Natural England Commissioned Report NECR140

New Forest SSSI Geomorphological Survey Overview

Annex P: Wootton Riverine Woodland - SSSI Unit 539

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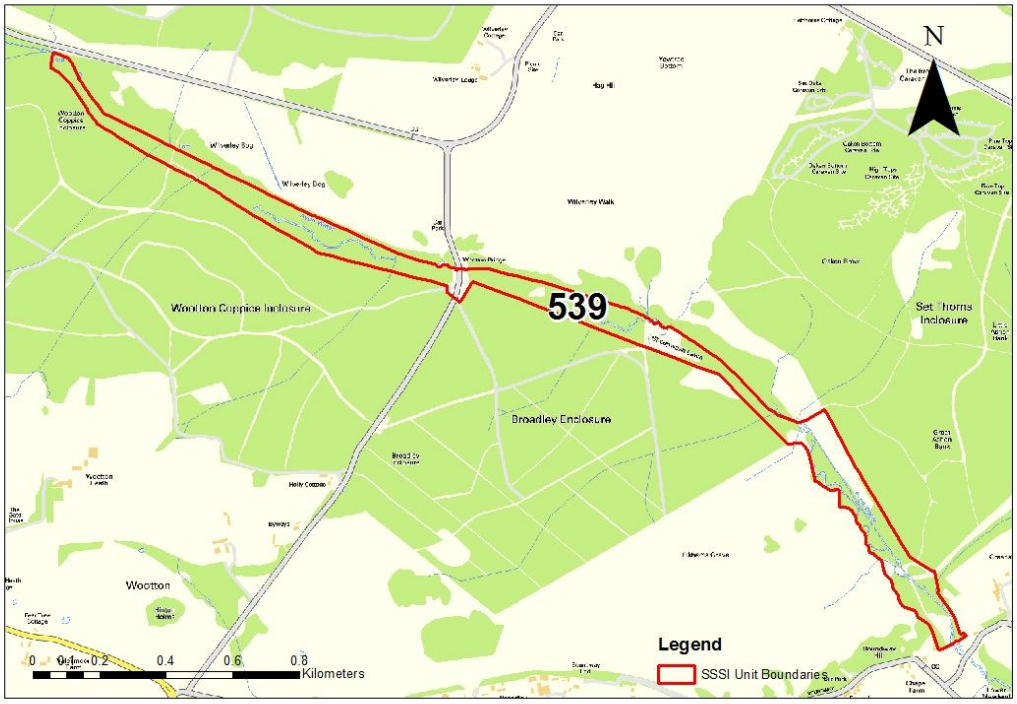
1 Wootton Riverine Woodland - SSSI Unit 539

1.1 Introduction

Wootton Riverine Woodland (Unit 540) is classified as broadleaved, mixed and yew woodland - lowland stream habitat (the Avon Water). It was classed as unfavourable recovering in 2008. The unit is on the southern boundary of the New Forest with the stream exiting and flowing through Lymington and into the Solent. It is associated with SSSI unit 525 (Wilverley Bog) an area of bog Dwarf shrub heath - lowland to the north which is also classed as unfavourable recovering following an assessment in 2012. Former drains across Wilverley Bog have now largely re-colonised with mire vegetation and there is no evidence of on-going adverse impacts to the SSSI. Abundant Purple Moor-grass *Molinia caerulea* tussocks in places suggest that water levels are fluctuating more than is desirable and this could be linked to the behaviour of the stream in unit 539.

The Forestry Commission 10 year restoration plan has identified works on the unit for 2013-2014 including drain infill, meander restoration and scrub management.

Figure 1-1: SSSI Unit 539 location



1.2 Current hydromorphic conditions and issues

A summary of the hydromorphic conditions for unit 539 is given in Table 1-1.

Table 1-1: Summary of hydromorphic conditions for unit 539

Geomorphological Assessment Area		Avon Water
Site Name		Wootton Riverine Woodland
Size (ha)		23.6
SSSI Unit(s)		539
Channel Condition	River type (s)	Weak lowland anastomosed; mild wandering; active meandering; passive meandering
	Responsiveness	Moderate - moderate gradient, straightening, strong gravel supply, minor tree clearance (historic)

