Natural England Commissioned Report NECR141

New Forest SSSI Ecohydrological Survey Overview

Annex Q: Northern Mires

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Contents

1 Northern Mires

1.1 Introduction

This Ecohydrological Assessment Area (EcoHAA) covers 140.6ha and is contained within SSSI Unit 33, 32, and 41 with its centre at National Grid Reference (NGR) 419836, 116165 (see Figure 1-1). These units have been joined together as one Ecohydrological Assessment Area because:

- two units are within the same valley
- two units form the headwater of valleys with very similar water supply mechanisms.

Unit 32 is the headwater of Miller Brook, Unit 33 lies in the middle reaches of Miller Brook (both these are mire to stream transition units) and Unit 41 forms the headwater of valley of Ashley Hole.

Figure 1-1: Location Map

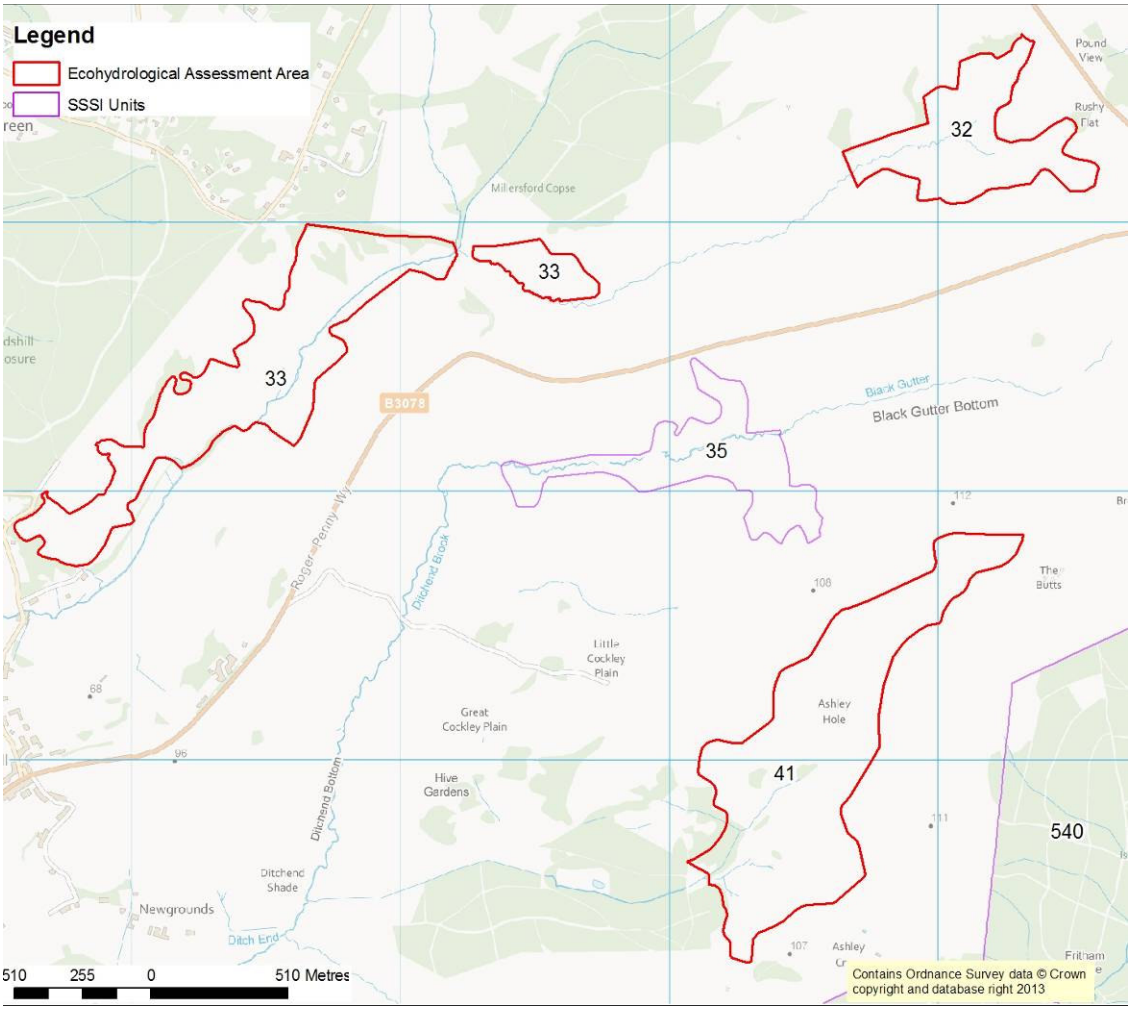


Table 1-1: Ecohydrological Assessment Area Summary Table

Eco-hydrological Assessment Area	R		
Name	Northern Mires		
Relative Geomorphology Assessment			
Size (ha)	140.6		
SSSI Units	32	33	41

Valley Side Wetland	Present	Y	Y	Y
	Wetland Type	Flush Dominated Wetland	Flush Dominated Wetland	Flush Dominated Wetland
	Main Source of water	Seepages from River Terraces in distinct locations where they intersect the valley sides	Seepage line at junction of the Poole Formation with the underlying London Clay (River terraces set back from the valley sides and mires so do not contribute water to mires)	Seepages from River Terraces in distinct locations where they intersect the valley sides
	Indicative NVC communities	U4, W4b, M16a, M21a, M1, M29, M25a	H2a, H2c, H3abc, M9a, M16abc, M21a, M1, M29, M25a, W4b, W7, W11, U1, U4, MG6, M23a	H2a, H3c, H2c, H3a, M1, M9a, M16abc, M29, M21, M23a, M25a, U1, U4
	Wetland Types	Mire, wet heath, wet woodland, wet grassland	Wet heath, mire, wet woodland, wet grassland	Mire, wet heath, wet grassland
	Drainage Damage	N	Y - straight drains (possible forestry related), paths (Minor)	Y (Moderate in headwaters)
	Scrub/Tree Encroachment Damage	N	Y - Pine, Gorse, Birch, Hawthorn, Blackthorn and Rhododendron (Minor)	Y - Pine seedlings
	Poaching and Grazing Pressures Damage	N	Y	Y - Path creation
Valley Basin Wetland	Present	Y	Y	Y
	Wetland Type	Flush Dominated Wetland	Flush Dominated Wetland	Flush Dominated Wetland
	Main Source of water		Seepage line at junction of the Poole Formation with the underlying London Clay plus out of bank water from stream	Seepages from River Terraces in distinct locations where they intersect the valley sides
	Indicative NVC communities	M16a M21a	H2c, H3b, H3c, M9a, M16abc, M21a, M1, M29, M25a, W4b, W7, W11, U1, M23a, S22	M21a, M29, H3b, H3c, M16a, M16b, M16c, M30, S22, W4b
	Wetland Types	Wet heath, mire	Mire (upper part)/ wet grassland, wet heath	Mire, wet heath, wet woodland, swamp
	Drainage		Y - Stream has been straightened and deepened, lawn creation	N
	Scrub/Tree Encroachment Damage	Y (minor) - Pine and Gorse	Y - considerable on sides of drainage, including trees and shrubs (Moderate)	Y - Willow growth on deeper ponds (Minor)
	Poaching and Grazing Pressures	N	Y (Minor)	N

Additional Comments	Well developed path network. This has a very narrow mire system in valley bottom and a natural main channel. Same geology and WETMECs as 41 divided by watershed	Some of the valley sides have undergone drainage schemes and lower down the system are old field systems which are still obviously drier. The stream in the valley base has been straightened and deepened and possibly a hydromorphology assessment is required. Where the modifications are less there is a valley bottom mire, otherwise the mire has been replaced by wet grassland.	A large and varied unit with many different habitats and a history of manmade disturbance (bombing range and ponds). The same geology and WETMECs systems as unit 32 though they are divided by a watershed. Within the final report restoration measures will be given for both units separately

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, ecology, hydrogeology, 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 sites lie within two valleys containing Ashley Hole and Miller Brook.

Unit 32

The area lies in the headwater valleys of Miller Brook. Valley bottom wetlands start relatively high up the valley side with narrow shallow strips of valley side wetlands supporting them. There is one area in the south where the valley deepens, where there is a wider valley side wetland.

Figure 1-2: Long Flushed Slope of south side of Unit 32 (NGR 421225, 117163)

Figure 1-3: Valley Bottom Wetland in Unit 32 (NGR 421290, 117265)

Figure 1-4: Head of valley in Unit 32 with seepage face from river terrace gravels (NGR 421515, 117170)

Unit 33

The area occupies the valley of the middle reach of Miller Brook. The valley has a narrow bottom and Miller Brook appears to have been artificially straightened and deepened over several sections. The narrow nature of the valley bottom and the works to the brook have limited the areas of valley bottom wetland (although it was never likely to have been extensive).

