleying | None |

## 1.7 Monitoring requirements

### 1.7.1 Water Monitoring

Monitoring is recommended in the valley bottom mires with significant peat deposits. The locations of these should encompass intact and degraded areas and possibly stilling wells within major drains.

### 1.7.2 Vegetation

A simple two-yearly survey utilising a fixed point photographic record and a simple transect and quadrat method recording seedlings and nearest trees would suffice here.

**Table 1-4: Monitoring Requirements**

| Eco-hydrological Assessment Area | SSSI Units | Site Names | Requirements for monitoring: ecology | Requirements for monitoring: hydrology (number of installations estimated) |
|---|---|---|---|---|
| A | 509, 511, 512 and 515 | Holmhill/Redhill Bogs (Silver Stream), North Weirs Mire 1, North Weirs Mire 2 and Hincheslea Bog East | Fixed point camera survey (specifically focussing on areas where footpaths are impeding flows and poaching)<br>Fixed point quadrat survey | 8 boreholes and 2 stilling wells (10 installations in total)<br>Plus associated monitoring and data processing |

# 2 Maps

**Map 1: Location**

**Map 2: Aerial Photography**

**Map 3: Topography, Hydrology and Wetland Distribution**

**Map 4: Phase One Habitat**

**Map 5: Drift Geology**

**Map 6: Bedrock Geology**

**Map 7: Eco-Hydrology Map**

**Map 8: Restoration Plan**

North

Rhinefield Walk

Whitefield Moor

Ober Water

Silver Stream

Crab Tree Bog

Crab Tree Earth

Holm Hill

Holmhill Bog

Redhill Bog

Red Hill

White Moor

Hincheslea Moor

Five Thorns Hill

Furzy Hill

Bats Bush

Horseshoe Earth

Hincheslea Holms

Hincheslea Wood

Horseshoe Bottom

Long Slade Bottom

Hincheslea Bog

Trenley Lawn

Blackhamsley Hammock

Beachern Wood

Beachern Wood Cottage

New Cottage

Ober Farm

Ober Lodge

The Lodge

The Bungalow

Farm Cottage

Weirfield Holt

The Weirs Cottage

Barnfield

Laurel Cottage

Lambert Cottage

Forest View

Huntsgreen

Edgemo House

Blackhamsley House

Cater's Cottage

Gatehouse Cottage

Car Park

Puttles Bridge

HINCHFIELD ROAD

BURLEY ROAD

WHITEMOOR ROAD

FOREST ROAD

THE COPPICE

MOORLANDS

RIDGE

FOREST CLOSE

NORTH WEIRS

SOUTH WEIRS

Path

520 260 0 520 Metres

Scale 1:9,716

LEGEND

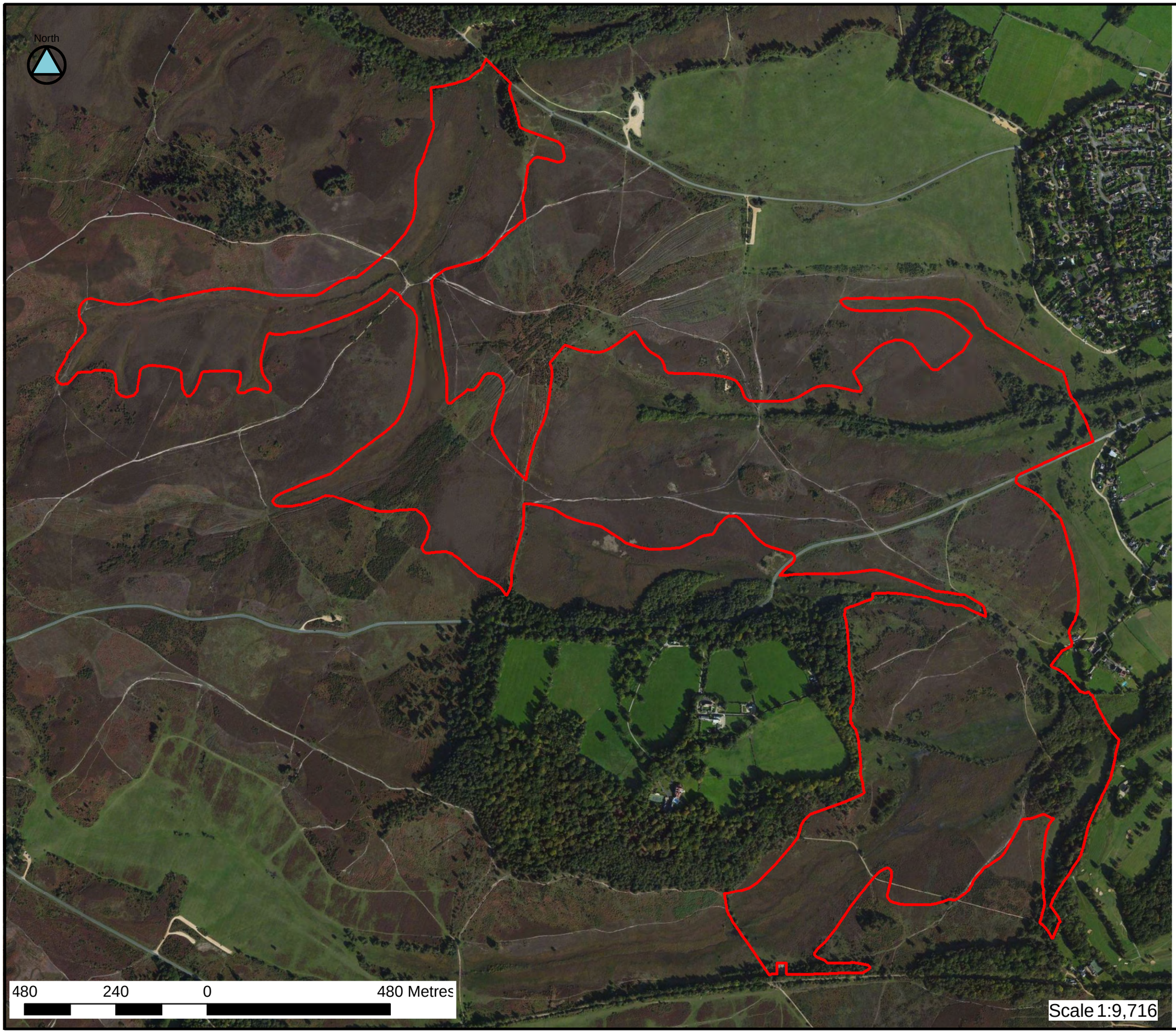
Ecohydrological Assessment Area



JBA consulting

MAP 1

Site Location




LEGEND

Ecohydrological Assessment Area



JBA consulting

MAP 2

Aerial Photography

North

LEGEND

Ecohydrological Assessment Area

Seepage face

Drainage

Valley Bottom Wetland

Valley Side Wetland

**LIDAR**

**mAOD**

High : 46

Low : 20

300 150 0 300 Metres

Scale 1:5,480



JBA consulting

# MAP 3

Topography, Hydrology and Wetland Distribution

North

LEGEND

Ecohydrological Assessment Area

Seepage face

Drainage

Valley Bottom Wetland

Valley Side Wetland

**LIDAR**

**mAOD**

High : 40

Low : 17

300 150 0 300 Metres