Geomorphological Assessment Area		Avon Water
	Sediment delivery, type and mobility	Strong gravel supply but less deposition due to greater incision. Few fines. Very mobile gravels.
	Main source of water	Upstream source (Avon Water - Stony Moors, Wilverley Inclosure) and drains
	Aquatic vegetation	The channel is dominated by gravels and at the time of survey the water level was high and no aquatic vegetation was evident
	Drainage damage	Right bank drains incised, straight and embanked
	Morphology	Pool, riffle, point bar, lateral bar, mid-channel bar, transverse bar, debris jams. All gravel features fewer and not as well developed as d/s reach
	Incision	Incision in drains, knickpoints evident.
	Engineering	Channel straightening throughout. Dredging. Embankments. Bridges, with boulder weirs to manage incision
	Bank activity	Moderate, some sporadic lateral but more collapse associated to incision
	Flow type (s)	Flows impacted by upstream and local drainage network. Flood peaks concentrated in channel.
Floodplain Condition	Valley type	Wide floodplain
	Main source of water	Drains / overland flow, some out of bank flows
	NVC communities	W14, W10a, W1, W8
	Key habitat types	Coniferous plantation, Mixed woodland plantation, Broadleaved woodland
	Drainage	Embankments on bank edge where previously dredged / straightened. Natural drainage impacted through artificial drainage network
	Scrub / tree Encroachment Damage	Not identified as a significant issue
	Palaeo features	Not as evident as d/s reach but some evident
	Floodplain connectivity	Moderate to low
	Poaching and grazing Pressures	Minor
Generic restoration options		Coarse woody debris jams, tree felling.
Additional comments		At the downstream end, a significant quantity of foam was present on the water surface, potentially indicating a pollution issue

The Wootton Riverine Woodland SSSI unit 539 may be broadly characterised as a lowland mixed single thread system (Figure 1-2) with some higher flow anastomosing evident (Figure 1-3 and Figure 1-10 - A). The channel has a moderate gradient and is actively transporting gravel resulting in local erosion and deposition. It has also been subject to major channel straightening in the past, altering the nature and functioning of the river (Figure 1-10 - B). This has concentrated flows in a single channel leading to increased erosive energy. The initial impact of straightening would have encouraged incision along significant lengths of the wooded watercourse which can instigate knick point development along tributary channels and drainage ditches. This was not apparent from the walkover survey in this SSSI unit.

Despite the historic straightening a well wooded riparian corridor has largely prevented excessive lateral erosion, however, bed incision has occurred leading to variable disconnection from the floodplain. Multiple channels were active at the time of survey and distinct hydraulic differences were observed between the primary channel and the subordinate channel network with strong flow remaining concentrated in the main channel. Several reaches are now strongly incised by up to 2 m, helping to maintain the flow concentration, however, flood flows are able to expand out of bank to inundate the marginal riparian woodland.

The riparian woodland is well developed along the SSSI and is presently acting to concentrate flood flows along anastomosed sub-channels creating and helping to maintain hydraulic,

morphologic and habitat diversity. Natural woody debris features, both live and dead, are common in the anastomosed reach. These create short lengths of impounded watercourse and promote flow spreading, improving floodplain connectivity significantly. However, Alder *Alnus glutinosa* regeneration rates appear to be low potentially linked to grazing pressures along the riparian margin.

Figure 1-2: Anastomosed channel type along the Avon Water

Figure 1-3: Active single thread channel type along the Avon Water

A large number of ditches drain forestry areas. Many of these were ponded and heavily silted (Figure 1-4). The degree of artificial drain creation is shown in Appendix A and is impacting significantly on the flow regime. Many of these drains have low embankments associated with them, often these run perpendicular to the main flow impacting on natural anastomosing processes and concentrating flow back into the main channel (Figure 1-5). More formal main channel embankments appear further upstream and are impacting strongly on natural channel functioning (Figure 1-6) and creating a strongly incised channel in the upper reaches of the

SSSI. Bridges and crossings are also altering the nature of the channel and floodplain locally, confining flow to a single often revetted channel and creating focussed scour problems (Figure 1-7)

Surface and groundwater flows have also been altered as a result of the incision, infilling and spoil dumping (embankment creation). Some sections of the immediate floodplain have become drier than natural and these areas have generally been exploited for livestock linked to clearing of the riparian woodland (Figure 1-8)

Figure 1-4: Silted drains entering the Avon Water

Figure 1-5: Embanked drains impacting on floodplain functioning

Figure 1-6: Main channel embankments altering channel-floodplain connectivity.

Figure 1-7: Flow concentration and hydromorphic alteration at Wooton Bridge.

