Natural England Commissioned Report NECR140

New Forest SSSI Geomorphological Survey Overview

Annex I: The Grove - SSSI Unit 286

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1 The Grove - SSSI Unit 286

1.1 Introduction

The Grove (Unit 286) has Fleet Water running north-west to south-east through the unit. The unit is in unfavourable recovering condition and is approximately 9.82ha in size.

This unit comprises a conifer plantation, with some broadleaved tree species along the southern boundary and adjacent to the watercourses.

Figure 1-1: SSSI Unit 286 location (flow direction north-west to south-east)

1.2 Current hydromorphic conditions and issues

A summary of the hydromorphic conditions for unit 286 is given in Table 1-1.

Table 1-1: Summary of hydromorphic conditions for unit 286

Geomorphological Assessment Area		Fleet Water
Site name		The Grove
Size (ha)		9.8
SSSI unit(s)		286
Channel Condition	River Type (s)	Active meandering single thread
	Responsiveness	Moderate - moderate / steep gradient, moderate gravel supply, tree clearance (historic)
	Sediment delivery, type and mobility	Moderate upstream gravel supply and local gravel sources, gravels are mobile. Few fines.
	Main source of water	Upstream source (Stoney Cross) and drains, overland flow
	Aquatic vegetation	No in-channel vegetation present
	Drainage damage	Small drains over both banks straight and dug. Some incision in d/s right bank drain, some straightening, no clear embankments
	Morphology	Pools, riffles, runs with some point and lateral bars although limited development, due to limited floodplain connectivity and incision.
	Incision	Yes - some moderate incision in main channel and right bank drain although this is checked in areas through natural debris jams.
	Engineering	Pond upstream of SSSI unit possible sediment sink. Drain straightening
	Bank activity	Some moderate lateral activity, particularly where small gravel features have formed. Some bank collapse associated to incision
	Flow type (s)	Flows impacted by upstream drainage network. Flood peaks concentrated in channel due to incision
Floodplain Condition	Valley type	Narrow floodplain
	Main source of water	Seepage, drains / overland flow, out of bank flows
	NVC communities	None (Plantation woodland)
	Key habitat types	Coniferous plantation woodland, Broadleaved plantation woodland
	Drainage	Some drains may have been straightened but not over-deepened and only moderate incision at present
	Scrub / tree encroachment damage	Floodplain consists of plantation woodland
	Palaeo features	Yes - possible minor palaeo features, one at downstream end on right bank
	Floodplain connectivity	Low - steep v-shaped floodplain
	Poaching and grazing pressures	Limited
Generic restoration options		To raise groundwater levels and reduce incision, more debris jams could be used, which are successful at present within the reach, gravel feature enhancement
Additional Comments		

The Grove SSSI Unit and Fleet Water is characterised by an active single thread river type throughout (Figure 1-2 and Figure 1-3). The stream is within a relatively confined valley with relatively steep sides, restricting lateral activity to a narrow active band. This has resulted in a poorly developed marginal floodplain.

