Natural England Commissioned Report NECR140

New Forest SSSI Geomorphological Survey Overview

Annex R: Dockens Water Woods Restoration Plan - SSSI Unit 545

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1 Dockens Water Woods Restoration Plan - SSSI Unit 545

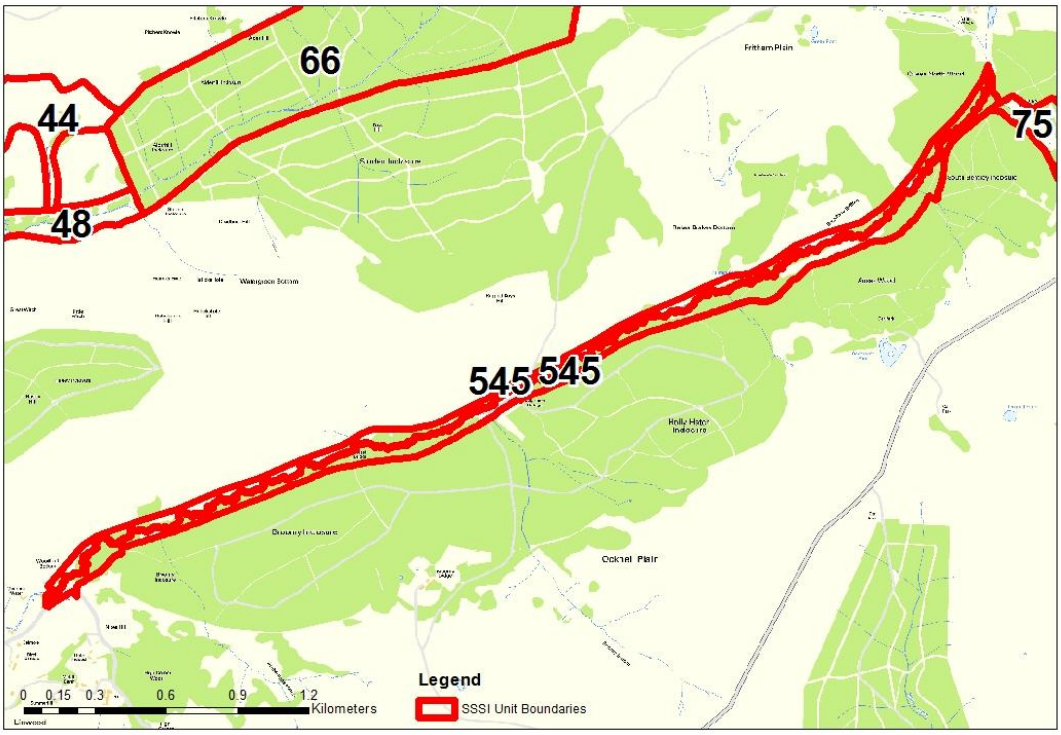
1.1 Introduction

Dockens Water Woods (Unit 545) incorporates the upper reaches of Dockens Water (Figure 1-1). The SSSI unit is considered to be in unfavourable recovering condition. It is approximately 44.89ha in size.

This unit is predominantly made up of broadleaved woodland, which is a mixture of bog and pasture woodland. Along the northern edge of the site are areas of wet heath. In open, grazed areas within the woodland and adjacent to the watercourse wet grassland occurs.

Unit 75 (Suburbs Wood Mire) flows into Dockens Water Woods at the upstream end of the unit. It is important to consider undertaking works within this unit alongside works for unit 75 upstream as works will assist approaches suggested for this unit.

Figure 1-1: SSSI Unit 545 location (flow direction is north east to south west)



1.2 Current hydromorphic conditions and issues

A summary of the hydromorphic conditions for unit 545 is given in Table 1-1.

Table 1-1: Summary of hydromorphic conditions for unit 545

Geomorphological Assessment Area		Dockens Water
Site Name		Dockens Water Woods
Size (ha)		43.4
SSSI Unit(s)		545
Channel Condition	River type (s)	Active single thread with sections of lowland anastomosed
	Responsiveness	Moderate / high - moderate gradient, strong gravel supply, tree clearance (historic), grazing