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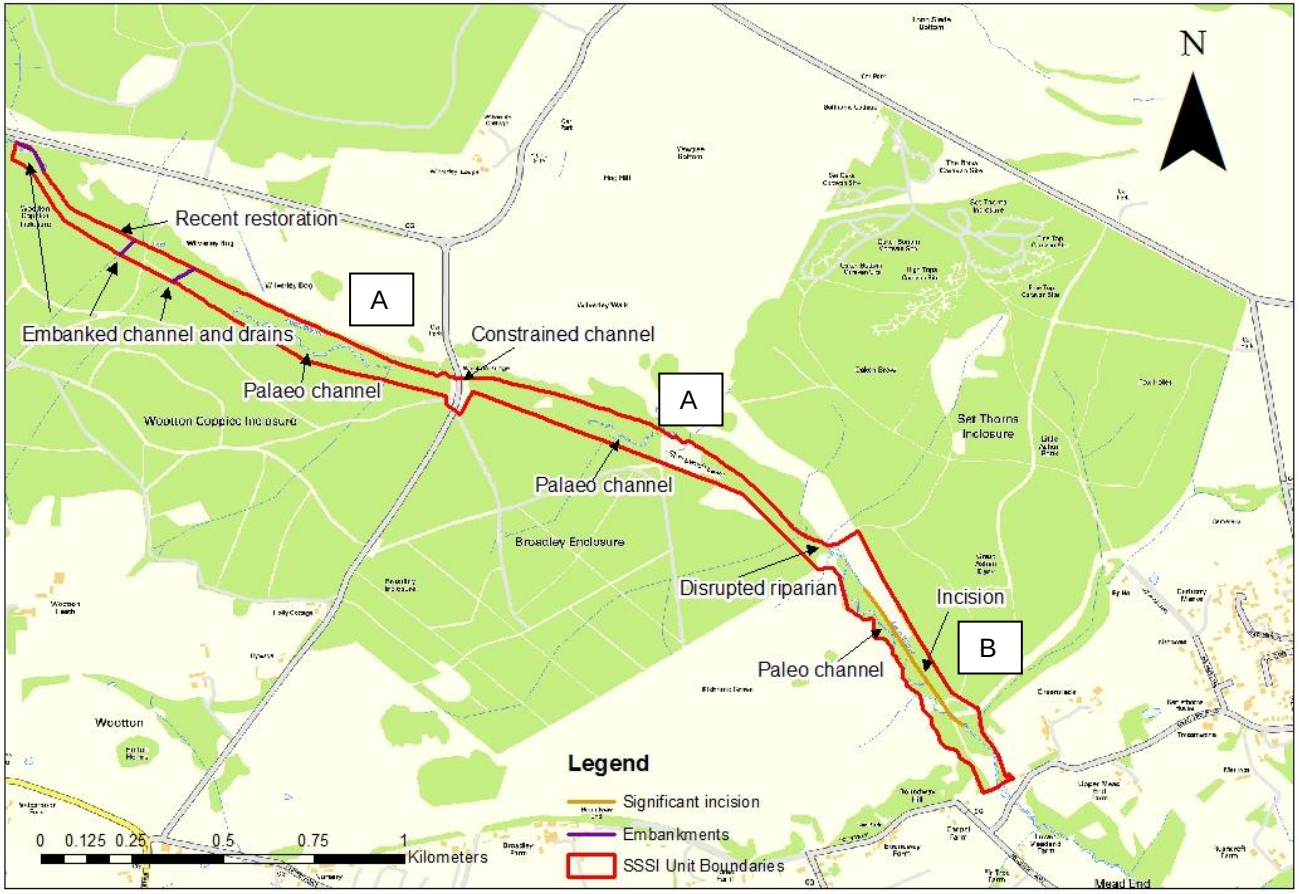
Figure 1-8: Floodplain riparian woodland clearance along the Avon Water.

Previous restoration has occurred in the upper reaches with debris dam installation to encourage flow out of the main channel (Figure 1-9). These are presently functioning but look likely to suffer outflanking in the near future.

Figure 1-9: Introduced debris dams on the Avon Water.

Figure 1-10: Current hydromorphic conditions and pressures on SSSI unit 539



1.3 Probable channel development

The process of adjustment to the channel straightening, dredging, embanking and floodplain vegetation disruption is continuing despite the historic nature of many of the changes to the Avon Water. As such the river remains highly responsive in nature.

Hydromorphic recovery of the river is slow due to the incised nature of the main channel although flood connectivity with the riparian woodland appears good in places. As such in-channel features are rare and woody debris is absent. Restoration attempts appear close to failure and require immediate attention.

Unless action is taken incision is likely to continue resulting in increased floodplain disconnection and reduced wet woodland inundation. Over time this will alter the nature of the riparian vegetation community and will impact on the adjacent wetland SSSI unit.

1.4 Current Ecological Condition

As the river was very flooded at the time of survey, access to some parts of the floodplain was very difficult. At the downstream end of the unit, the Avon Water itself was flowing through and around an area of Alder and Willow *Salix sp.* woodland in an anastomosed pattern, although the main incised channel was on the north-east side of the valley. A significant quantity of foam was present on the water surface here, potentially indicating a pollution issue.

Moving upstream, to north of the footbridge, the stream is wooded with the high water levels showing numerous channels across the floodplain. Moving away from the wooded floodplain, onto the valley sides the vegetation is dominated by Gorse *Ulex europaeus* and acid grassland dominated by bent and fescue species (*Agrostis sp.* and *Festuca sp.),* with occasional patches of heavily grazed Hawthorn *Crataegus monogyna* and also Common Heather *Calluna vulgaris*.

Around the forestry plantation of the Broadley Inclosure, there is a large lawn, crossed by a number of tracks, and which has been cut into by the heavily incised river. Due to the high water levels at the time of survey, the water was flowing across the grassland.

Upstream from the large lawn the woodland becomes much denser and, at the time of the visit, the anastomosed channels through this area were being used by the river. Further upstream the floodplain becomes less constrained and the trees have been cleared to create a lawn, although this area is quite wet with Feathery Bog-moss *Sphagnum cuspidatum* being common, although there are few old Purple Moor-grass tussocks. Due to the high water levels, part of this lawn was covered with standing water at the time of the site visit.