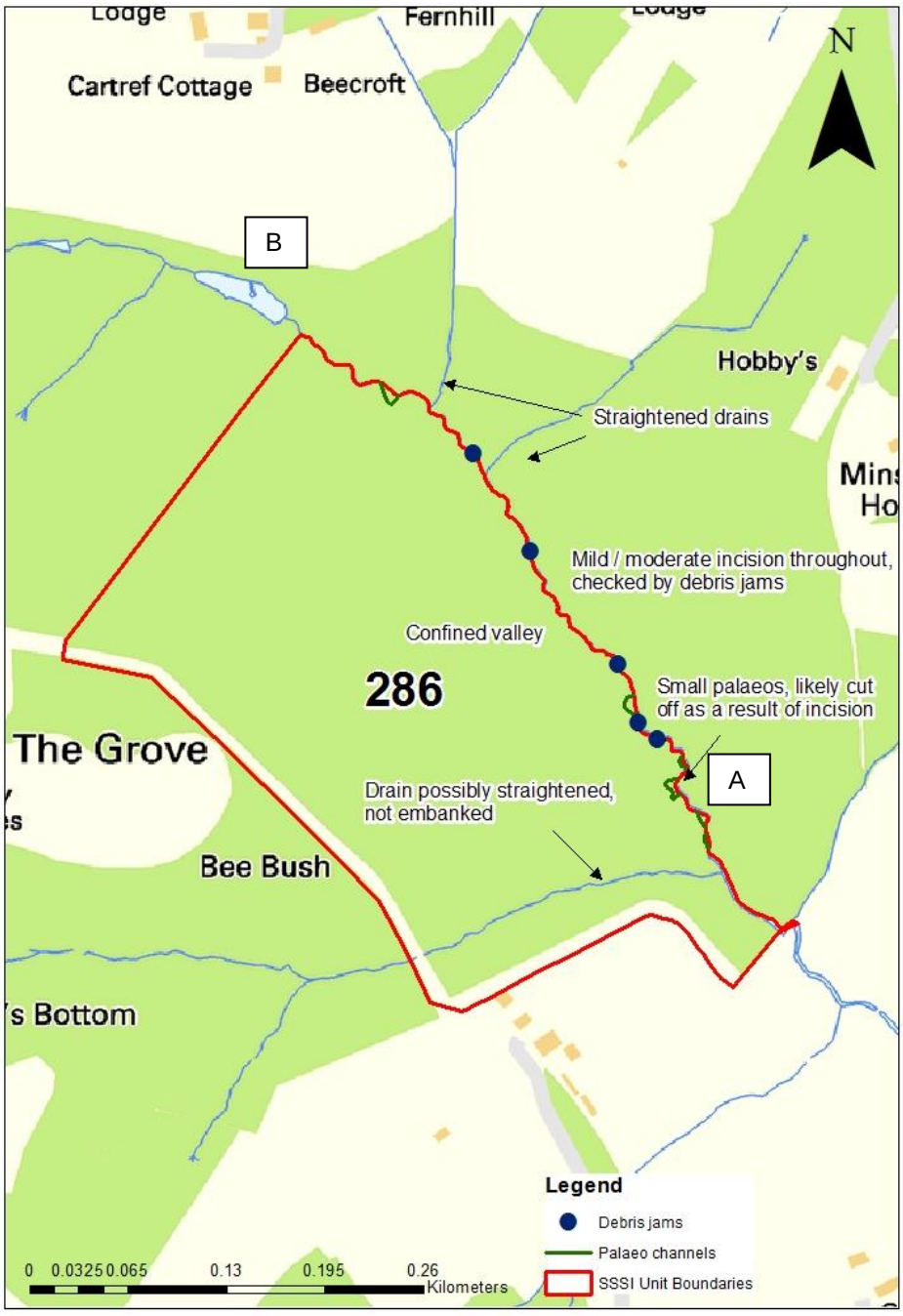
Figure 1-2: Active single thread characteristics

Figure 1-3: Active single thread channel type - bank erosion

Figure 1-4: Confined, v-shaped valley

The source of the stream is Stoney Cross. Figure 1-5 summarises the existing hydromorphology and pressure impacting unit 286.

Figure 1-5: Current hydromorphic conditions and pressures



It was not apparent during the survey that significant straightening of the main channel has occurred in the past as only small meander palaeos were identified (Figure 1-5 - A), which are likely to be linked to incision rather than artificial straightening. Only small palaeo channel sections were identified from the LIDAR (Appendix A). The palaeos are likely to have been left where there was once channel bifurcation, with incision in the dominant channel leaving the bifurcation at a higher level. As a result, there are no obvious embankments (constructed from in-channel arisings) along the bank tops throughout the unit. Therefore, artificial straightening is unlikely to be a reason for the mild to moderate incision seen along the reach.