On the valley sides are long extensive areas of flush dominated valley side wetland. Where this flow concentrates the slope is wetter and where drainage collects water or the natural shape of the valley side sheds water the valley side is drier. There are several areas where there have been limited attempts to drain the valley side. This has been most successful at the bottom end of the site, where an area on the lower slopes (outside the SSSI unit) has been converted to fields.

Figure 1-5: Straightened Miller Brook at the top of Unit 33 (NGR 419005, 116865)

Figure 1-6: Example of an extensive area of Flushed Slope on the right bank of Miller Brook in Unit 33 (NGR 418400, 116350)

Unit 41

This area lies in Ashley Hole. A narrow valley bottom wetland lies along the base of the valley incorporating a natural stream along most of its length. In the final section, the stream runs along the edge of an area of forestry. It appears the stream has been artificially deepened and gulleyed along this section; however the gulleying does not extend upstream of the woodland so may be eroding back at a slow rate. Another valley joins the main valley near the bottom of the site. This contains a smaller intact valley bottom wetland. The valley sides

form a near continuous, flush dominated valley side wetland with no evidence of any areas of significant drainage observed.

Figure 1-7: Upper part of the main valley in Unit 41 containing a valley bottom wetland (NGR 420815, 115490)

Figure 1-8: Gulleyed straightened section of drain in the lower part of Unit 41 (NGR 420255, 114635)

1.3 Ecology

Unit 32

Unit 32 occupies a broad and relatively shallow valley head and mire exposures are generally linear features associated with the streams. Seepage step mires are present along the

southern side (north-facing) of the unit and around the valley heads. These give rise to small areas of valley bog where the narrow valleys become restricted. The northern arm of the unit has a linear bog formed of typical M21a species, particularly Common Cottongrass *Eriophorum angustifolium*, Bog Asphodel *Narthecium ossifragum*, White Beak-sedge and *Sphagnum papillosum* and *S. denticulatum*. Cross-leaved Heath *Erica tetralix* is present throughout with Heather *Calluna vulgaris* occupying ridges and drier areas at the edges. Downy Willow *Salix pubescens* has begun to develop within this bog and Gorse *Ulex europaeus* is beginning to invade, having developed on moss hummocks raised above the water level. Bog Myrtle *Myrica gale* is also reasonably widespread within this bog.

There is very little transition zone between the valley bog community and the wet heaths surrounding them. These are best represented by changes in the *Sphagna* species, as both *S. compactum* and *S. tenellum* become widespread. Higher up the slopes the ground becomes drier and typical dry heaths dominate often with a high proportion of Gorse and other scrub development. This unit is surrounded by large stands of Gorse and there are Inclosure plantings to the north of the unit. Seedlings from these areas are beginning to develop with occasional Pine *Pinus sp.* seedlings scattered throughout.

The western arm of the valley has several large bog pools which have formed above constrictions in the drainage channels. These are widespread and contain most of the species typical of a M1 *Sphagnum auriculatum* bog pool community. Also present were Lesser Bladderwort *Utricularia minor* and Brown Beak-sedge *Rhynchospora fusca.* These pools were formed behind rafts of vegetated peat with well-developed M25a (*Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community).

Streams exiting these two valleys flow in small incised channels, with small parallel soakways, through a band of M25a Purple Moor-grass *Molinia caerulea* mire. This results in a strip of mire vegetation with wet heath completing the valley bottoms. The M25a continues up the southern slope of the valley across the seepage step mire, but outside of this isolated area, the valley sides are M16a or M16b wet heaths.

Unit 33

Unit 33 is a continuation of the same valley described above, now with a very clearly-defined stream system along the valley bottom. With some exceptions this is mostly a river system with occasional seepage step mires spread, sporadically, along both valley sides. These generally follow a similar pattern throughout this valley with seepages forming wide strips of M25a Purple Moor-grass mire. These develop into M29 soakways with shallow runnels dominated by Bog Pondweed *Potamogeton polygonifolius* and Lesser Spearwort *Ranunculus flammula*. This valley contains the range of transitional heathland from full wet heath, typified by M16a, to dry, H2a, heaths. The local 'humid heath' is also present between the wet and dry areas. Bell Heather *Erica cinerea*, common in the dry heaths, is rare, and *Sphagna* are restricted to hollows on the slopes, or areas where drainage is otherwise impeded. The main component of the bryophyte community is represented by *Leucobryum glaucum*, which is relatively widespread.

The main part of the valley is affected by drainage 'improvements', particularly around the Miller's Ford area. Here the channel has been deepened and straightened and this has resulted in the development of a lawn area. Relict channels are still evident within this lawn and where these seasonally hold water the NVC community OV31 *Rorippa palustris-Filaginella uliginosa* community is present. Lawns in the valley bottom are typically the well-grazed, wet grassland-type M23a *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus acutiflorus* sub-community, but moving up the slopes these develop a drier character and are better represented by the U1 communities (*Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland). Scrub and trees have developed along spoil banks and there are some large thickets of Gorse and Bramble *Rubus fruticosus agg*. within the drier grasslands.

Downstream of the lawn area there is one of only a handful of valley bogs within this unit. This is restricted to the right bank of the stream and has formed on a wide, flat floodplain with poor connectivity to the channel. This has allowed a more typical M21a vegetation to form where soakways flowing from a relatively high seepage face are impeded. Further isolated valley bogs occur between SU18171642 and SU18341631. At this location, a seepage step mire has formed at the top of the valley-side, but outflows are first restricted by an 'island' of Scot's Pine *Pinus sylvestris* and Rhododendron *Rhododendron ponticum* allowing a high-level valley bog

to form. Soakways from this bog flow around both sides of the copse and down towards the valley bottom, further restrictions have allowed a deep quagmire to have developed immediately adjacent to the main stream.

The far southern end of Unit 33 has a well-defined seepage step mire which has formed from groundwater issuing at the break of slope. This has resulted in a deep and wide area of floating vegetation, again typical of M21a, including extensive areas of Common Cottongrass and also containing Round-leaved Sundew *Drosera rotundifolia*. At the very boundary of the unit a drain has been cut which directs flow across the slope and down to Millersgarth.

Occasional side-channels within this unit show evidence of previous drainage attempts, often with a parallel line of scrub which has developed on the relict spoil-bank. Human disturbance along the valley bottom was in evidence, with a series of regular drainage lines occurring in a small central area, suggesting previous attempts to develop Inclosure woodland have taken place. In the lower reaches the left bank of the stream has been converted into improved grassland and this field pattern continues up the lower part of the right bank, with relict field boundaries remaining visible. This area remains drier than the remainder of the unit and is M24c *Molinia caerulea-Cirsium dissectum* fen-meadow, *Juncus acutiflorus-Erica tetralix* sub-community.

Dating the drainage works on the Miller Brook is difficult, however, there are a number of clues along the stream channel that will permit the approximate dating of the drainage works that have taken place within this unit. At Miller's Ford, three channels meet and the paths of these and the associated earthworks are instructive. The westernmost stream is channelised and follows a woodbank, which is probably Medieval in age. However, the middle channel flowing from Millersford Copse currently flows across the land surface and is dammed by a series of small logs and associated leaf accumulation dams here and there. This area of land that it flows across is clearly an old stream valley, however, it is to the west of a Medieval woodbank, against which it pools. The eastern side of the woodbank contains a drain which is now dry. In essence what appears to have happened is that, upstream of this location, this stream has become diverted such that it no longer flows the excavated channel on the east side of the woodbank but has re-occupied its previous valley. This has caused ponding on upstream side of the woodbank when it reaches Miller's Ford and this has led the land manager to dig a channel through the woodbank and, following the line of least resistance, reconnecting with the main channel at Miller's Ford, creating a small island immediately upstream. The appearance is now of a braided channel, however, this is in fact fairly recent drainage (within the last ten years or so) work that has superseded the Medieval drainage works that took place here in the past, when the woodlands were compartmentalised.

Immediately downstream of the ford, the stream becomes incised and straight and this is the result of additional drainage works that were undertaken to drain the pasture on the North side of the brook. Looking at the age of the trees growing below the browse line on the streamsides, this work took place in the region of 200 years ago. That the land to the north was pasture at this time and not woodland is demonstrated by the growth pattern of the oaks *Quercus robur* and other ancient trees that still inhabit this 'lawn'. These are in excess of 250 years of age and show that this area was being used as wood pasture at this time. Palaeo-channels on this lawn and, further downstream, on the opposite bank show the former meandering course of the main thread although it is likely that the stream had many threads , all of which would be occupied at times of high flow.

The straightening of the channel here has led to its incision and the disconnection of the stream from the surrounding *Molinia* grassland (M25a) which, in turn, has led to its drying-out leaving a relict population of *Molinia* tussucks with sad Bog Myrtle *Myrica gale* bushes sitting atop of these. This straightening extends down to the nest bridging point and was engineered to create lawns on both sides of the stream. To this end the new channel was excavated at the break of slope in turn on both sides of the valley, ensuring that the flat valley floor area could be drained and converted to lawn habitat.