Scale 1:5,480



JBA consulting

MAP 3

Topography, Hydrology and Wetland Distribution

North

LEGEND

Ecohydrological Assessment Area

Seepage face

Drainage

Valley Bottom Wetland

Valley Side Wetland

**LIDAR**

**mAOD**

High : 35

Low : 20

250 125 0 250 Metres

Scale 1:4,570



JBA consulting

MAP 3

Topography, Hydrology and Wetland Distribution

North

Crab Tree Bog

Rhinefield Walk

Car Park

Crab Tree Earth

M16a

M16a

M24c

Holm Hill

M24

M16a

edhill Bog

S4

Red Hill

H2

W23

H2

Hincheslea Moor

Scale 1:5,000

300 150 0 300 Metres

LEGEND

Ecohydrological Assessment Area

**Habitat**

**Habitat_code**

- A1.1.1
- A1.2.2
- A1.3.1
- A2.2
- B1.1
- B5
- C1.2
- D1.1
- D2
- D5
- D6
- E3.1
- F1
- J4



JBA consulting

MAP 4

Phase One Habitat

North

RHINEFIELD ROAD

Car Park

Lodge

THE COPPICE

NORTH WEIRS

Red Hill

M16c

M21a

M16a

M29

M23a

H2

M16a & M24

BURLEY ROAD

The Lodge

Weirfield Holt

Scale 1:5,000

300 150 0 300 Metres

LEGEND

**Habitat**

**Habitat_code**

- A1.1.1
- A1.2.2
- A1.3.1
- A2.2
- B1.1
- B5
- C1.2
- D1.1
- D2
- D5
- D6
- E3.1
- F1
- J4



JBA consulting

MAP 4

Phase One Habitat

North

BURLEY ROAD

The Lodge

Weirfield Holt

The Bungalow

Farm Cottage

Hincheslea

Laurel Cottage

Barnfield

Blackhamsley House

Golf Cours

Cater's Cottage

Gatehouse Cottage

Dismar

Blackhamsley Hill

H2

S4

M23a

M23a & M29

W10b & W7

M25

H2 & W23

M18a

S4

M21

300 150 0 300 Metres

Scale 1:5,000

LEGEND

Ecohydrological Assessment Area

**Habitat**

**Habitat_code**

- A1.1.1
- A1.2.2
- A1.3.1
- A2.2
- B1.1
- B5
- C1.2
- D1.1
- D2
- D5
- D6
- E3.1
- F1
- J4



JBA consulting

MAP 4

Phase One Habitat

North

Crab Tree Bog
Puttles Bridge
Car Park
Ober Water
Rhinefield Walk
Car Park
Whitefield Moor
Beachern Wood
New Cottage
Beachern Wood Cottage
Ober Farm
Car Park
Ober Lodge
WHITEMOOR ROAD
OBERFIELD ROAD
RHINEFIELD ROAD
Car Park
Crab Tree Earth
Silver Stream
Holm Hill
Holmhill Bog
Redhill Bog
Red Hill
White Moor
Redhill Bog
Hincheslea Moor
Five Thorns Hill
Furzy Hill
Edgemo House
Huntsgreen
Lambert Cottage
Forest View
South We
NORTH WEIRS
SOUTH WEIRS
Car Park
Bats Bush
Car Park
BURLEY ROAD
The Weirs Cottage
Laurel Cottage
Horseshoe Earth
The Lodge
Weirfield Holt
The Bungalow
Farm Cottage
Barnfield
Trenley Lawn
Hincheslea Holms
Path
Hincheslea Wood
Hincheslea
Blackhamsley Hammock
Blackhamsley House
Horseshoe Bottom
Hincheslea Bog
Long Slade Bottom
Car Park
Gatehouse Cottage

440 220 0 440 Metres

Scale 1:9,716

## LEGEND

- Ecohydrological Assessment Area
- No Drift
- Other Deposits
- Alluvium - Clay, Silt, Sand and Grave
- Head - Clay, Silt, Sand and Gravel
- Head - Gravel, Sand, Silt and Clay
- Head - Silty Clay
- Head - Gravelly Sand
- Peat
- River Terrace Deposits - Clay and Silt
- River Terrace Deposits - Sand and Gravel
- River Terrace Deposits - Sand, Silt and Clay