The major drains within this SSSI unit show evidence of past straightening and over-deepening, although they have no significant embankments along the bank tops. The smaller flow routes show some signs of artificial modification through straightening and realigning, as shown in the flow line maps in Appendix A. The modifications to the main drains marked in Figure 1-5 are likely to be concentrating flows at local points in the main channel, leading to elevated erosive conditions. This is likely to be a contributing factor to the mild to moderate incision within this unit (Figure 1-6). The pond upstream of the SSSI unit (Figure 1-5 - B) is likely to be acting as a sediment sink, starving the reach of some sediment, resulting in some bed incision.

Figure 1-6: Mild / moderate incision

The modified drainage regime, concentrating flows in the main channel, leads to energetic flow conditions that increase erosive energy potential. The well wooded riparian corridor (Figure 1-7) has largely prevented excessive lateral erosion, hence erosive energy is focused on bed incision. This has resulted in variable disconnectivity from the floodplain, although the v-shaped valley means that connectivity levels would naturally be reduced. There are some small floodplain areas at a lower level where improved connectivity may result in multi thread channel development, possibly where bifurcation once occurred. The lowered bed level will have impacted groundwater levels locally however, resulting in drier areas within the floodplain. Widespread incision has also been prevented through the frequent occurrence of natural woody debris jams within the channel (Figure 1-8).

Figure 1-7: Well wooded riparian corridor

Figure 1-8: Woody debris jams

The gravel supply to the unit, and from local bank sources, is moderate but gravels are not abundant enough to create and sustain large gravel features (Figure 1-3). Riffle - pool - run sequencing has developed (Figure 1-9) throughout the unit as a result of the moderate gravel supply and moderate / steep gradient. Gravel bars and berms are generally only small, embryonic features throughout.

An assessment should be made as to whether the pond just upstream of the SSSI unit is significantly impacting the sediment transfer to the reach, which may be inhibiting morphological feature development and starving the reach of gravel and in turn providing excessive erosive energy for bed incision. The development of gravel features is also controlled by the mild incision in the channel and the limited connectivity to the floodplain. However, this unit is considered to be a transporting reach, due to the gradient and surrounding topography, therefore significant gravel features are unlikely to naturally occur within the channel.

Figure 1-9: Riffle - pool - run development

1.3 Probable channel development

The Fleet Water is a responsive system due to the moderate / steep gradient, moderate gravel supply and artificial drainage modification. Whilst the channel banks are considered to be robust due to the well wooded riparian corridor, incision of the channel bed is likely to continue resulting in increased floodplain disconnection, and lowered groundwater level that will result in floodplain drying. Over time, this will alter the nature of the riparian vegetation community.