Geomorphological Assessment Area		Dockens Water
	Sediment delivery, type and mobility	Strong upstream and local gravel sources (banks), few fines, reduction in gradient at anastomosed sections. Very mobile gravels
	Main source of water	Upstream source (Longcross Plain, Janesmoor Plain) and drains
	Aquatic vegetation	Through the wooded sections the channel is heavily overshaded and consequently there is very little aquatic vegetation. In the more open sections channel vegetation consisted of Floating Sweet-grass, Fool's Water-cress, Water Forget-me-not, Bog Pondweed, Stream Water-crowfoot
	Drainage damage	Drains over both banks incised, straight and embanked
	Morphology	Pools, riffles, debris jams, chutes, mid-channel bars, transverse bars, lateral bars
	Incision	Minor incision in some locations throughout
	Engineering	Bridges and footbridges
	Bank activity	Moderate, some lateral activity in active single thread sections.
	Flow type (s)	Flows impacted by upstream and local drainage network. Decent connectivity to floodplain
Floodplain Condition	Valley type	Wide floodplain
	Main source of water	Drains / overland flow, out of bank flows
	NVC communities	W11, W14, W1, W8, M16a, M23a, M29, H2, U4, U1
	Key habitat types	Broadleaved woodland, Wet heath, Marshy grassland, Acid dry heath, Dry grassland
	Drainage	Drains impacted by embankments and straightening.
	Scrub / tree encroachment damage	In some areas the woodland is encroaching into the wet grassland and heath. Some felling has taken place.
	Palaeo features	Yes - both in single thread sections and anastomosed sections that are now less connected in some locations
	Floodplain connectivity	Moderate / high - better in anastomosed sections
	Poaching and grazing pressures	Significant grazing damage
Generic restoration options		Remove embankments along drains to improve floodplain wetting. Opportunities to bring water level up in main channel, re-anastomose some sections, particularly in wooded areas. Debris jams to raise water levels, would encourage multi-thread development
Additional comments		

The Dockens Water within Unit 545 varies between:

- short lowland anastomosed sections (Figure 1-2), particularly in the mid to lower reaches e.g. Splash Bridge and some sections just downstream of this;
- active single thread channels between anastomosed sections with a good gravel supply, this is the dominant channel type (Figure 1-3).

