European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features

River Mease Special Area of Conservation (SAC)
Site Code: UK0030258

River Mease SAC

Date of Publication: 31 May 2016

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to the River Mease SAC. This advice should therefore be read together with the SAC Conservation Objectives available here.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England, when developing, proposing or assessing an activity, plan or project that may affect this site. Any proposals or operations which may affect the site or its qualifying features should be designed so they do not adversely affect any of the attributes listed in the objectives and supplementary advice.

This supplementary advice to the Conservation Objectives describes in more detail the range of ecological attributes on which the qualifying features will depend and which are most likely to contribute to a site's overall integrity. It sets out minimum targets for each qualifying feature to achieve in order to meet the site's objectives.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	River Mease Special Area of Conservation (SAC)
Location	Leicestershire, Derbyshire and Staffordshire
Site Maps	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	14 June 2005
Qualifying Features	See section below
Designation Area	21.86 hectares
Designation Changes	N/A
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	River Mease SSSI
Relationship with other European or International Site designations	N/A
Other information	Natura 2000 Standard Data Form for River Mease SAC

Site background and geography

The River Mease arises in North West Leicestershire and flows westwards through Derbyshire and Staffordshire for around 25 kilometres across a largely rural and agricultural landscape to its confluence with the Trent at Croxall. It is a small tributary of the River Trent system and represents a relatively unmodified lowland river with a diverse range of in-channel features, including riffles, pools, shoals, vegetated channel margins and bank side tree cover.

Included in the designation are the lower reaches of the Gilwiskaw Brook which are steep and fast-flowing with sparse aquatic vegetation. The upper reaches of the Mease, while mainly rural, also includes the small urban area of Measham. The middle reaches meander across the broad lowland floodplain. Submerged aquatic vegetation becomes more varied on the lower reaches of the river.

Much of the river catchment's underlying geology is dominated by Triassic Mercia Mudstone which gives rise to productive reddish clay soils. There are also outcrops of older Triassic sandstones which support well drained sandy soils, particularly in the Mease lowlands and a raised plateau in Leicestershire which is underlain by Carboniferous Coal Measures, and which have been worked historically for coal. The River Mease catchment is characterised by extensive areas of arable cultivation with low, sparse hedges and few hedgerow trees.

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying habitats:

- **H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation ('Rivers with floating vegetation often dominated by water-crowfoot')**

  This habitat type is generally characterised by the abundance of water-crowfoots *Ranunculus* spp. Floating mats of these white-flowered species are characteristic of river channels in early to mid-summer. They help to vary water flow, promote fine sediment deposition, and provide shelter and food for fish and invertebrate animals.

  There are several variants of this habitat in the UK, depending on geology and river type, and at each site, the *Ranunculus* species will be associated with a different assemblage of other aquatic plants.

  The River Mease SAC supports good examples of water plants from the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (Rivers with floating vegetation often dominated by water-crowfoot). Submerged aquatic vegetation is varied, particularly in the lower reaches of the river, and is characterised by frequent river water-crowfoot *Ranunculus fluitans*, common water-crowfoot *R. aquatilis*, blunt-leaved pondweed *Potamogeton obtusifolius*, fennel pondweed *P. pectinatus*, arrowhead *Sagittaria sagittifolia* and yellow water-lily *Nuphar lutea*.

Qualifying Species:

- **S1092 White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes***

  The white-clawed crayfish lives in a diverse variety of clean aquatic habitats but especially favours hard-water streams and rivers.

  A major threat to the native white-clawed crayfish is posed by the introduction of non-native species of crayfish, which have been farmed in Britain since the late 1970s. Soon after this, crayfish plague (a virulent disease caused by the fungus *Aphanomyces astaci*) broke out and spread rapidly, causing drastic losses of native crayfish in rivers in England. It is believed that this disease was introduced and is spread by the most frequently farmed species, the North American signal crayfish *Pacifastacus leniusculus*, a carrier of the disease. Crayfish plague can be introduced into a waterbody not only by entry of signal crayfish but also by water, fish or equipment that has been in contact with signals. This greatly increases the risk to remaining white-clawed crayfish populations.

  White-clawed crayfish can grow up to 12cms long and live in rivers and streams about 1 metre deep where they hide in rocks and submerged wood. They can live up to 12 years and they usually have their first young when they are 3 years old. Females carry their eggs for 9 months until they hatch, once hatched the young hitch-hike on their mothers for a further 2 weeks.