JBA consulting

# MAP 5

Drift Geology

North

BECTON SAND FORMATION AND CHAMA SAND FORMATION (UNDIFFERENTIATED) - SAND, SILT AND CLAY

HEADON BEDS AND OSBORNE BEDS (UNDIFFERENTIATED) - CLAY, SILT AND SAND

HEADON BEDS AND OSBORNE BEDS (UNDIFFERENTIATED) - CLAY, SILT AND SAND

HEADON BEDS AND OSBORNE BEDS (UNDIFFERENTIATED) - CLAY, SILT AND SAND

HEADON BEDS AND OSBORNE BEDS (UNDIFFERENTIATED) - CLAY, SILT AND SAND

HEADON BEDS AND OSBORNE BEDS (UNDIFFERENTIATED) - CLAY, SILT AND SAND

410 205 0 410 Metres

Scale 1:9,716

## LEGEND

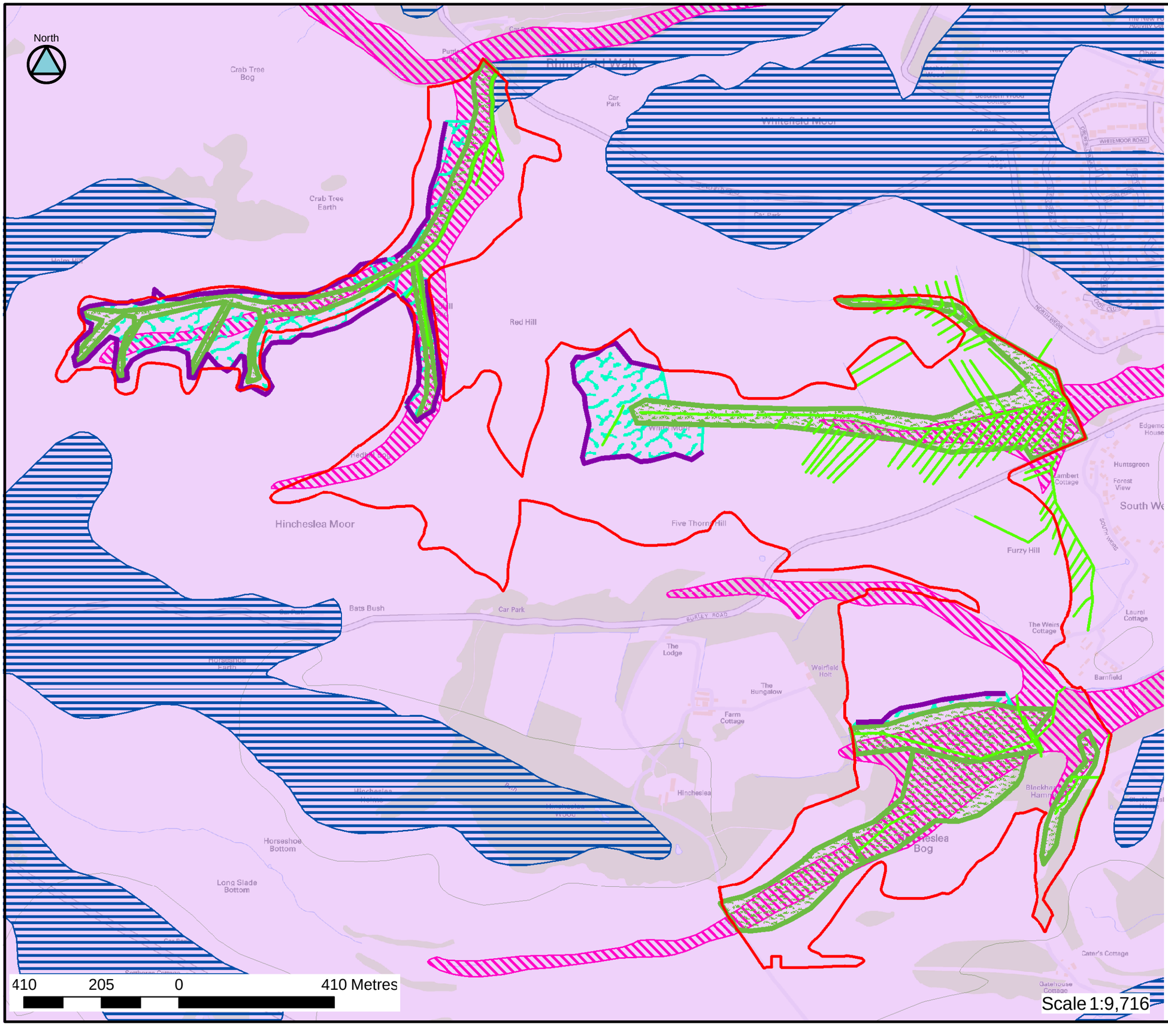
- Ecohydrological Assessment Area
- Other Rock Types
- Headon and Osbourne Beds - Clay, Silt and Sand
- Headon Formation - Clay, Silt and Sand
- Lyndhurst Member - Sand, Silt and Clay
- Becton Sand Formation - Sand
- Becton and Chama Sand Formation - Sand, Silt and Clay
- Becton Bunny Member - Clay
- Chama Sand Formation - Sand
- Chama Sand Formation - Sand, Silt and Clay
- Chama Sand Formation - Silty Clay
- Barton Clay Formation - Clay
- Barton Clay Formation - Sand
- Selsey Sand Formation - Sand, Silt and Clay
- Marsh Farm Formation - Clay, Silt and Sand
- Poole Formation - Sand, Silt and Clay
- London Clay Formation - Clay, Silt and Sand



JBA consulting

# MAP 6

Bedrock Geology




LEGEND

- Ecohydrological Assessment Area