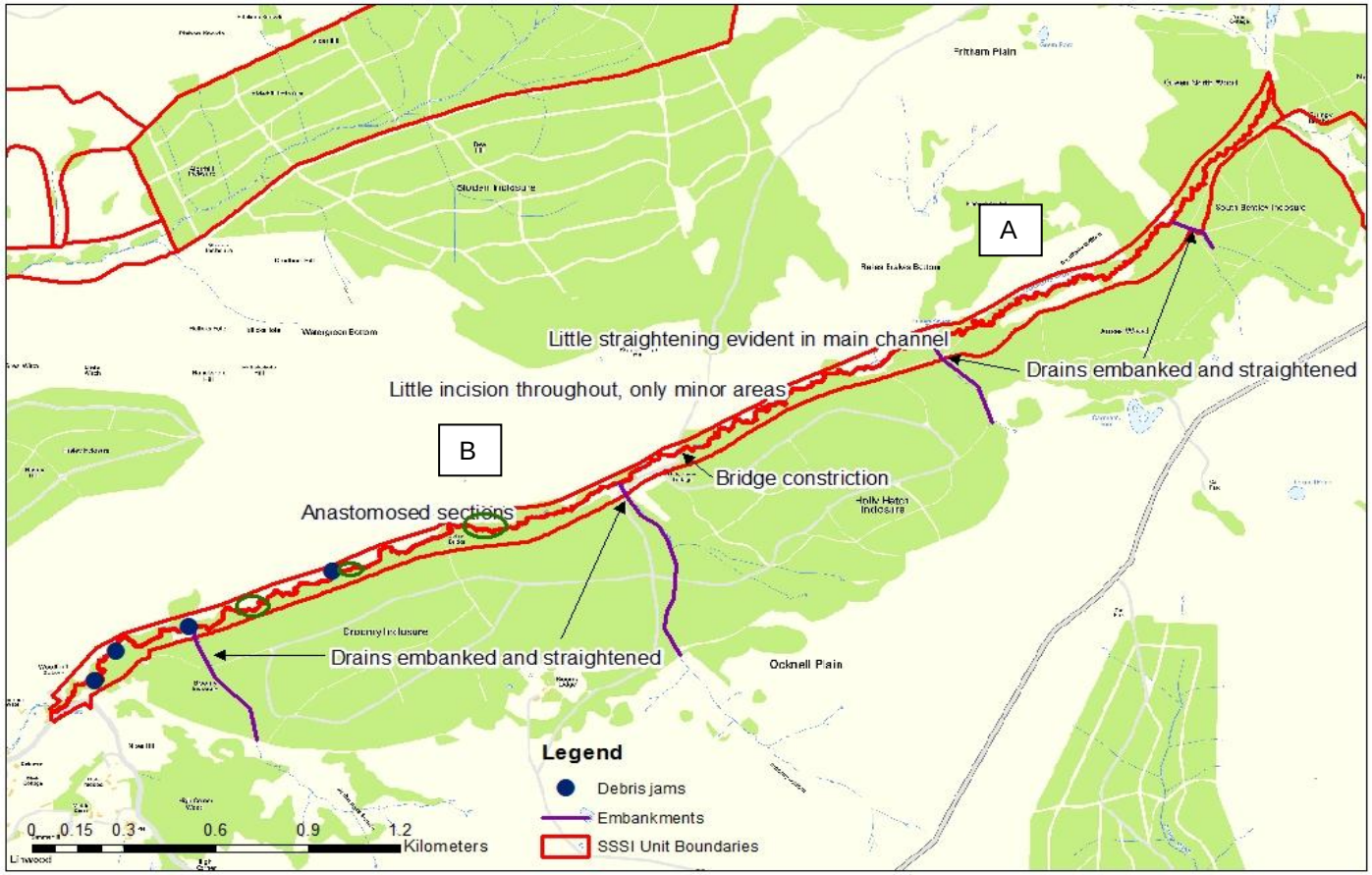
Figure 1-2: Anastomosed channel section

Figure 1-3: Active single thread characteristics

The source of Dockens Water is at Longcross and Janesmoor Plains. Gravels are readily transported through the unit, transferring via a number of active gravel bar and riffle units, and the Dockens Water downstream of the SSSI unit will rely on continuing sediment supply from this reach.

Figure 1-4 summarises the existing hydromorphology and pressure impacting Unit 545.

Figure 1-4: Current hydromorphic conditions and pressures



The Dockens Water has a moderate gradient, particularly in the upper active single thread reaches (Figure 1-4 - A). The gradient is shallower through the short anastomosed section (Figure 1-4 - B). Some sections may have been modified / straightened in the past, although this does not appear to be widespread. This may account for the limited incision seen within this unit throughout in combination with the limited bankside embankments and generally good floodplain connectivity. This results in flood water spreading over a wide area, reducing in channel flood shear stress levels and erosive potential. However, bank erosion does still naturally occur at higher flows, particularly on the outside of bends where flows are concentrated on the outer banks and where gravel shoal deposits encourage channel asymmetry and widening (Figure 1-5).

Figure 1-5: Bank erosion associated to gravel bar growth

Figure 1-6: Bank erosion associated to gravel point bar growth at a meander

Where the channel banks are stronger (due to the presence of more resistant boulder clays rather than fluvio-glacial gravels or where riparian woody vegetation is dense enough to provide a coherent resistant root mat) limited erosion occurs and it was clear from the audit that erosion was certainly more widespread in the heavily grazed sections where bank cohesion is limited due to a lack of a resistant deep root mat (Figure 1-6).

Where floodplain connectivity is good, within the wooded sections, a multi-thread anastomosed channel network has developed between stabilised wooded areas (Figure 1-4 - B). Lateral and vertical erosion is reduced through these sections as channels are wetted at different flow levels, spreading erosive energy across a wide area as flow levels increase. Whilst on site, high flow levels showed the anastomosed channel network well (Figure 1-2). The success of the anastomosed networks is assisted by local natural debris jams which maintain improved floodplain connectivity (Figure 1-7).

Figure 1-7: Debris jams

Often in rivers with moderate to high energy, lateral erosion and widening is also associated with bar deposition concentrating flows around gravel shoals and promoting further lateral activity (Figure 1-3). This is particularly true for the active single thread sections of the Dockens Water, where continual bar growth has result in channel widening and migration (Figure 1-8).

Figure 1-8: Progressive bar development and channel widening

There are numerous drains and ditches over both banks within the unit, some of which have clearly been artificially modified through straightening, embanking and deepening (Figure 1-9). This will have impacted on the flood flow regime of the watercourse creating a more responsive system where flood peaks are concentrated and increased and water enters the main channel more efficiently. The degree of artificial drain creation / modification is shown in Appendix A and is impacting on the flow regime, particularly where drains flowing parallel to the watercourse collect surrounding inflows and concentrate them in the main channel at one point. There is some minor incision in a few of the drains and the connectivity to the floodplain has been significantly impacted through embanking, creating drier surrounding floodplain conditions lowering groundwater levels.

Figure 1-9: Artificial drain showing straightening and embankments

Groundwater levels have also been altered as a result of the deepening and spoil dumping (embankment creation). Sections of the immediate floodplain have become drier than natural in some of the sections of this unit.

Gravel supply is good, both from upstream and local bank sources, and this combined with flow regime alterations through surrounding drains, as well as historic tree clearance and poor sapling regeneration, give responsive channel conditions.