- **S1163 Bullhead *Cottus gobio***

  The bullhead is a small bottom-living fish that inhabits a variety of rivers, streams and stony lakes. It appears to favour fast-flowing, clear shallow water with a hard substrate (gravel/cobble/pebble) and is frequently found in the headwaters of upland streams. However, it also occurs in lowland situations on softer substrates so long as the water is well-oxygenated and there is sufficient cover. It is not found in badly polluted rivers.

Bullheads spawn from February to June and up to four times. The male excavates a nest under a suitable large stone to attract a female. Part of this may be achieved by emission of acoustic 'knocking' sounds by the males. The female lays a batch of up to 400 eggs (2–2.5 mm in diameter), which adhere to the underside of the stone. In situations without suitable stones, bullheads may use other media, such as woody material or tree roots. The male then defends the brood against egg predators such as caddis larvae and manages the nest by fanning the eggs with his pectoral fins. The eggs hatch after 20 to 30 days, depending on water temperature. The newly hatched larvae (6–7mm in length) are supplied by a large yolk sac, which is absorbed after 10 days, after this time they leave the nest.

Generally, bullheads attain a length of 40–50 mm after their first year, 60 mm after their second and 70–90 mm after their third. They do not generally live for more than three or four years, although fish of over 10 years old have been recorded.

- **S1149 Spined loach *Cobitis taenia***

The spined loach *Cobitis taenia* is one of the UK's smallest freshwater fish, usually reaching no more than 14 centimetres in length. Its name is derived from the two small spines present under each eye. It is a small, bottom dwelling fish, which is confined to the rivers and drainage channels in the Midlands and eastern England; its optimum habitat consists of sandy substrates with plenty of dense macrophytes interspersed with open sandy areas.

The spined loach typically reaches an adult length of 8–10 cm, although females may grow up to 12 cm. Adults weigh between 20–60 g, their backs feature a yellow-brown colouring interspersed with many small grey or brown scales on the spinal ridge. The scales on the belly are pale yellow or orange and the body is long and thin. During the day, they bury themselves in the sandy bed of the body of water, leaving only the head and tail exposed. At night they consume sand on the riverbed and with it small animals and other organic material. Sand, stripped of nutrients, is ejected through the gills. The spawning season is from April to June with the females producing between 300 and 1,500 eggs on stones, roots or plants. The eggs are then fertilized by the males. The larvae hatch in 4 to 6 days.

- **S1355 Otter *Lutra lutra***

Otters are semi aquatic, living mainly along rivers. They mainly eat fish, though crustaceans, frogs, voles and aquatic birds may also be taken. Being at the top of the food chain, an otter needs to eat up to 15% of its body weight in fish daily.

Otters are solitary shy animals, usually active at dusk and during the night. Otters can travel widely over large areas. Some are known to use 20 km or more of river habitat. Otters tend to live alone as they are very territorial. Otters deposit faeces in prominent places along a watercourse (known as spraints) which have a characteristic sweet musky odour. These mark their range which may help neighbouring animals keep in social contact with one another.

The Otter is also a 'European Protected Species' in the UK, and it is an offence to disturb, capture, injure or kill an otter (either on purpose or by not taking enough care), or to damage, destroy or obstruct access to its breeding or resting places, without first getting a Licence.

Table 1: Supplementary Advice for Qualifying Features: H3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation ('Rivers with floating vegetation often dominated by water-crowfoot')