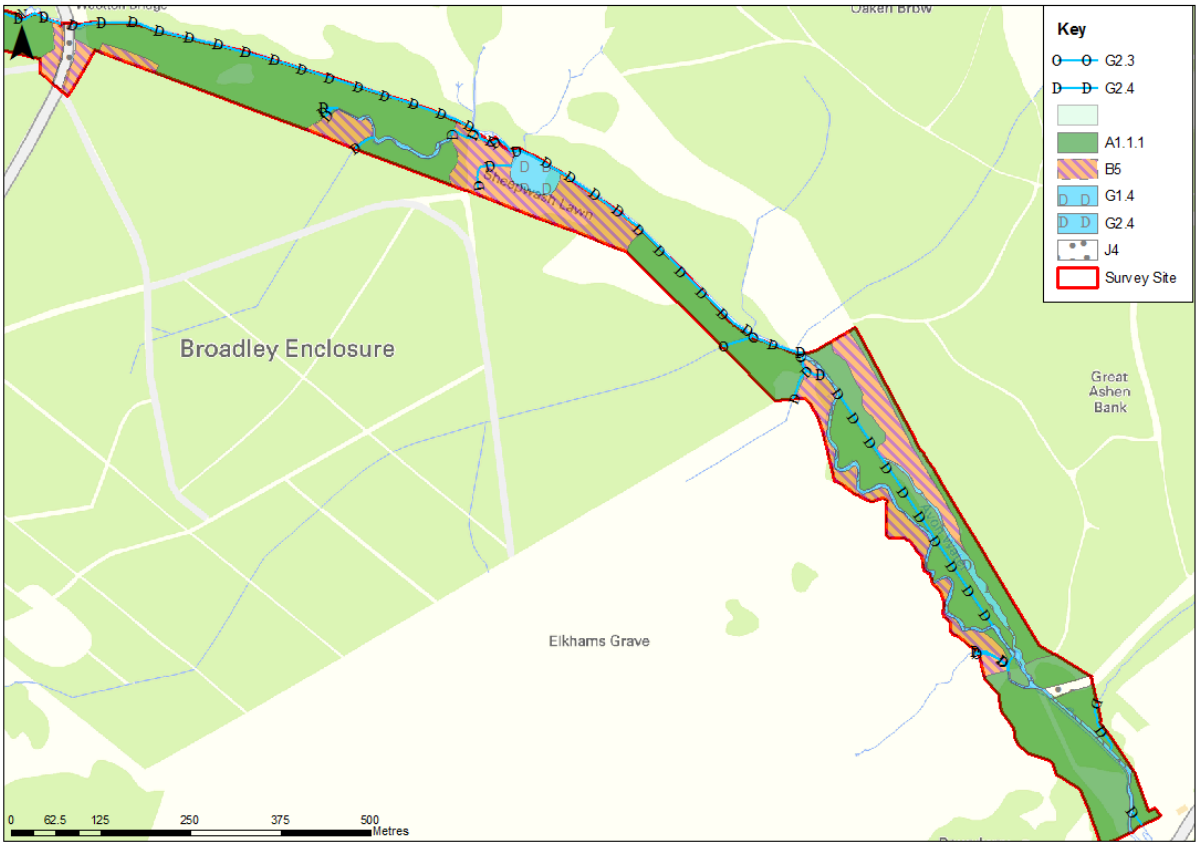
Moving upstream, the woodland becomes increasingly dominated by Oak *Quercus robur*, with frequent Ash *Fraxinus excelsior*. However, around Wootton Bridge there are also wet lawn areas on both sides of the bridge.

Upstream of the bridge on the left bank, just outside of the SSSI unit boundary, there is a large area of Purple Moor-grass dominated-mire on the left bank (Wilverley Bog); this habitat type persists to the very upstream end of the unit. At its southern end, within the unit there is a lawn which has some recreational pressures (car park and picnic area).

Upstream of Wootton Bridge, Alder and Ash woodland dominates the floodplain, which is again criss-crossed with channels, all of which were active at the time of the site visit. As discussed above some restoration measures have been implemented here, using coarse woody debris dams (which is a key feature along the wooded lengths of the Avon Water) and these have resulted in the channel water being diverted across the floodplain and into the old channels.

Along the length of the unit several tributaries join the main channel, from the right bank. These generally have a high sediment load and were turbid at the time of the site visit. The main Avon Water however was dystrophic, even in spate, and there was little mixing. The exception to this is the most upstream tributary on the right bank, which was gravel bottomed and running clear.

Figure 1-11: Phase 1 Habitat Map



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 1-12.

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

- Improved anastomosed channel network development, through using woody debris jams to improve floodplain connectivity, will improve hydromorphological diversity;
- Better floodplain connection through water level raising and artificial drain restoration;
- Improved in-channel habitat.