The strong supply of gravels has resulted in significant gravel feature growth within the channel in the throughout and particularly where gradients are shallower in the form of mid channel bars, lateral bars, transverse bars and point bars (Figure 1-3). The good connectivity to the floodplain provides conditions where deposition is promoted, forming dynamically stable features. In the upper reaches, features are generally composed of larger gravels and cobbles (Figure 1-10) due to the steeper gradient and higher energy flow conditions with most of the smaller gravels transported downstream.

Figure 1-10: Larger gravel / cobble features in upper reaches

Natural woody debris features are common along the channel, particularly in the mid to lower sections, which have often been created as a result of local bank erosion / collapse (Figure 1-11). These create short lengths of impounded watercourse that does improve floodplain connectivity significantly, as is clearly seen in the anastomosed sections of this unit. These provide useful analogue features for the restoration plan.

Figure 1-11: Natural woody debris jams

Palaeo channels have been identified in Figure 1-15 and show where reconnection could be possible through some of the proposed restoration measures in Table 1-2. These have been identified from the audit and supplied LIDAR. Reconnecting these whilst maintaining the existing channel will encourage further anastomosed network development.

One of the bridge structures within the unit has been identified for improvement / replacement (see Table 1-2), close to Holly Hatch Cottage, which is currently creating a constriction to channel development and is interrupting the flow and sediment regime due to the pipe design (Figure 1-12).

Figure 1-12: Bridge at Holly Hatch Cottage

1.3 Probable channel development

This unit is considered to be in a reasonable hydromorphic condition due to the well developed gravel features, good floodplain connectivity, connected anastomosed channel sections, limited incision and few embankments.

Continuing processes are likely to encourage further gravel feature development and channel widening, inherent to the character of the active single thread sections of this unit. The nature and distribution of these is likely to alter over the next decades. However, continued bankside grazing could lead to exaggerated channel migration rates due to a lack of bank strength and high fine sediment inputs that could lead to choking of the currently good gravel bed.

Modifications to the surrounding drainage network has impacted floodplain wetting processes and groundwater levels locally, and this will continue without mitigation. The impacts on the flow regime could lead to enhanced erosion and incision both within the drain and main channel in the medium to long term.

1.4 Current ecological conditions

This unit is predominantly made up of broadleaved woodland, which is a mixture of riparian and pasture woodland. The riverside woodland occurs almost continuously along the banks of the watercourse and consists predominately of Grey Willow *Salix cinerea* and Downy Birch *Betula pubescens* (W1). Pasture woodland is less continuous but occurs in larger blocks, mainly on the south side of the watercourse. It is dominated by Oak *Quercus robur* with an understorey of Holly *Ilex aquifolium* (W10a). At the upstream end of the watercourse, Beech *Fagus sylvatica* tends to dominate some areas (W14).

Along the northern edge of the site are areas of wet heath, with abundant patches of Cross-leaved Heath *Erica tetralix* (W16a) and also frequent Bracken *Pteridium aquilinum* (W25). In open, grazed areas within the woodland and adjacent to the watercourse wet, grazed grassland, and some areas of dry acid grassland occur.

Aquatic vegetation was present within the channel, particularly in the more open sections where the channel was not overshaded. Species present included Floating Sweet-grass *Glyceria*

fluitans, Fool's Water-cress *Apium nodiflorum*, Water Forget-me-not *Myosotis scorpioides*, Bog Pondweed *Potamogeton polygonifolius* and Stream Water-crowfoot *Ranunculus fluitans*. Some patches of Rhododendron *Rhododendron ponticum* were also present on the banks of the watercourse.