The central section of the watercourse, beginning downstream of the bridge has not been straightened and this may be because in this area the stream was already occupying one side of the valley floor, rather than its centre. At the bottom end of the unit, where the stream enters the field system, straightening and incision has again taken place and, as upstream, this can be dated to approximately 200 years ago. Here the remains of the former meanders and the associated riverside trees can be seen perched some 2m or so above the current bed level of

the Miller Brook. This drainage has dried out some of the wet woodland on the North side of the stream here and has allowed its colonisation by conifers, such as European Larch *Larix decidua*.

Unit 41

Unit 41 occupies a large valley system fed by seepages along both slopes for most of the length. This valley is similar in character and vegetation composition to Unit 33, however it has some features which appear more natural and undisturbed, despite having undergone considerable, historical human-influenced interference. There are clear transitions from scrub-invaded dry heaths at the crest of the slope, through 'humid heaths' to wet heaths down both valley-sides. Where the seepages are present this cross-section changes from dry heath to Purple Moor-grass mire (M25a) with soakways (M29) carrying water to the stream.

In the upper valley, where the soakways are impeded, small areas of isolated raised bog, corresponding to M21a have formed. Through the middle sections and the lower reaches valley bogs become more extensive along the valley bottom and in some areas reaching up to 60m in width. These valley bogs are excellent examples of M21a. In the centre of the valley there are a few stands of bog woodland with extensive bryophyte carpets including Sphagnum *capillifolium, S. fallax, S. papillosum, S. Squarrosum, Polytrichum commune, Aulacomnium palustre* and the liverwort *Chiloscyphus polyanthos*. The tree canopy is purely composed of Grey willow *Salix cinerea* and Downy Willow.

Of particular note through this valley, and also the secondary lower valley, are the number of ponds and pools. These are a relative rarity within the New Forest but there are a large number of waterbodies within this unit dating back from WWII, when this was used as a bombing range. The resulting craters, ranging in size from 1m diameter to over 30m, are now a mix of temporary and permanent ponds. Vegetation communities contained within these ponds range from: the bog pool community M1; and aquatic communities: A9c *Potamogeton natans* community, *Juncus bulbosus-Myriophyllum alterniflorum* sub-community; A22a *Littorella uniflora-Lobelia dortmanna* community, *Littorella uniflora* sub-community; and A24b *Juncus bulbosus* community, *Sphagnum auriculatum* sub-community.

WWII features in this unit also include bull-dozed tracks lined with chalk which were used as target markers. Chalk exposures are not naturally found in the New Forest but these do allow pockets of calcicolous vegetation to develop.

At the lowest end of the valley there is a block of Inclosure woodland, dating to the circa 1768, (Stagg, 1989[1]) where the stream has been channelled. Planting at this site is principally Beech *Fagus sylvatica* and Holly *Ilex aquifolium*, *thus the present community resembles W14 woodland.*

1.4 Geomorphology

Unit 32

The area lies in the headwater valleys of Miller Brook. Valley bottom wetlands start relatively high up the valley side with narrow shallow strips of valley side wetlands supporting them. Miller Brook begins as a series of diffuse seepage flows forming a shallow undifferentiated flow out of the mire units. These flows have amalgamated in several locations to form a single channel which has become inset leading to slight riparian zone drying. Strong flow is entering from the right bank and is likely to cut a channel over the medium term. The flow exit point should be altered to reduce the likelihood of this occurring.

Unit 33

Unit 33 is a continuation of the seepage channels from unit 32 and there is now with a very clearly-defined stream system along the bottom. This has been extensively modified

[1] Stagg, D. J. (1989) 'Silvicultural enclosure in the New Forest to 1780'. Proceedings of the Hampshire Field Club & Archaeological Society, 45, pp135-45.

historically to maximise lawn development and grazing access with the stream straightened and moved to the valley bottom edge. This has occurred in two sections separated by a short (200 m) semi-natural sinuous reach with the straightened channel switching from one side of the valley bottom to the other. The straightening must have occurred over 150 years ago based on the approximate age of the birch trees lining the channel and lateral movement has been very limited over this period. Channel incision has occurred leading to an over-deep channel capable of transporting supplied gravels. As such there are very few in-channel features present except through the un-straightened reach where deposition (due to a reduced slope) has created a wider better connected channel with a diverse hydromorphology. The palaeo-features present across the modified and disconnected floodplain are now largely non-functional and are terrestrialising

The impact of riparian woodland clearance is marked and extensive lawn areas are now established.

1.5 Geology and Hydrogeology

Table 1-2 shows the geology at the Northern Mires. The geology and hydrogeology of Unit 32 and 41 are broadly similar but Unit 33 is quite different.

Unit 32 and 41 are valley heads surrounded by a plateau covered in river terrace deposits. The valley sides and base are formed from the Selsey Sand Formation and the lower part of Unit 41 is underlain by the Poole Formation). A seepage face has formed on the junction of the river terrace deposits (acting as an aquifer) and the Selsey Sand Formation (augering shows it local to be a silty clay and it acts as an aquitard). The extent of seepage faces and the valley side wetlands they support is dependant on how the river terrace gravels intersect with the valley sides. In Unit 32 this occurs in three distinct locations (limiting the extent of valley side wetlands), however, in Unit 41 it occurs along the majority of the edge of the site.

The upper edge of Unit 33 lies halfway down the valley side. The slopes above the site are formed from River Terrace Gravels, overlying the Selsey Sand Formation, overlying the Poole Formation. The majority of Unit 33 is underlain by the London Clays. A seepage face supporting the valley side wetlands forms at the junction between the London Clays and Poole Formation. The Poole Formation is unlikely to be a highly permeable unit in this area, however, the relative difference in permeability between the two units (London Clay being less permeable than the Poole Formation) creates a seepage face at this junction.

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.
		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)	Bracklesham Group	Selsey Sand Formation	Fine-grained SAND, sandy SILT and sandy CLAY; locally shelly and glauconitic.	0 –50 m	Aquifer / Aquitard - Spring line at base	Variable lithology makes borehole yield hard to predict. Boreholes up to 200 mm in diameter may yield up to 200 m^3/d; boreholes over 400 mm diameter have

						yielded more than 1800 m^3/d from sandier strata. However, boreholes with little or no yield have been recorded.
	Bracklesham Group	Poole Formation	Fine- to very coarse-grained (locally pebbly) cross-bedded, commonly lignitic, SAND. Interbedded with pale grey to dark brown, carbonaceous, lignitic and (commonly) laminated CLAY. Red-stained structureless clay and silty clay present locally.	25 – 110 m	Aquifer / Aquitard - Spring line at base	
	Thames Group	London Clay Formation	Brownish grey to grey, sandy to silty CLAY. Also clayey and sandy SILT and silty SAND. Commonly glauconitic. Thin beds of flint pebbles present locally.	30 - 115 m	Aquitard - Springs common at base of sand layers.	Sandy beds may provide small yields of up to 100 m^3/d; initial yields often diminish with time.

1.6 Water Supply Mechanisms

All the wetlands on site are flush dominated (see Figure 1-9 and Figure 1-10). Units 32 and 41 receive water from a seepage face at the junction between river terrace deposits (aquifer) and the underlying Selsey Sands Formation (aquitard), whereas Unit 33 receives water from the junction of the Poole Formation and the underlying London Clay. The water runs over the surface of the slopes, forming flushed surfaces before reaching the valley bottoms.