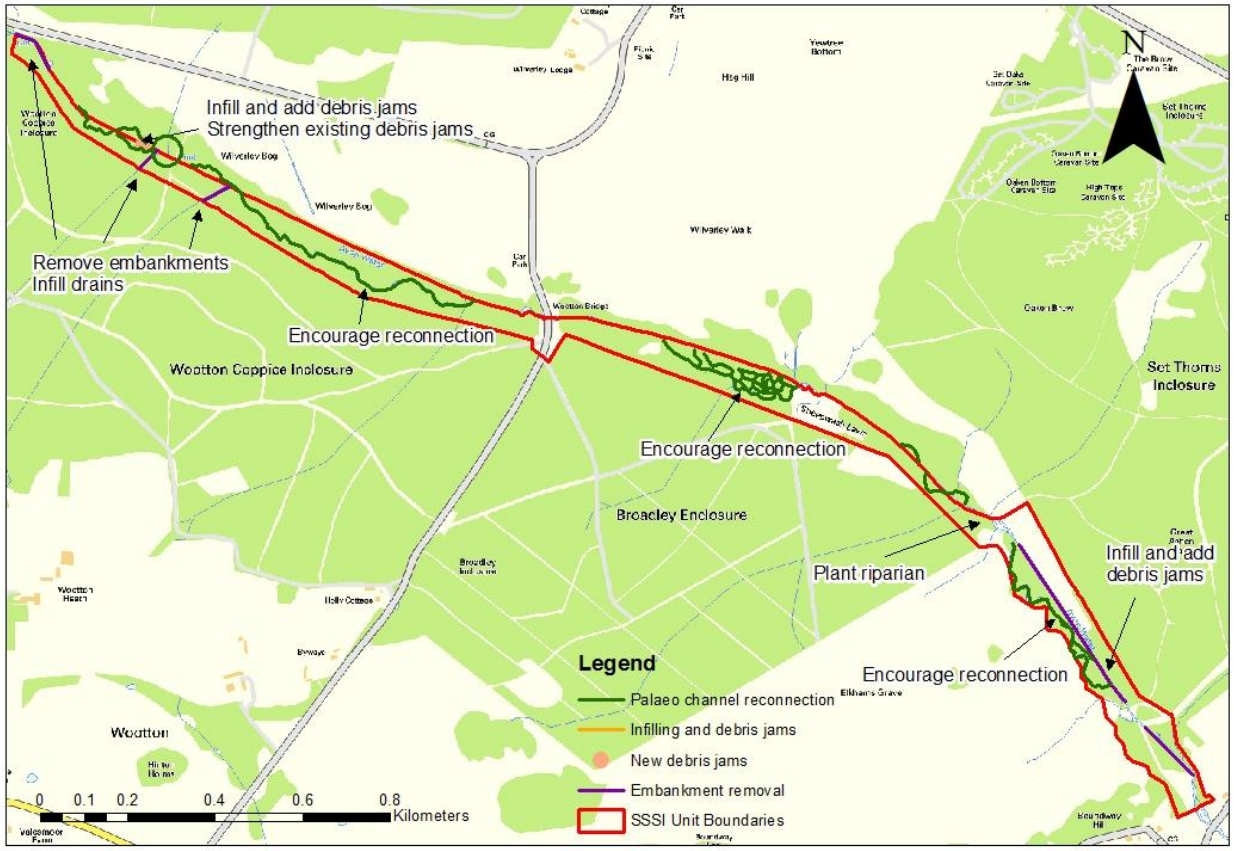
Table 1-2: SSSI Unit 539 current pressures, unmitigated impacts and proposed restoration measures

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
Historic dredging Straightening	Long term river response, cut and fill activity. Enhanced in-channel energy levels. Disconnected sub-channels. Loss of in-channel features.	Large scale infilling of the main channel through morphologic unit reinstatement. Restore connectivity. Treat knick points.	Will promote out of bank flows, raise surface and groundwater levels, lower energy levels in the main channel. Will create in-channel diversity. Encourages anastomosing channel development. Reduces fine sediment inputs. Slows gravel movement. Stabilises in-channel features.	Increased inundation of floodplain and raised water levels will enhance wet woodland habitats and lawn areas. Allows colonisation of in-channel features by seral vegetation communities Increase connectivity and flow regimes on woodland floor.	Considerable engineering works. Likely to require significant tree felling to allow access for works. Cost Cultural objections
Historic dredging Straightening	Long term river response, cut and fill activity. Enhanced in-channel energy levels. Disconnected sub-channels. Loss of in-channel features.	Incision management - debris jams, morphological restoration, floodplain works. Infill. Restore connectivity. Treat knick points.	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. Local floodplain works may be necessary to give sufficient connectivity.	Improved floodplain connectivity will increase inundation of the floodplain, enhancing the wet woodland habitats and lawn areas. Increased in-channel habitat diversity, particularly with debris jams creating habitat variety within channel. Increased anastomosing flows and channels with different flooding characteristics developing wetland floras and seeps with *Chrysosplenium*	Incision is severe in the upper reaches, meaning significant works / features would be required to improve this. Debris jams may form a barrier to fish, a fish pass may be required but is unlikely. Large amounts of material are likely to be required if bed works are undertaken, particularly upstream.