Figure 1-13: Phase 1 Habitat Map - East

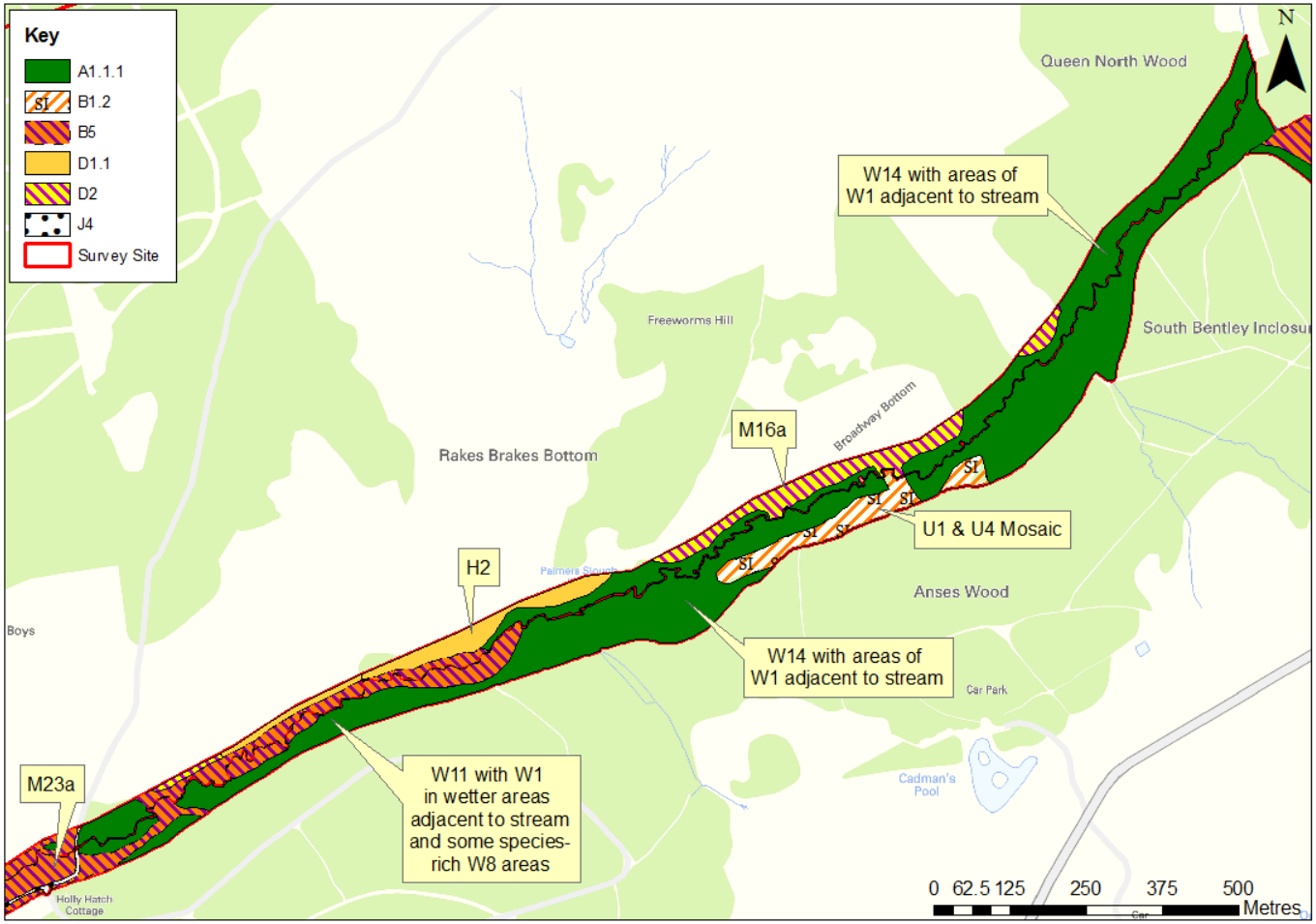


Figure 1-14: Phase I Habitat Map - West

1.5 Restoration plan proposals

A summary of the current pressures, unmitigated impacts and restoration proposals is given in Table 1-2 and shown in Figure 1-15.

The key hydromorphological and ecological gains associated to the proposed restoration measures are:

- Palaeo channel reconnection, alongside embankment removal will create improved morphological features;
- Improved anastomosed channel network development through the use of woody debris jams to improve floodplain connectivity will improve hydromorphological diversity and encourage naturalisation;
- Better floodplain connection through water level raising and artificial drain restoration;
- Opportunities to increase the area and improve the quality of bog woodland, wet grassland and wet heath habitats within the floodplain.