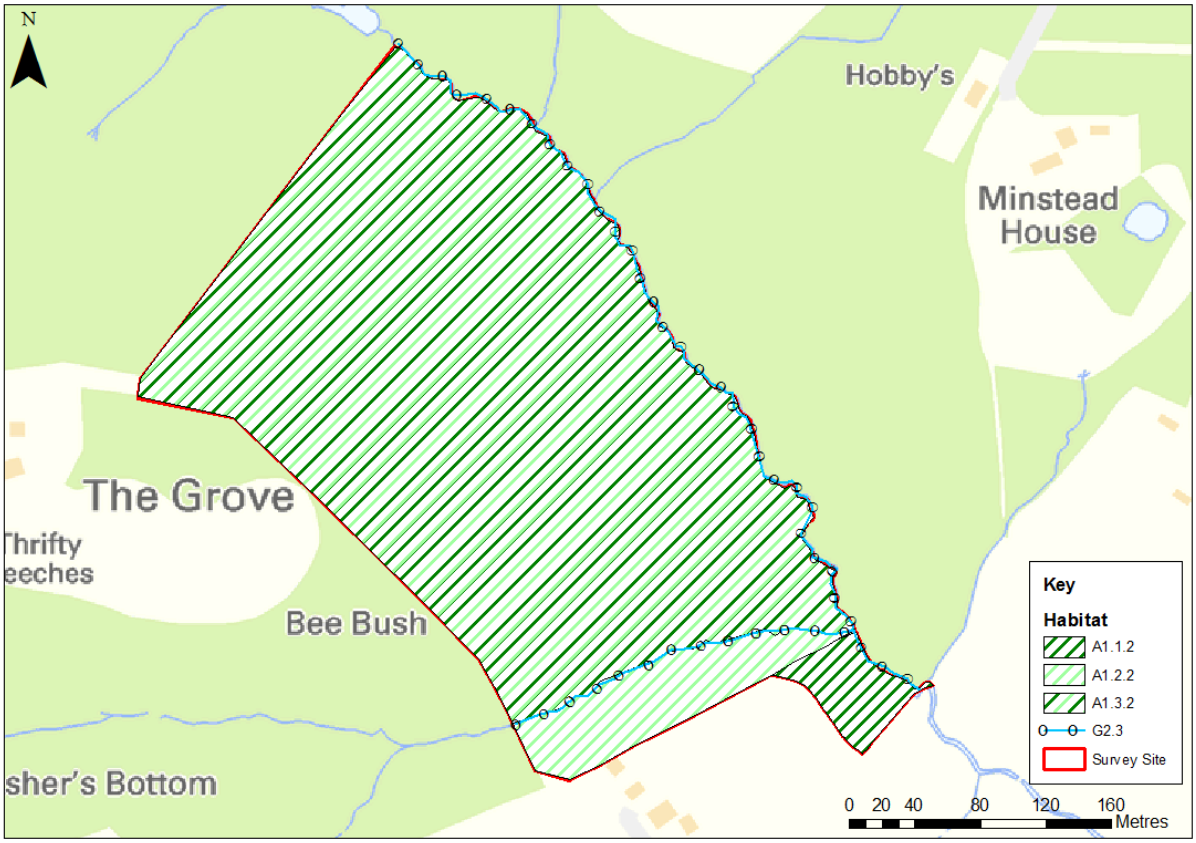
Although this is considered to generally be a sediment transfer reach, gravel feature development is considered to be below natural levels and incision is likely to prevent these features recovering suitably.

1.4 Current Ecological Condition

This unit comprises of a conifer plantation consisting mainly of Douglas Fir *Pseudotsuga menziesii*, with some broadleaved tree species (Oak *Quercus robur*, Beech *Fagus sylvatica* and Silver Birch *Betula pendula*) along the southern boundary and adjacent to the watercourses.

The ground flora is very poor and the watercourse contained no aquatic vegetation, however, there were a few fern species alongside the watercourse, in particular Hard Fern *Blechnum spicant* with an occassional Broad Buckler fern *Dryopteris dilitata*.

Figure 1-10: 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 1-11.

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

- Bed and water level raising through debris jam and morphologic feature enhancement (which would involve creating gravel features such as riffles, point bars, lateral bars etc using suitably sized material) will improve the hydromorphic diversity and reduce incision;
- Water level raising will improve groundwater levels locally and may reconnect some of the small palaeo channels identified;
- Infilling the ponds upstream of the SSSI unit will restore a natural sediment regime and is likely to increase sediment transfer to the reach, possibly reducing incision;
- Potential to restore riverine woodland and improve the mix of broadleaved and conifer species.

Table 1-2: SSSI Unit 368 current pressures, unmitigated impacts and proposed restoration measures