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
			Encourages anastomosing channel development. Reduces fine sediment inputs. Slows gravel movement. Stabilises in-channel features.	*oppositofolium.*	Likely to require some tree felling to allow access for works.
Embanking	Enhanced in-channel energy levels. Disconnected sub-channels.	Embankment removal - main channel and drains	Reconnect the floodplain, reducing incision rates and improving in-channel hydromorphic conditions. Drain embankment material could be used to infill drains. Slows gravel movement. Stabilises in-channel features.	Improved floodplain connectivity will increase inundation of the floodplain, enhancing the wet woodland habitats and lawn areas. Increased in-channel habitat diversity and potential for greater development of riparian and in-channel vegetation, especially wet woodland habitats.	Drains may also require infilling to restore natural flow regime and reduce incision. Likely to require some tree felling to allow access for works.
Artificial drainage	High flows impacted. Water table lowered locally.	Drain infilling	Restore a natural flow regime, reducing incision in the drain and channel network. Reduces flood peaks. Reduces fine sediment inputs. Slows gravel movement. Stabilises in-channel features.	Increased in-channel habitat diversity and potential for greater development of riparian and in-channel vegetation. Allows colonisation of bar features by seral vegetation communities. Increased overland flow and complementary community development.	May require import of material. Likely to require some tree felling to allow access for works.
Riparian vegetation removal	Loss of bank stability.	Reduced tree clearance at bank edge.	Will help to stabilise banks in the wandering	Reduced disturbance to vegetation within the	Tree clearance is a necessity in some

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
	Loss of shading. Loss of organic inputs to the watercourse.	Replant or allow to naturalise through reducing grazing pressure. Half-fell selected bankside trees	sections and alongside bed restoration to minimise incision, could improve floodplain connectivity. Creates riparian hydromorphic diversity. Acts as fine sediment trap. Allows woody debris accumulation.	riparian zone Potential for increased inundation of floodplain through growth of Alder trees which divert flows across the floodplain and develop wet hollow communities ideal for invertebrates.	locations. Cultural objections Potential loss of some grazing at times of high water.
Forestry	Significant impact on low flow regime. Flow quantity, quality, variability. Increases water temperature. Fine sediment dynamics Water table impacts.	Phased removal to promote age class differences and allow light to forest floor. Ring barking	Reduced risk of drying, improved hydromorphic diversity, lowered risk of in-channel fine sediment accumulation	Increased floristic diversity of ground flora on floodplain. Restoration of wetland habitats and an increase in their diversity Invertebrate habitats in standing and fallen dead wood.	Large-scale removal of conifer species is unlikely to be feasible or economically viable Cultural objections
Riparian grazing	Fine sediment production. Disruption to woody species recruitment.	Exclude livestock	Encourages riparian hydromorphic diversity	Increased floristic diversity of ground flora on floodplain and reduction in poaching Restoration of wetland habitats and recovery of species-poor swards.	Some grazing is likely to be maintained Potential loss of grazing Culturally unacceptable
River Crossings	Disrupted sediment transport. Localised sedimentation and erosion.	Replace with more suitable structure	Removes pinch point	Increased floristic diversity of ground flora on floodplain. Restoration of wetland habitats.	Structures will need to be fit for the purposes of vehicle crossings in some cases

Figure: 1-12: Proposed restoration measures for SSSI Unit 539



1.6 Design considerations

The channel is unlikely to completely stabilise as a result of the proposed restoration, however, retaining the dynamism of the channel should be an objective of the restoration plan.

Debris jams must extend into the adjacent banks to ensure longer term functioning.

The major straightened / modified drainage channels are identified in Figure 1-12. Other minor modifications could be considered for infilling and Appendix A should be used for reference.

The age and piecemeal nature of the embanking along the Avon Water is such that it is having only a very local effect on the hydrology of the unit, retaining ponded water in areas where free flow would naturally have occurred. Removal of embanked material from close to the river will result in the loss of these ponded zones but will also improve more general floodplain connectivity. No significant adverse impact is predicted for the Wilverley Bog SSSI to the north of the watercourse.

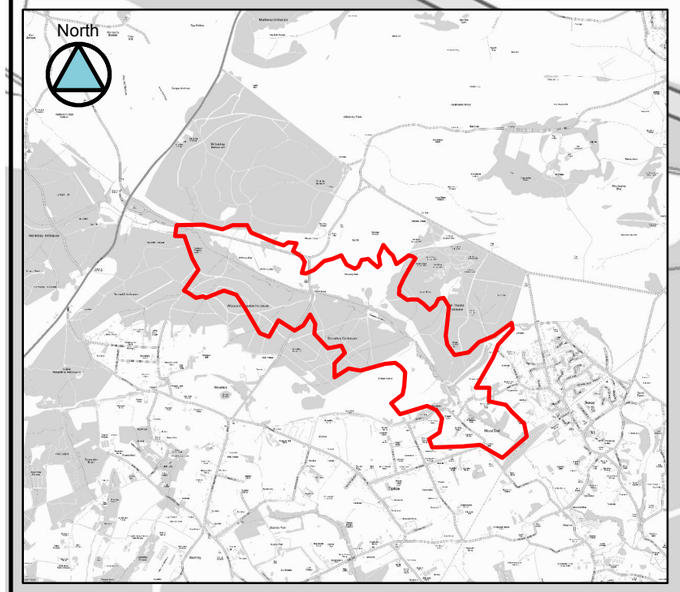
1.7 Monitoring requirements

It is anticipated that the proposed restoration works will create a dynamic anastomosed channel system with frequent overbank flooding and a heightened potential for local channel switching in response to natural debris blocking. 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 Avon Water.