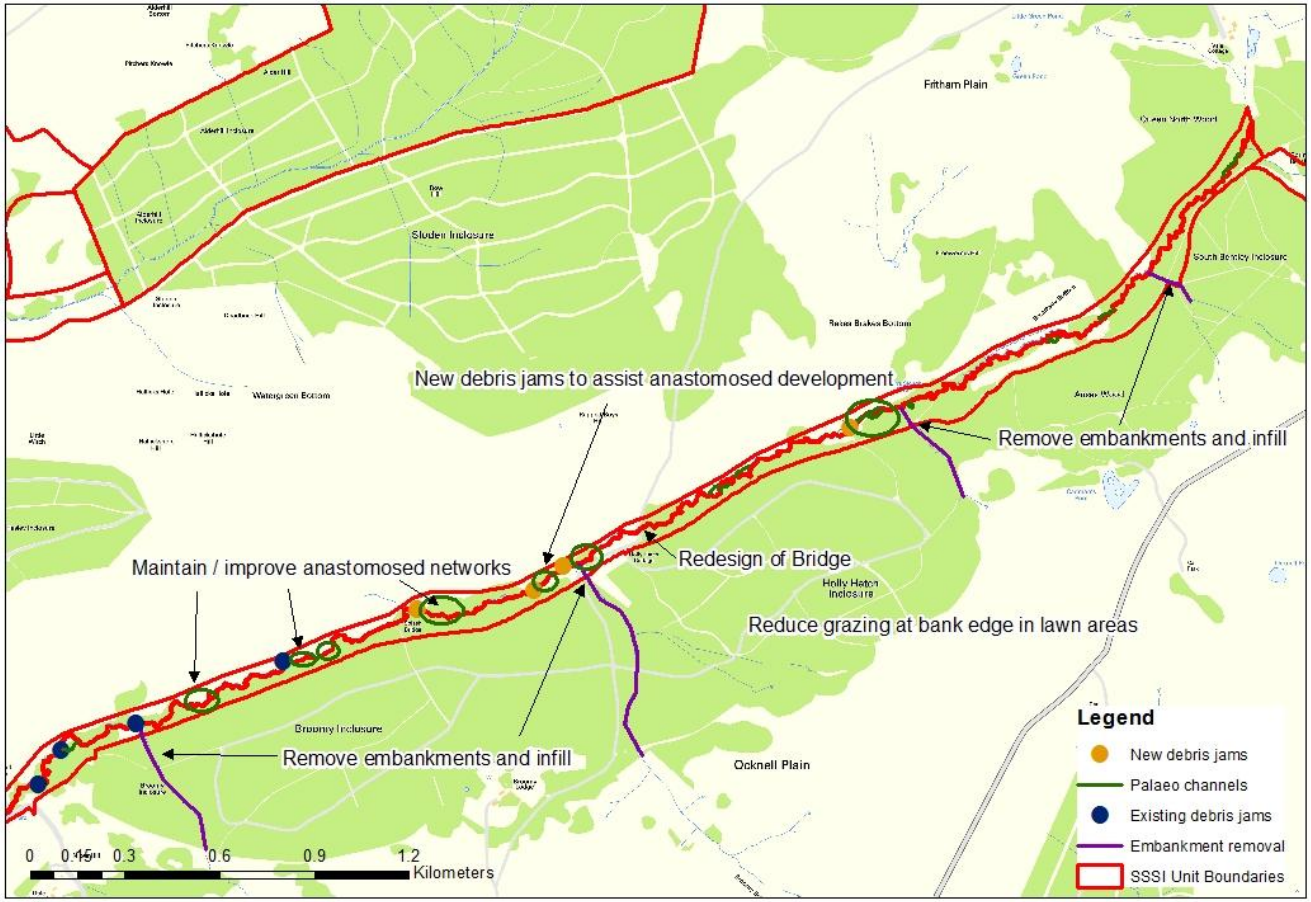
Table 1-2: SSSI Unit 545 proposed restoration measures

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
Minor straightening	Disconnected sub-channels. Loss of in-channel features.	Palaeo channel reconnection. Infill. Restore in-channel morphology. Restore connectivity.	Reinstate some channel length lost through straightening. Encourages anastomosing channel development. Reduces fine sediment inputs. Slows gravel movement. Stabilises in-channel features.	Improve diversity of in-channel and floodplain habitats. Opportunities to increase the area and improve the quality of riverine woodland, wet grassland and wet heath habitats within the floodplain. Raise water table in riparian zone and allow wet heath (M25a) to recolonise areas	Likely to require import of gravels. Some identified palaeos may not warrant restoration and initial focus should be on improving floodplain connectivity and anastomosed channel development in wooded sections. Loss of grazing quality
Drain modification impacts	Minor incision in some locations	Incision management - debris jams, morphological restoration, floodplain works. Infill. Restore connectivity further.	Reconnecting the floodplain will improve in-channel hydromorphic condition and will reduce incision. Debris jams naturally occur along the reach, use local materials. Morphological enhancement to raise bed and water levels will help improve floodplain connectivity. Encourages anastomosing channel development. Reduces fine sediment inputs. Slows gravel movement.	Improve diversity of in-channel and floodplain habitats. Opportunities to increase the area and improve the quality of bog woodland, wet grassland and wet heath habitats within the floodplain. Encourage colonisation of bar features with seral vegetation communities adding to habitat diversity. Debris dams will increase flow around obstacles and encourage new channel development.	Debris jams may form a barrier to fish, a fish pass may be required although this is unlikely. Significant amounts of material are likely to be required if bed works are undertaken. May require some felling of selected trees. Cultural objections Loss of grazing