Figure 1-9: Conceptual Model Diagram for Unit 32 and 41

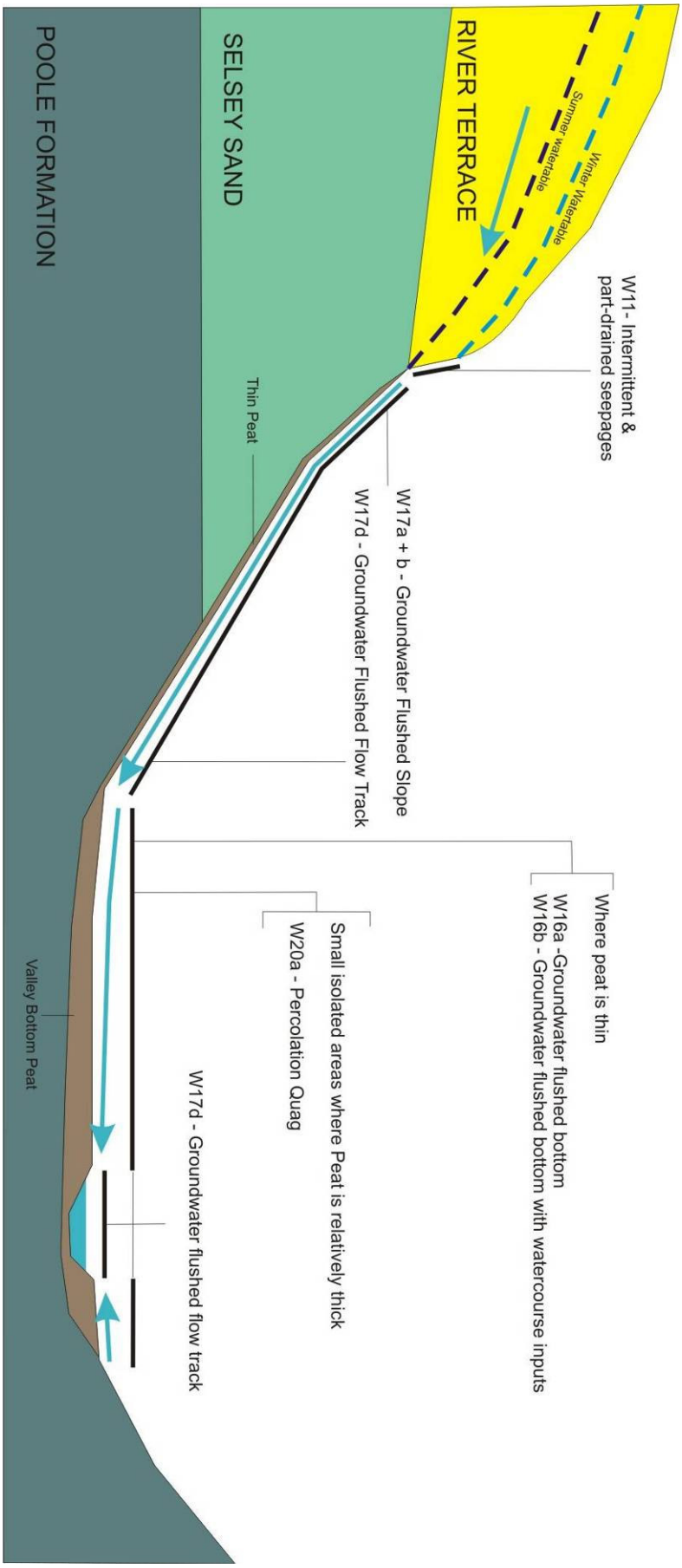
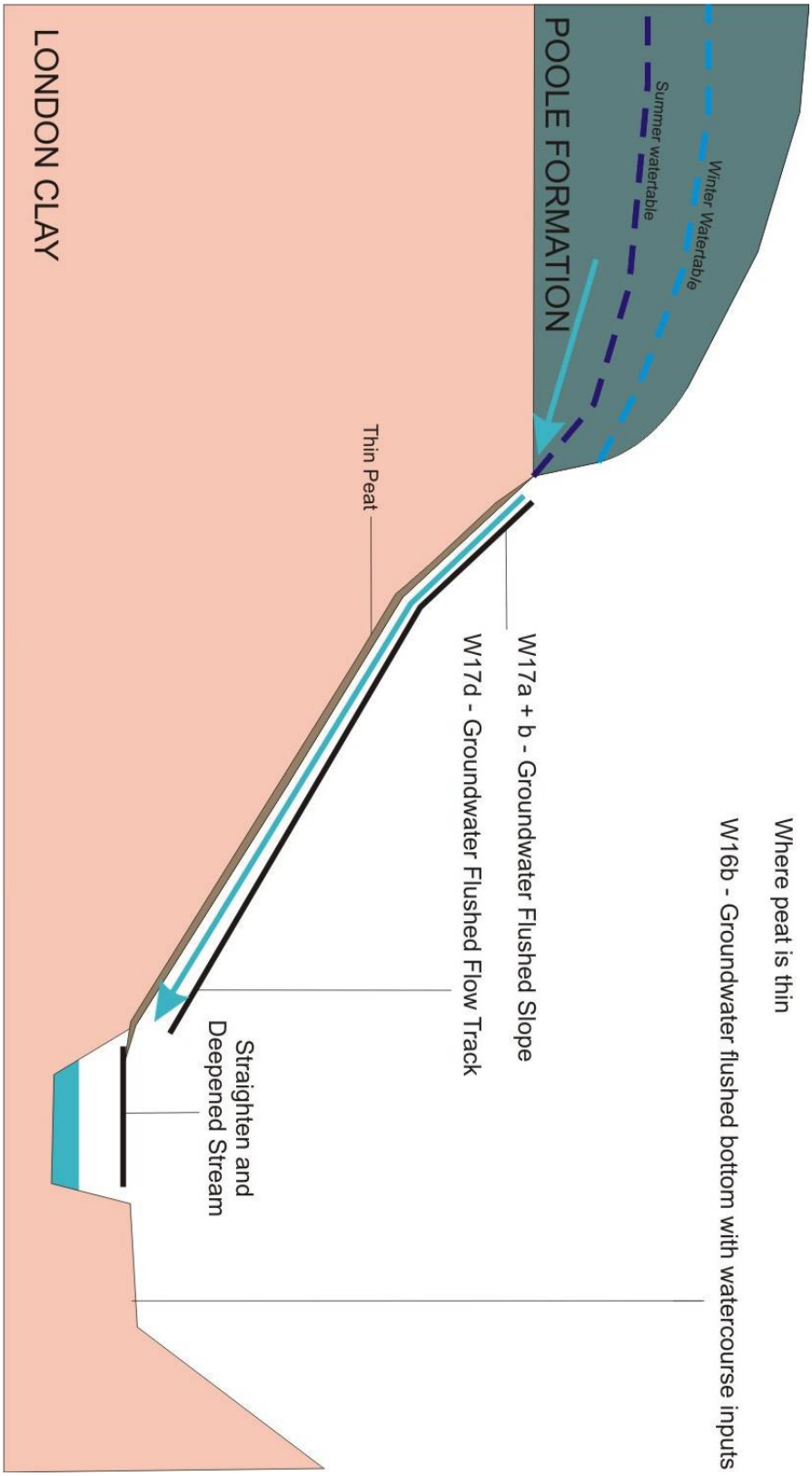


Figure 1-10: Conceptual Model Diagram for Unit 33 and 41



1.6.1 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 - W17a+b and W17b with small areas of W11 above (where seepage is from River Terrace Deposits.