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

Appendix A - Artificial drainage and flow lines - SSSI Unit 539



SSSI 539: Wootton Riverine Woodland

Ford

Wootton Coppice Inclosure

Ford

Wilverley Bog

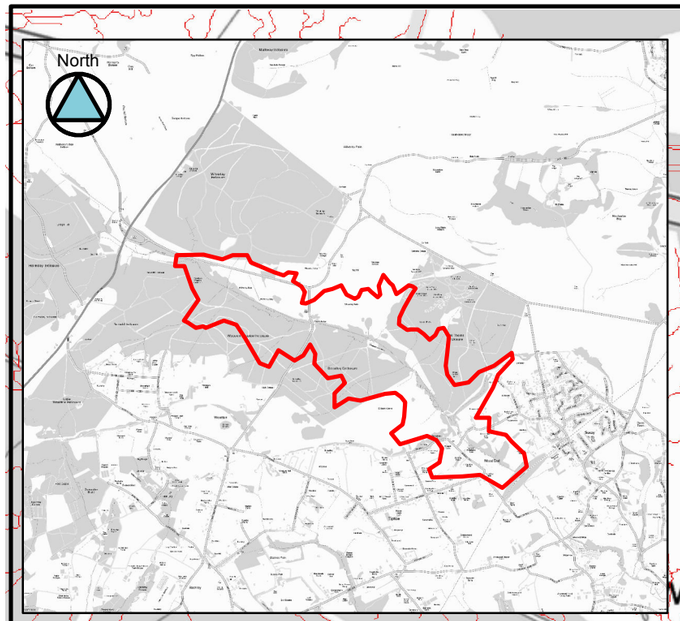
Wilverley Bog

Avon Water

ure

Wootton Coppice Inclosure

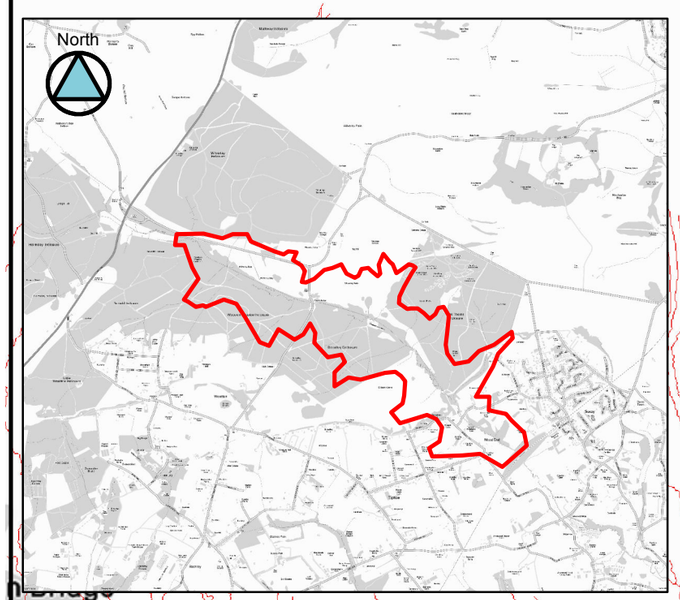
0 50 100 200 300 Metres



SSSI 539: Wootton Riverine Woodland

Picnic Site
Wilverley Lodge
Hag Hill
CG
Wilverley Bog
Wilverley Walk
Avon Water
Car Park
Wootton Bridge
Wootton Coppice Inclosure