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
			Stabilises in-channel features.		
Artificial drainage - embanking, straightening (Inflows)	High flows impacted. Water table lowered locally.	Drain infilling. Embankment removal.	Restore a natural flow regime, reducing incision in the drain and minor incision in the channel network. Reduces flood peaks. Reduces fine sediment inputs. Slows gravel movement. Stabilises in-channel features.	Improve diversity of in-channel habitats. Reconnection of floodplain and channel, increasing habitat diversity and allowing colonisation by wetland habitats (M23a, M25a)	May require import of material with risk of introduced alien species Cost Cultural objections
Riparian vegetation removal	Loss of bank stability. Loss of shading. Loss of organic inputs to the watercourse.	Reduced tree clearance at bank edge. Selective half-felling Ring barking	Will help to stabilise banks in the active sections where no bankside vegetation and alongside bed restoration to minimise incision, could improve floodplain connectivity. Creates riparian hydromorphic diversity. Acts as fine sediment trap. Allows woody debris accumulation.	Opportunities to improve and expand bog woodland habitat in floodplain. Increased light on forest floor promoting release. Creation of CWD and standing dead wood habitat.	Tree clearance is a necessity in some locations. Removal of non-native species.
Riparian grazing	Fine sediment production. Disruption to woody species recruitment.	Exclude livestock (Fencing)	Encourages riparian hydromorphic diversity	Increased floristic diversity of ground flora on floodplain. Restoration of wetland habitats.	Some grazing is likely to be maintained as part of commoners' rights. Cultural opposition Loss of grazing.
Woody invasive species	Alters floodplain species	Eradicate Rhododendron	Creates riparian	Increased floristic	Continued maintenance

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
	assemblage. Impacts bank stability.	and allow natural regeneration / plant alder & willow.	hydromorphic diversity	diversity of ground flora on floodplain and will allow native woodland species to develop in area. Restoration of wetland habitats.	requirements. Cost
River crossing / structure at Holly Hatch Cottage	Local hydromorphic alteration - flow and sediment regime impacts	Replacement with a more suitable structure such as a single span bridge	Reinstate anastomosed reach	Improve diversity of in-channel habitats.	None. Promote natural processes.

Figure 1-15: Proposed restoration measures for SSSI Unit 545



1.6 Design considerations

The channel is unlikely to completely stabilise as a result of improving connection to the floodplain through debris jams / morphologic feature introduction. However, retaining the dynamism of the channel should be an objective of the restoration plan.

The major straightened / modified drainage channels are identified in Figure 1-15. Other minor modifications could be considered for infilling and Appendix A should be used for reference.

Flood risk may need to be considered here due to location of Holly Hatch Cottage close to the watercourse and a Flood Risk Assessment may be required.

Works within this unit should be aligned with works undertaken in unit 75 as the linkage between these units is important.

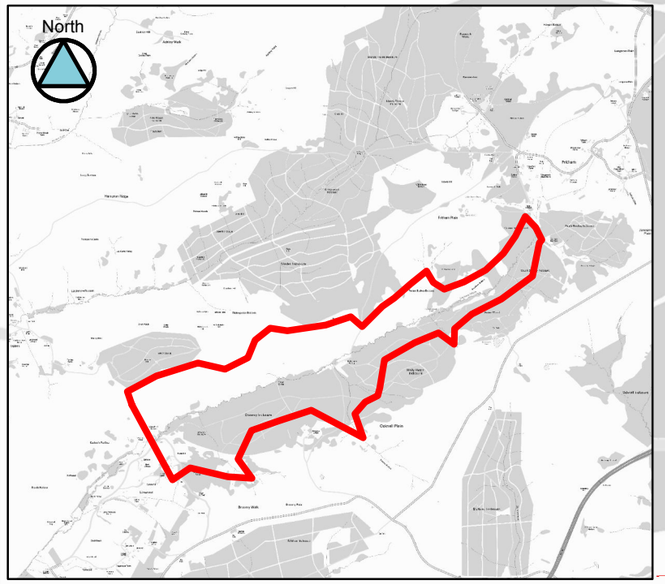
1.7 Restored channel and monitoring requirements

It is anticipated that the proposed restoration works will create a dynamic, sinuous channel with further / improved anastomosed sections and improved floodplain connectivity, with frequent overbank flooding. This pattern of development is difficult to document accurately due to the complex nature of the river network and the difficult surveying conditions. As such a qualitative monitoring approach is recommended with automated time lapse photography employed at key restoration points to record daily images of flow types, morphology and vegetation character. This could be undertaken alongside two-yearly reconnaissance audits to determine hydromorphological change over the entire reach, which fixed point photography will not cover. The daily photographic records should be analysed to estimate and record the parameters detailed in Table 1-3.

Table 1-3: Monitoring parameters, frequency and suggested approaches for the Unit 545.