Valley bottom Wetland - W16a and W16b

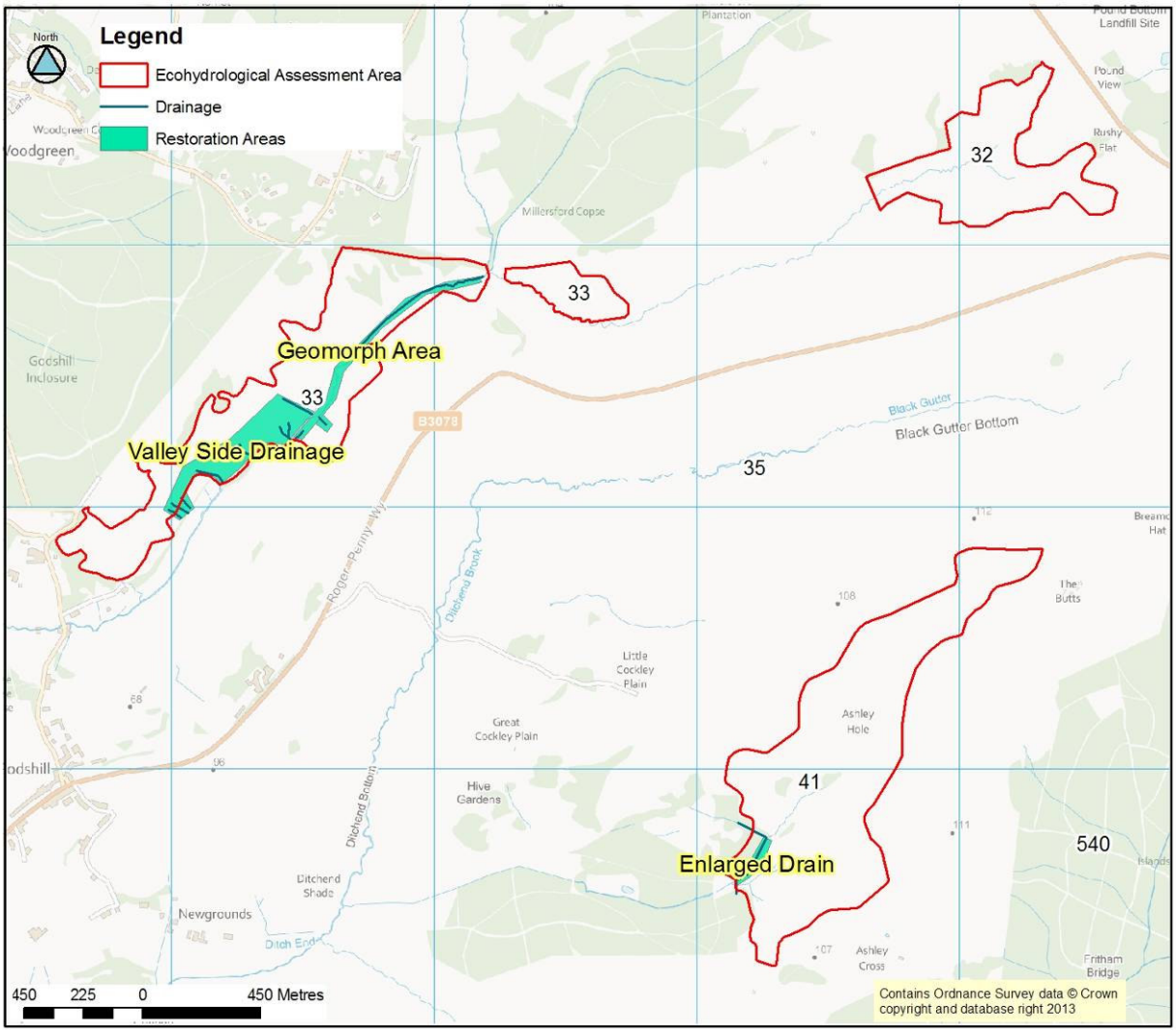
1.7 Damage and Restoration

1.7.1 Damage

There are three areas of significant damage (see Figure 1-11):

- Unit 33 Geomorph Area - the stream along the bottom of Unit 33 has been artificially straightened and deepened. Because of the narrow nature of the valley bottom it is unlikely to have destroyed a large area of wetland. Local over-deepening has impacted on riparian drying and, combined with tree removal and grazing, has degraded the valley bottom hydromorphology.
- Unit 33 Valley Side Drainage - In this area there are a small number of drains cut into the valley side to try to drain the valley side wetlands. In no location are these drains densely cut or particularly effective.
- Unit 41 Enlarged Drain - Where the stream runs along the side of a wood at the bottom of the valley, it has been straightened into a drain which has subsequently gulleyed. This gulleying does not seem to extend beyond the area where the stream was straightened, therefore it might be relatively stable.
- No significant areas of hydrological damage were identified in Unit 32, however, localised flow convergence and headcut erosion rates should be monitored.

Figure 1-11: Restoration Areas Map



Grazing pressures appear to be well balanced throughout these units with ecological damage limited to pinch-points at river crossings. There are Pine and Rhododendron seedlings developing at various sites throughout units 32 and 33 which should be subject to a planned control programme to ensure these isolated specimens do not spread further.

1.7.2 Restoration

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

- Unit 33 - Geomorph Area - construction of woody debris dams will encourage sediment accumulation upstream and raise water table levels across the valley bottom;
- Unit 33 - Valley Side Drains - a series of regular plugs made from suitable available material (earth, heather bails, plastic sheet piling) should be constructed to block the valley side ditches in this area;
- Unit 41 - as this gulley seems stable and runs along an area of woodland, regular monitoring is likely to be the best option for this stretch. If restoration is needed, it might require an engineered solution, due to the size of the gulley.

Table 1-3: Restoration Area Summary Table

Restoration Area	Damage Type	Restoration Proposals	Improvement	Constraints and Issues
Unit 33 - Geomorph	Straighten and deepening of	Woody debris dams	Increase wetness of	N/A

Restoration Area	Damage Type	Restoration Proposals	Improvement	Constraints and Issues
Area	main stream		valley bottom Improve in-channel hydromorphic diversity Encourage floodplain inundation	
Unit 33- Valley Side Drains	Slight drainage of some sections of valley side drains	Regular plugging of drains	Increase wetness of valley sides and extents of mire	Relatively little work required over a large area
Unit 41 - Enlarged Drain	Straightening and gulleying	Further monitoring	Ensure that the gulley is stable and not eroding backwards into the valley bottom wetland.	

1.8 Monitoring requirements

1.8.1 Water Monitoring

The site contains flush dominated wetlands with thin peats or peaty soils - groundwater monitoring is unlikely to be appropriate for such a site. A fixed point camera survey of the gulley in Unit 41 would help to understand the rate of headward erosion at the gulley head.

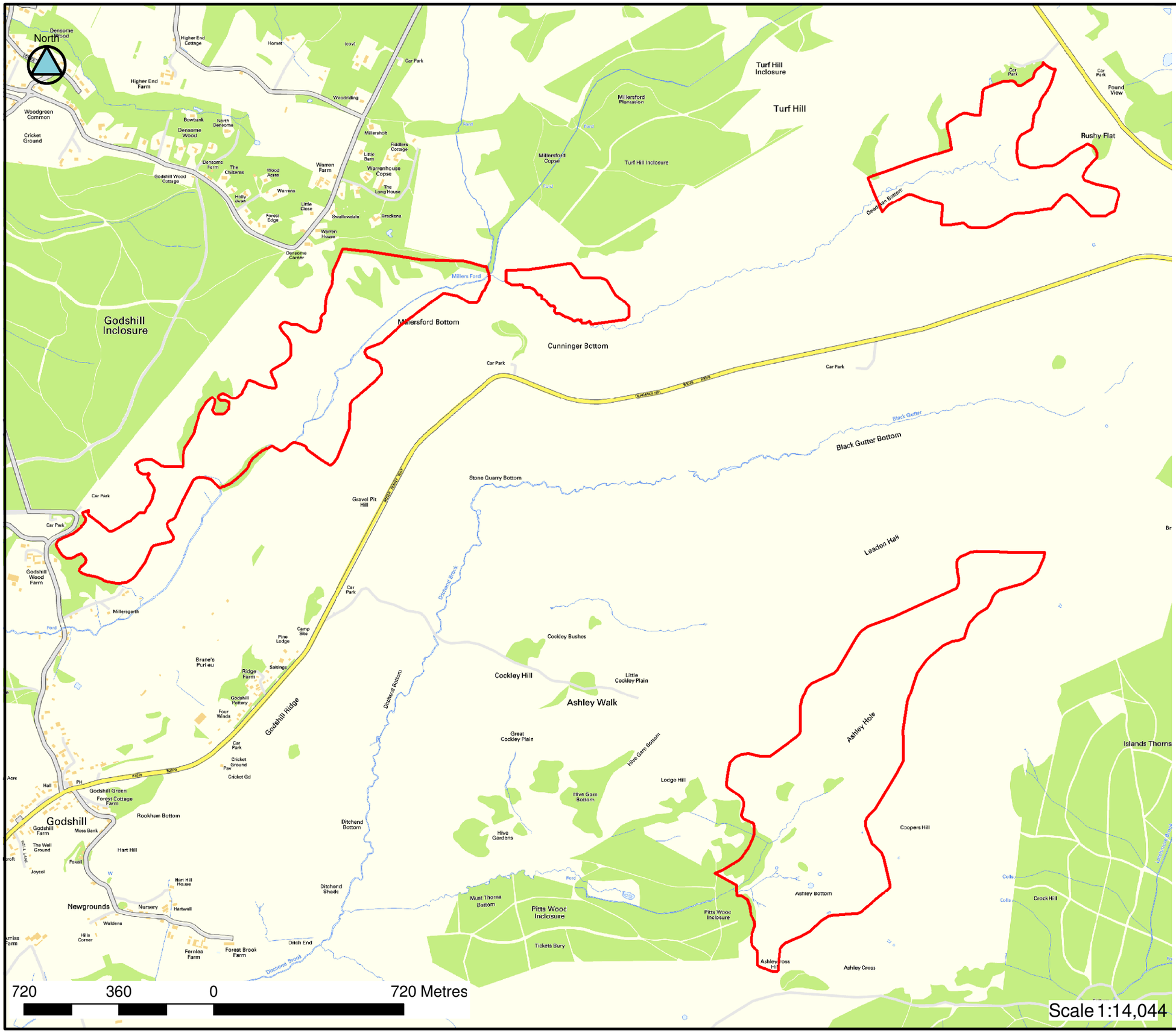
1.8.2 Vegetation

There is minor scrub encroachment (Pine and Rhododendron) throughout these units which need to be monitored to ensure they do not become extensive. Periodic monitoring of the extents of vegetation types should be carried out to ensure that there is no overall loss of SAC qualifying communities.