0 50 100 200 300 Metres



SSSI 539: Wootton Riverine Woodland

Oaken Bottom
Caravan Site

Oaken Bottom
Caravan Site

High Tops
Caravan Site

Oaken Brow

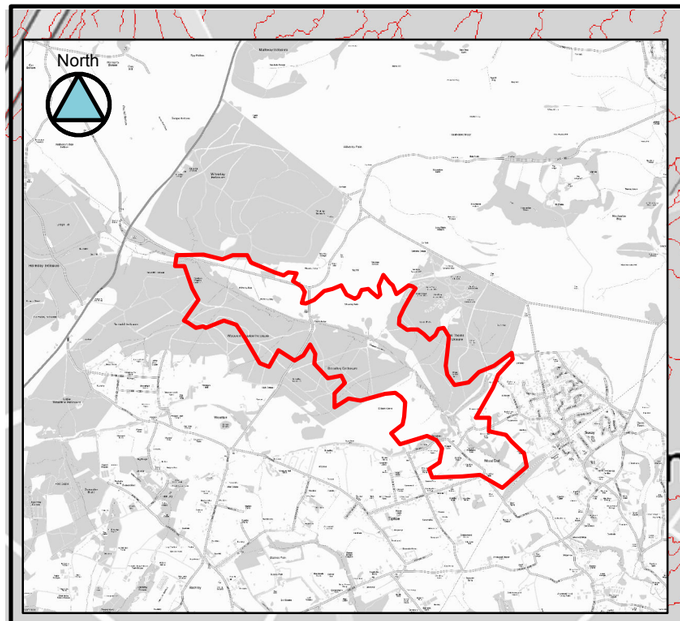
Set Thorns
Inclosure

Sheepwash Lawn

Broadley Enclosure

Great
Ashen
Bank

0 50 100 200 300 Metres



SSSI 539: Wootton Riverine Woodland

nclosure

Sheepwash Lawn

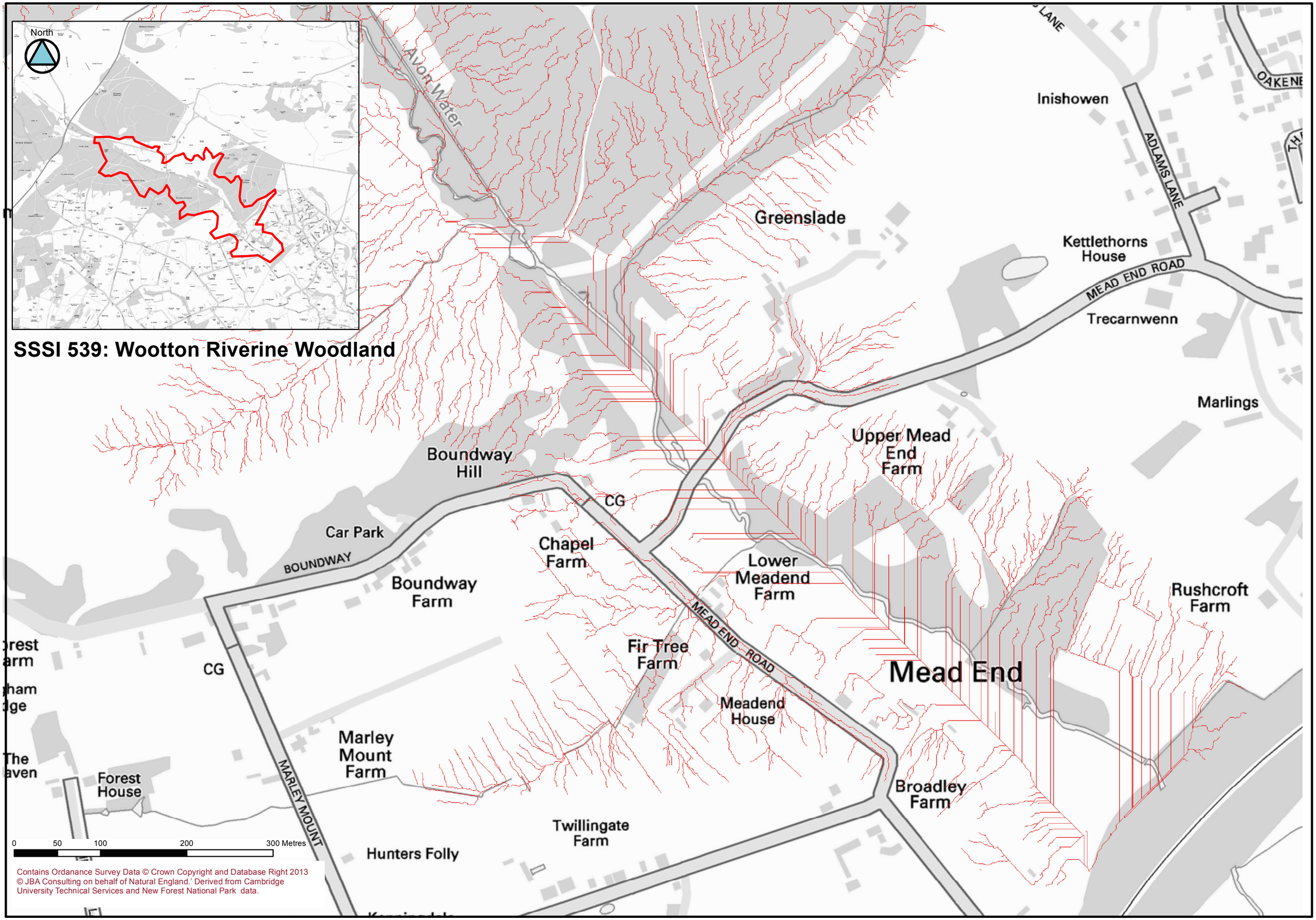
Avon Water

Elkhams Grave

Boundway Hill

Boundway End

0 50 100 200 300 Metres



SSSI 539: Wootton Riverine Woodland