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
Altered sediment dynamics / incision	Long term river response, cut and fill activity. Enhanced in-channel energy levels. Disconnected sub-channels. Loss of in-channel features.	Infilling of the main channel through morphologic unit reinstatement and debris jam installation. Restore connectivity. Treat knick points.	Will raise surface and groundwater levels, lower energy levels in the main channel, reducing incision. Debris jams naturally occur along the reach, use local materials. Will create in-channel diversity. Reduces fine sediment inputs. Slows gravel movement. Stabilises small in-channel features.	Improve connectivity with the riparian strip and raise water tables in this area promoting the growth of angiosperm species. Debris dams will increase flooding on adjacent land, although this is limited here due to the steepness of the valley sides. Stabilisation of in-stream features will result in their colonisation by vegetation.	Considerable amounts of material may be required to raise bed levels. Likely to require significant tree felling to allow access for works. Debris jams may form a barrier to fish, and a fish pass may be required although this is unlikely
Artificial drainage	High flows impacted. Water table lowered locally.	Drain infilling Consider infilling ponds upstream of SSSI unit.	Restore a natural flow regime, reducing incision in the drains and channel network. Pond infilling may increase sediment transfer to the reach and reduce incision. Reduces flood peaks. Reduces fine sediment inputs. Slows gravel movement. Stabilises in-channel features.	Raise water table and encourage colonisation by wet-loving plants. Sides probably too steep to support mire development. Fine sediment and gravel features will vegetate over and add to biodiversity value of the habitat	Import of material will be required for pond infilling. Risk of introducing invasive species. Likely to require some tree felling to allow access for works. Ponds may be designated features. Cultural objections
Forestry	Significant impact on low	Phased removal.	Reduced risk of drying,	Increased floristic	Large-scale removal

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
	flow regime. Flow quantity, quality, variability. Increases water temperature. Fine sediment dynamics Water table impacts.	Ring barking Half-felling	improved hydromorphic diversity, lowered risk of in-channel fine sediment accumulation	diversity of ground flora on floodplain. Restoration of riverine woodland and increase in light levels reaching woodland floor. Improve conditions for invertebrates Creation of standing dead wood habitat and CWD.	of conifer species is unlikely to be feasible or economically viable Culturally unacceptable Cost
Woody invasive species	Alters floodplain species assemblage. Impacts bank stability.	Exterminate and allow natural regeneration / plant alder & willow.	Creates riparian hydromorphic diversity	Increased floristic diversity of ground flora on floodplain, especially woodland ground flora such as Wood Avens *Geum rivale* and similar species. Restoration of riverine woodland.	Continued maintenance requirements. Cost