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)
R	32, 33 and 41	Deadmans Bottom, Millersford Bottom Mires and Ashley Hole Mire	Fixed point camera survey (specifically focussing on extent of pine, Rhododendron and other scrub encroachment and poaching) Fixed point quadrat survey	Fixed point camera survey of gulley in Unit 41

2 Maps



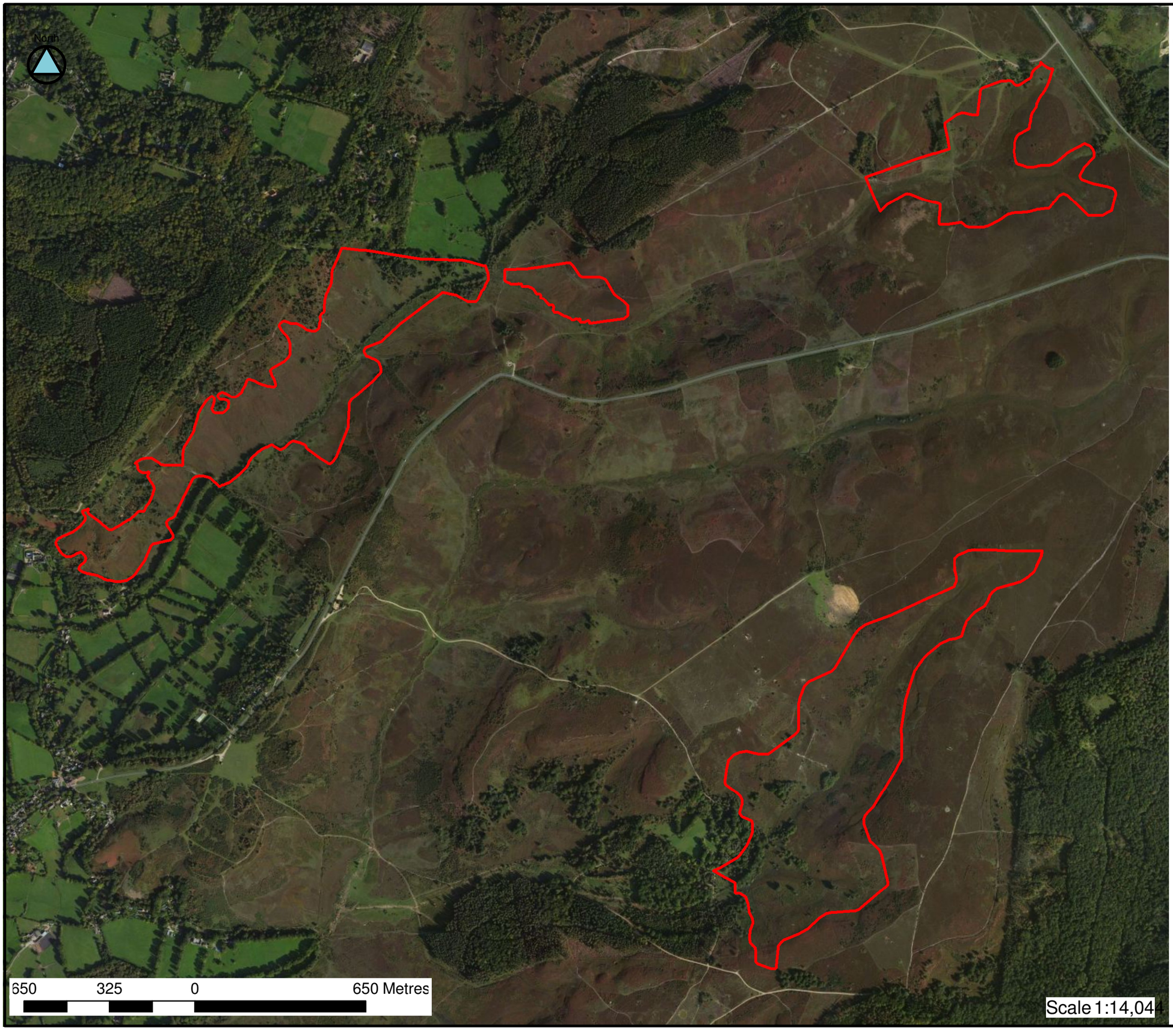
LEGEND

Ecohydrological Assessment Area

JBA consulting

MAP 1

Site Location



LEGEND

Ecohydrological Assessment Area

JBA consulting

MAP 2

Aerial Photography

North

200 100 0 200 Metres

Scale 1:3,526

LEGEND

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

LIDAR

mAOD

High : 117

Low : 90

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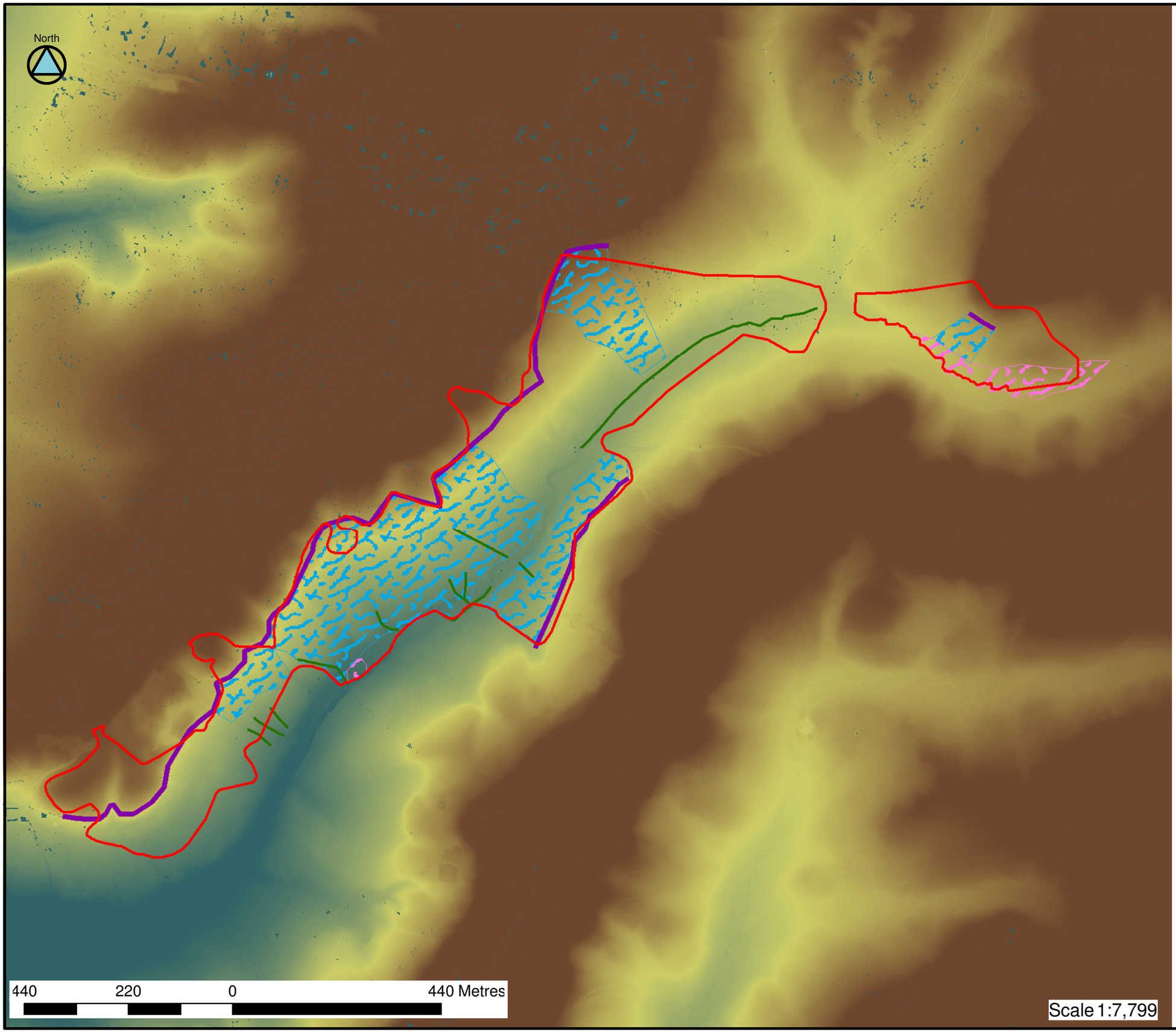
MAP 3

Topography, Hydrology and Wetland Distribution



LEGEND

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

LIDAR

mAOD

High : 85

Low : 50

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MAP 3

Topography, Hydrology and Wetland Distribution

North

LEGEND

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

LIDAR

mAOD

High : 46

Low : 18

360 180 0 360 Metres

Scale 1:6,401

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MAP 3

Topography, Hydrology and Wetland Distribution

North

Car Park

Car Park

Rushy Flat

M16a

M25a

M25a

M29 Soakaway

M18a

M18a

M16a

M18a

LEGEND

- Ecohydrological Assessment Area
- G2.3
- A2.2
- B1.1
- B5
- D2
- E1.6.1
- E2.1
- E3.1