- Seepage face
- Drainage
- Valley Bottom Wetland
- Valley Side Wetland

**Drift Hydrogeology**

- Aquifer
- Aquifer/Aquitard
- Aquitard

**Bedrock Hydrogeology**

- Aquifer
- Aquifer/Aquitard
- Aquitard



JBA consulting

MAP 7

Eco-hydrology

North

Silver Stream

Upper White Moor

Trenley Lawn

Hincheslea Causeway

Hincheslea Causeway

Crab Tree Bog
Crab Tree Earth
Holm Hill
Holmhill Bog
Redhill Bog
Redhill Bog
Red Hill
Hincheslea Moor
Five Thorns Hill
Furzy Hill
Horseshoe Earth
Horseshoe Bottom
Long Slade Bottom
Hincheslea Holms
Hincheslea Wood
Hincheslea
Bats Bush
Car Park
Puttles Bridge
Ober Water
Rhinefield Walk
Car Park
Whitefield Moor
Car Park
Car Park
Car Park
Car Park
Car Park
RHINEFIELD ROAD
BURLEY ROAD
WHITEMOOR ROAD
OBERFIELD ROAD
THE COPPICE
MOORLANDS
FOREST DRIVE
NORTH WEIRS
SOUTH WEIRS
The New Fo Activity Cor
New Cottage
Ober Farm
Beachern Wood
Beachern Wood Cottage
Ober Lodge
Lambert Cottage
Forest View
South We
Edgemo House
Huntsgreen
The Weirs Cottage
Laurel Cottage
Barnfield
The Lodge
The Bungalow
Farm Cottage
Welrfield Holt
Blackhamsley Hammock
Blackhamsl House
Cater's Cottage
Gatehouse Cottage
Path

550 275 0 550 Metres

Scale 1:9,716

LEGEND

- Ecohydrological Assessment Area
- Drainage
- Restoration Areas



JBA consulting

MAP 8

Restoration Plan