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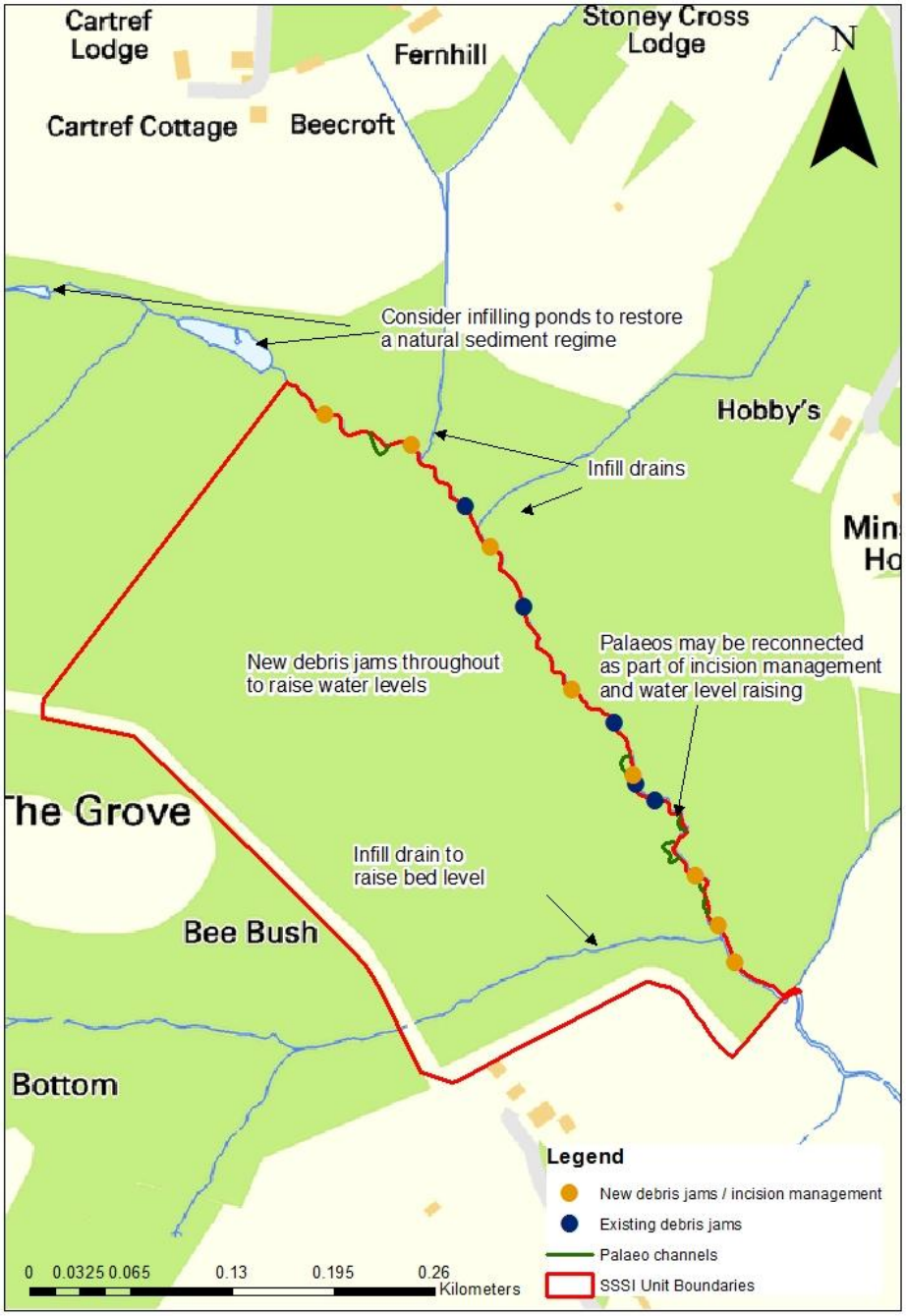
Figure 1-11: Proposed restoration measures for SSSI Unit 286



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 and maintaining the sediment transfer characteristics of the channel which downstream areas are likely to rely on.

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

The major straightened / modified drainage channels are identified in Figure 1-11. Other minor modifications could be considered for infilling and Appendix A should be used for reference.

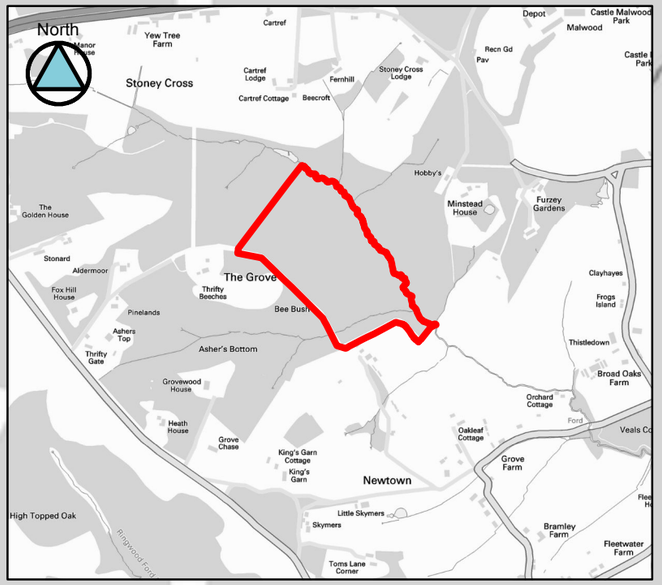
1.7 Monitoring requirements

It is anticipated that the proposed restoration works will create a dynamic channel system with improved bed and groundwater conditions that could give rise to low level gravel feature development, whilst maintaining significant sediment transfer characteristics. 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 unit 286.

Parameter	Approach	Frequency	Approximate cost
Morphologic unit change	Time lapse camera / audit	Daily (Annual statistical summary)	Capital 3 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 286



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