100 50 0 100 Metres

Scale 1:3,000

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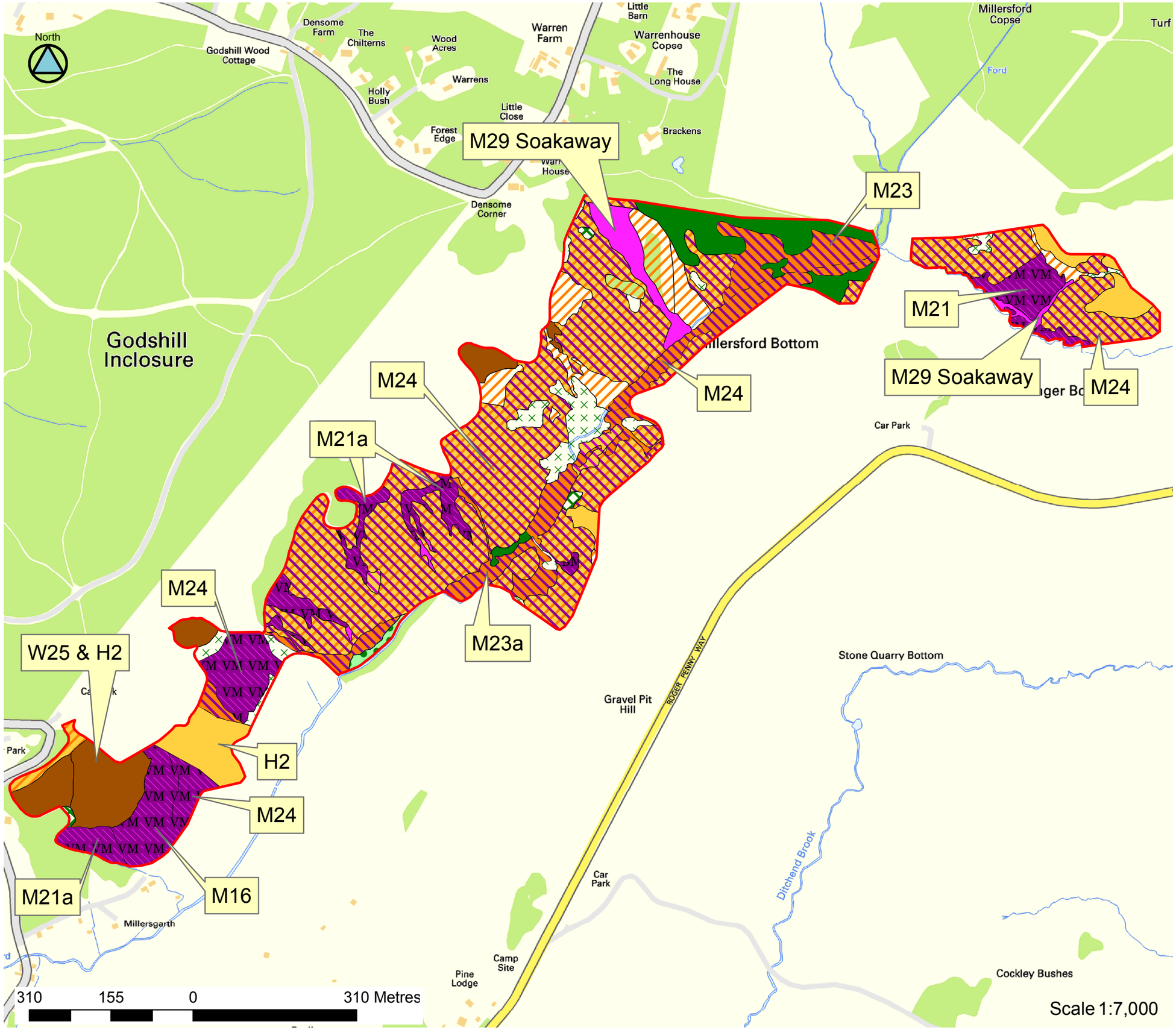
MAP 4

Phase One Habitat



LEGEND

- Ecohydrological Assessment Area
- A1.1.1
- A1.3.1
- A2.1
- A2.2
- B1.1
- B5
- C1.1
- D1.1
- D2
- D5
- D6
- E2.1
- E3.1
- E3.2

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MAP 4

Phase One Habitat

North

M23a

M16a

M25a

M16a

H2 & W25

M23a

H2

M21a

W25

M21a

M24

M24

Leaden

Little
ockley Plain

Hive Garn Bottom

Lodge Hill

Coopers Hill

Colls

Colls

Crock Hill

Pitts Wood
Inclosure

Ashley Cross

250 125 0 250 Metres

Scale 1:6,000

LEGEND

- Ecohydrological Assessment Area
- A1.1.1
- A2.1
- A2.2
- B5
- C1.1
- C1.2
- D1.1
- D2
- D6
- E3.1
- E3.2

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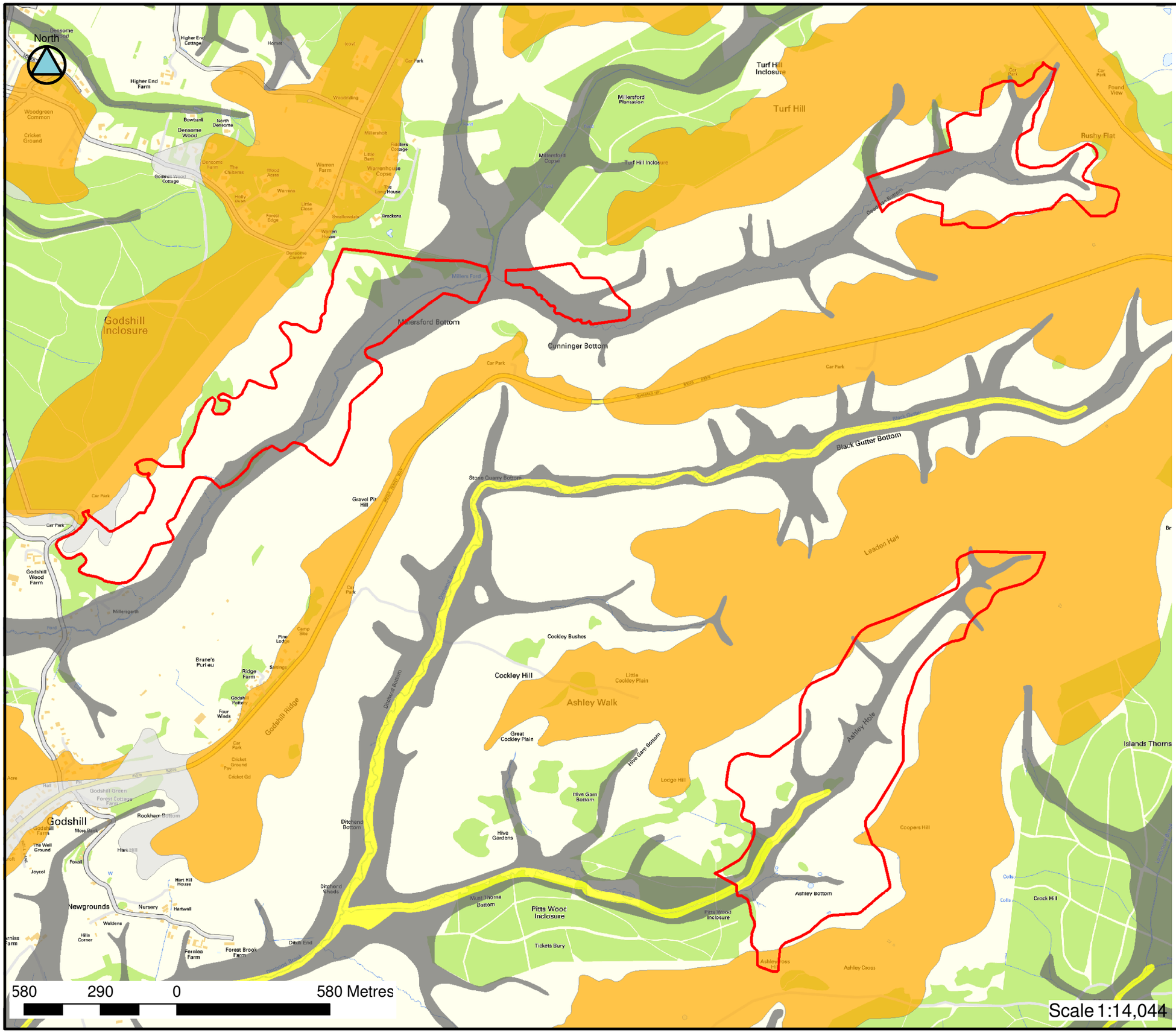
MAP 4