<table>
<tr><th>Parameter</th><th>Approach</th><th>Frequency</th><th>Approximate cost</th></tr>
<tr><td>Morphologic unit change</td><td>Time lapse camera / audit</td><td>Daily (Annual statistical summary)</td><td rowspan="4">Capital 5 x £200
Half yearly downloading £200
Annual summary £300
Two - yearly reconnaissance audit £500</td></tr>
<tr><td>Flow change</td><td>Time lapse camera / audit</td><td>Daily (Annual statistical summary)</td></tr>
<tr><td>Sedimentology</td><td>Time lapse camera / audit</td><td>Daily (Annual statistical summary)</td></tr>
<tr><td rowspan="3">Vegetation change</td><td>Fixed point camera survey</td><td>Biennially</td></tr>
<tr><td>Fixed point quadrat survey</td><td rowspan="2">Biennially</td><td rowspan="2">Survey £350
Analysis £500</td></tr>
<tr><td>Fixed point aquatic macrophyte survey</td></tr>
<tr><td colspan="4">NB. Costs assume downloading and site visits as part of wider field campaign.</td></tr>
</table>

Appendix A - Artificial drains and flow lines - SSSI Unit 545



SSSI 545: Dockens Water Woods

Hasley Inclosure

Hasley Hill

Broomy Inclosu

Woodford Bottom

Broomy Inclosure

Dockens Water

Ford

Ogden's Purlieu

Nices Hill

Belmore

Ten Oaks

Birch Cottage

Little Paddock

Middle Earth

High Corner Wood

Amberslade B

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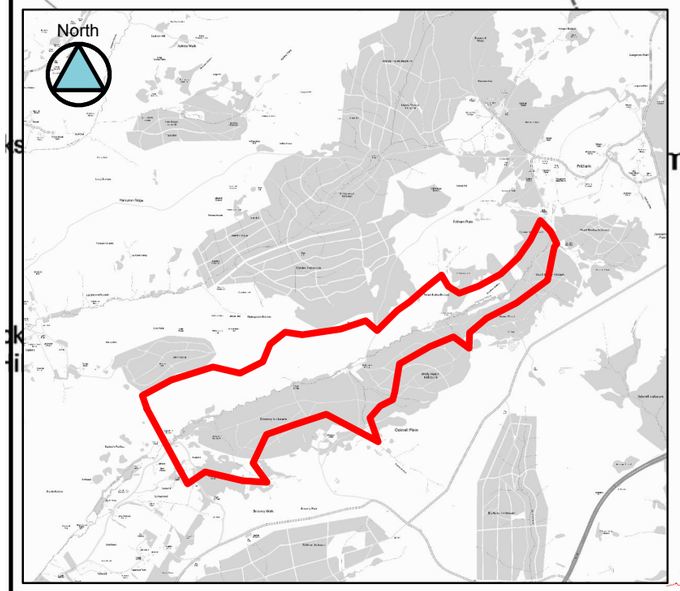

SSSI 545: Dockens Water Woods

Ragged Boys Hill

Holly Hatch Cottage

Splash Bridge

Broomy Inclosure

Ocknell

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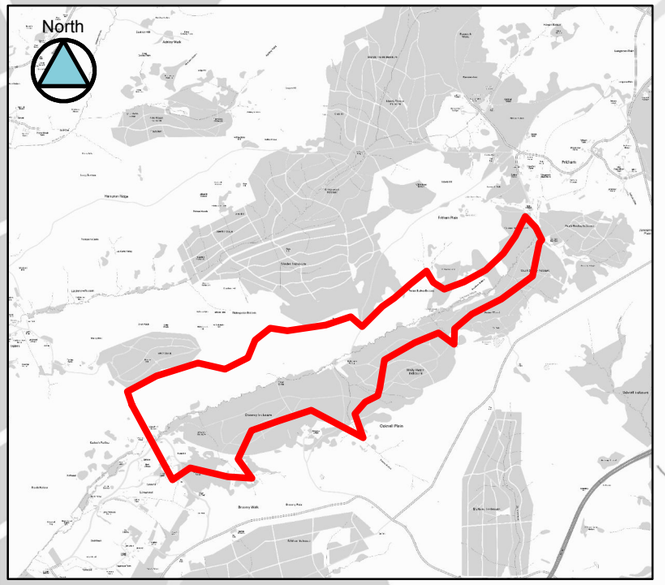

SSSI 545: Dockens Water Woods

Queen North Wood

Freeworms Hill

South Bentley Inclosure

Broadway Bottom

Rakes Brakes Bottom

Dockens Water

Palmers Slough (Ford)

Anses Wood

Car Park

Cadman's Pool

0 50 100 200 300 400 Metres