Phase One Habitat



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

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MAP 5

Drift Geology

READING FORMATION - SAND

North

LONDON CLAY FORMATION - CLAY, SILT AND SAND

POOLE FORMATION - SAND, SILT AND CLAY

POOLE FORMATION - SAND, SILT AND CLAY

LONDON CLAY FORMATION - CLAY, SILT AND SAND

MARSH FARM FORMATION - CLAY, SILT AND SAND

SELSEY SAND FORMATION - SAND, SILT AND CLAY

POOLE FORMATION - SAND, SILT AND CLAY

580 290 0 580 Metres

Scale 1:14,044

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

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MAP 6

Bedrock Geology

North

580 290 0 580 Metres

Scale 1:14,044

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

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MAP 7

Eco-hydrology

North

330 165 0 330 Metres

Scale 1:7,833

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

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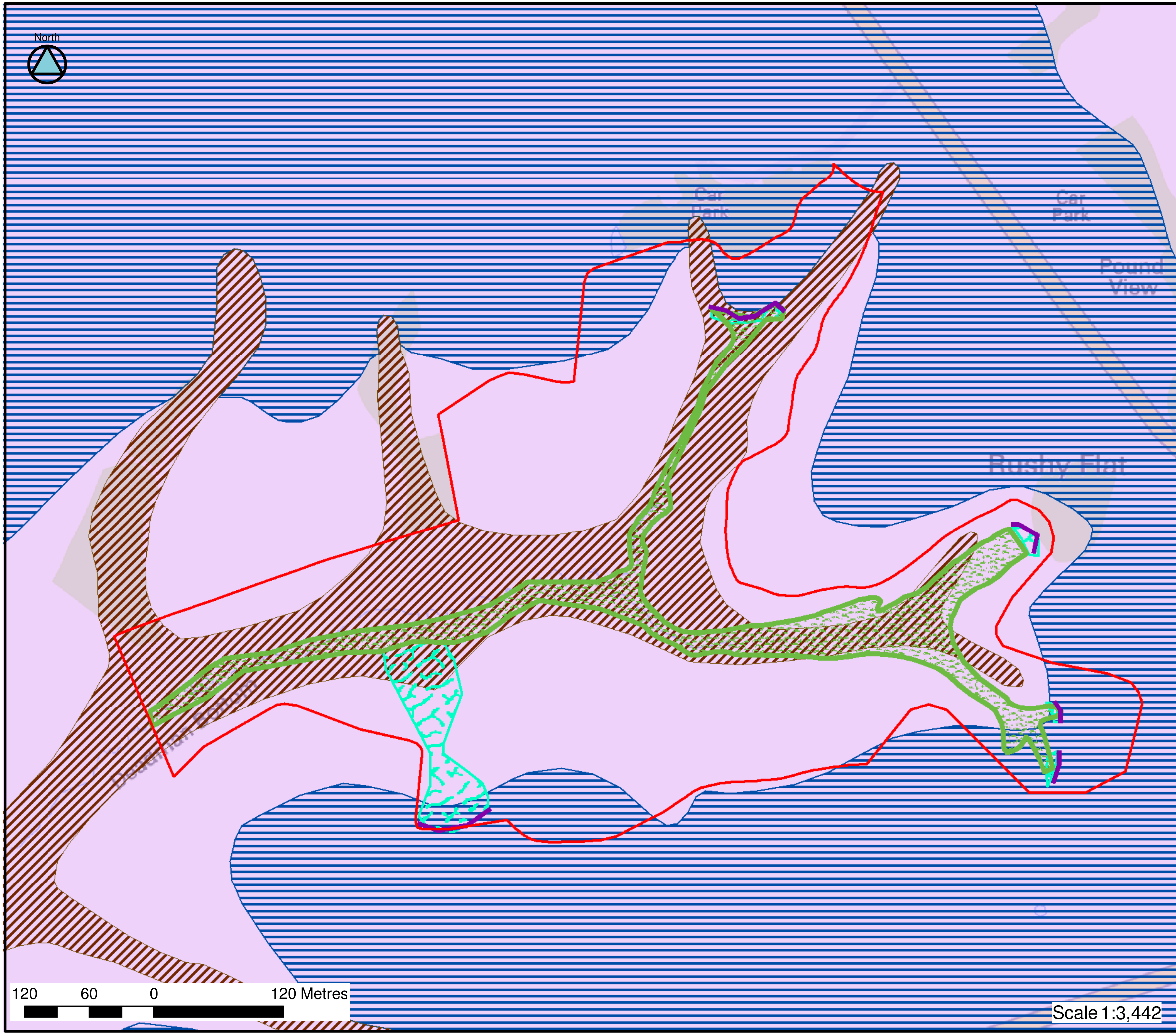
MAP 7

Eco-hydrology



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

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MAP 7

Eco-hydrology

North

Little Lockley Plain

Hive Garn Bottom

Lodge Hill

Coopers Hill

Ashley Bottom

Colls

Crock Hill

Ashley Cross

210 105 0 210 Metres

Scale 1:5,974

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

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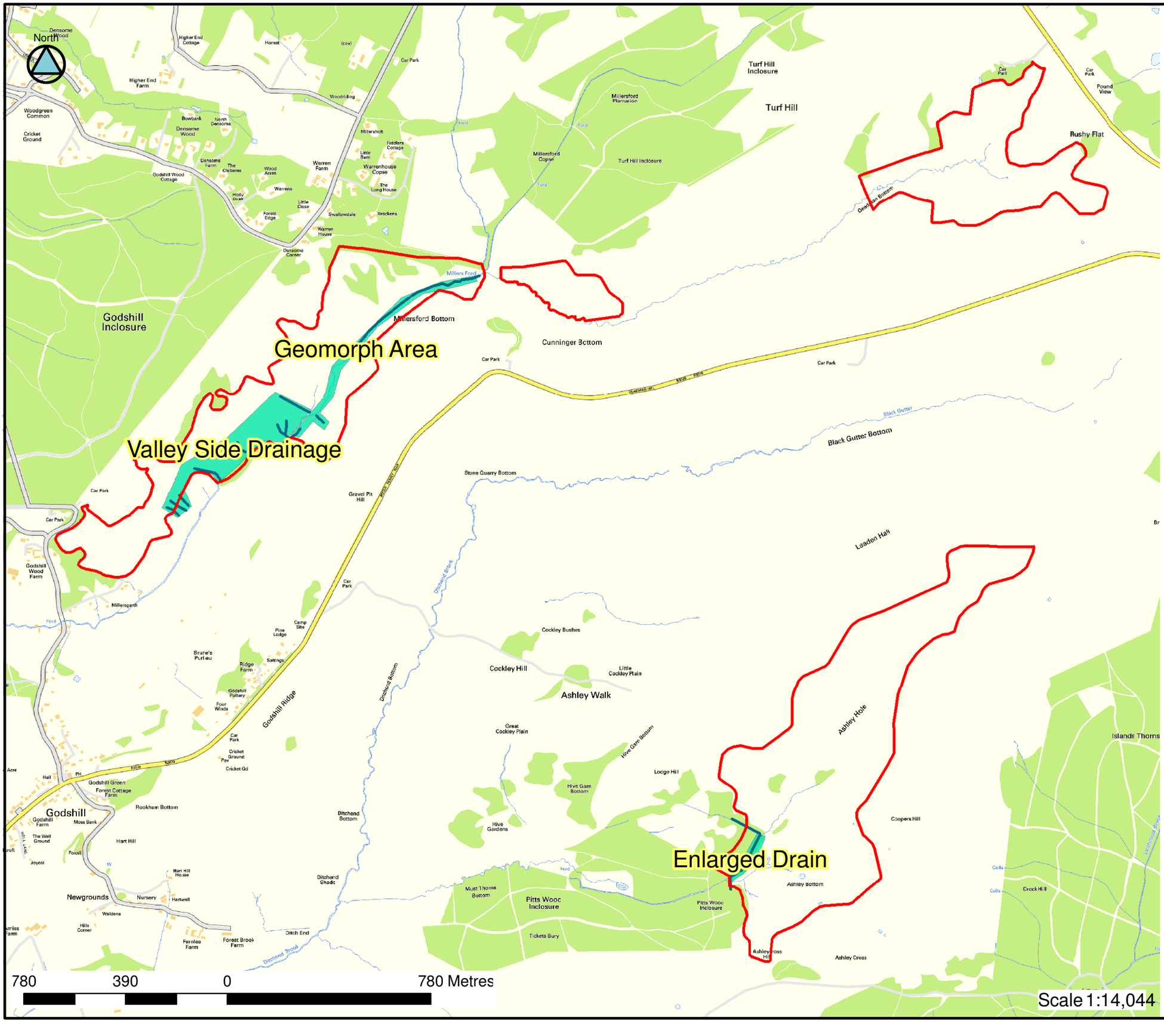
MAP 7

Eco-hydrology



LEGEND

- Ecohydrological Assessment Area
- Drainage
- Restoration Areas

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MAP 8

Restoration Plan