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	Extent of the feature within the site	Restore the total extent of the H3260 feature to that characteristic of the natural fluvial processes associated with the river type	There should be no measurable net reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. The extent of the H3260 feature this will include the range of in-channel, marginal and riparian habitats and vegetation communities. Where a feature is relies on or is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis.	
Structure and function (including its typical species)	River habitat mosaic	Restore the extent and pattern of typical in-channel and riparian habitats to that characteristic of natural fluvial processes associated with this river type	Watercourses with a high degree of naturalness are primarily governed by dynamic natural processes, which then provide a wide range of characteristic physical habitats associated with rivers, including a range of substrate types, variations in flow, channel width and depth, in-channel and side-channel sedimentation features (including transiently exposed sediments), bank profiles (including shallow and steep slopes), erosion features (such as cliffs) and both in-channel and bankside (woody and herbaceous) vegetation cover. Modification or disruption of these processes can adversely affect this range of river habitat, resulting in declines of the characteristic wildlife dependent upon them. Where sections of river are already significantly physically modified, these should be subject to the restoration of natural geomorphological processes (including restoration of hydrological continuity between river and floodplain) as far as possible to allow restoration of characteristic and sustainable river	JACOBS, 2012.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			habitat, working within the practical constraints of essential flood protection for people and the built environment. The morphology of the River Mease indicates that widespread channel re-sectioning (including some deepening) has been undertaken in the past. This channel modification has contributed to its relatively deep channel in comparison with its width. Plan-form adjustments and activities on the river's edge are also impacting factors. There is evidence of readjustment through the deposition of sediment on the bed but assisted natural recovery is required for many reaches of the Mease. For example, monitoring targets for this attribute are for less than 5% of the Evaluated Corridor Sections (ECS) to be artificial, re-aligned or constrained, and for ≥65% or more of monitoring sites should fall within the semi-natural class (class 1), with the remainder predominantly unmodified (class 2).	
Structure and function (including its typical species)	Riparian zone	Restore a patchy mosaic of natural woody and herbaceous (tall and short swards) and riparian vegetation. The riparian zone should be sufficiently wide to act as a healthy and functional habitat zone within the river corridor.	A mosaic of natural and semi-natural riparian vegetation will support a fuller range of characteristic in-channel and riparian wildlife to thrive, creating patches of tall and short riparian swards, a mixture of light and shade on the river channel, and tree root systems and a supply of large woody material that add channel complexity. A patchy tree cover will provide shade protection against rising water temperatures caused by climate change. Between 30-50% riparian tree cover is generally considered optimal for in-channel and riparian habitats.	SCOTT WILSON, 2010; JBA CONSULTING 2014; JACOBS 2012
	Woody material	Restore the presence of coarse woody material within the structure of the river channel. In smaller watercourses, temporary material dams should be a feature of channel dynamics.	Dead woody material that falls into streams ('woody material') plays an important role in increasing river habitat diversity, providing shelter for fish, supplying a food source for aquatic invertebrates, and for slowing the passage of nutrients downstream. Woody material is therefore a key, naturally-occurring feature of healthy rivers. Woody material should be left in situ unless there are overriding reasons of public safety (for example to prevent flooding or bridge collapse). Relatively few woody material accumulations are currently present along the river; this is due to a combination of the limited supply of riparian tree cover	JACOBS 2012

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			and flows sufficient to transport wood.	
	Water course flow	Restore the natural flow regime of the river, with daily flows as close to what would be expected in the absence of abstractions and discharges (the naturalised flow). Flow standards deviation from naturalised flow for the SAC are; between the River Trent and Snarestone: <Qn95 = 10% Qn50 to 95, = 15% Qn10 to 50 = 20%, >Qn10 = 10%. between Snarestone and Packington: Qn95 = 5% Qn 50 to 95 = 10% Qn 10 to 50 = 15% >Qn10 = 15%	The natural flow regime of a river will dictate current velocities and bed hydraulics, water levels and depths, wetted area, temperature regime and dissolved oxygen regime. This will both shape and sustain characteristic river habitats. All parts of the natural flow regime are important, including flushing flows, seasonal base flows and natural low flows. Natural seasonal flow recession is critical in supporting the full expression of ephemeral habitats (marginal and riparian vegetation, exposed riverine sediments, ephemeral headwaters). Flow targets used to define Water Framework Directive's high ecological status should be used to avoid deterioration and for restoration where this is technically feasible. These are: <5% deviation at <Qn95 and <10% at >Qn95 - based on 'natural' water (i.e. water that has not been abstracted and returned). As a minimum, the flow regime should be restored to the values given. Where multiple natural channels exist, flow targets should apply across all of these channels - any artificial channels should not create non-compliances in natural channels. The river Mease is not currently meeting flow targets. This is due to excess water from discharges entering the river system. This is causing the loss of naturalised low flow conditions which are considered necessary for the long-health and integrity of the site.	JBA CONSULTING 2014; NATURAL ENGLAND, 2014.
Structure and function (including its typical species)	Sediment regime	Restore the natural supply of coarse and fine sediment to the river.	Coarse sediment supply is essential for the stability of the river channel and for creating and sustaining key in-channel features including riffles and exposed shingle banks. Coarse sediment supply can be interrupted by weirs and other impounding structures, and by dredging or extraction, and can result in channel incision and heavy bankside erosion that have consequences for both biodiversity and river management (e.g. flood risk). Excessive fine sediment supply can lead to the smothering of coarse substrates and the loss of flora and fauna dependent on them (note that impoundment of the river can have the same effects). At this SAC, coarse sediments within the river banks are generally restricted	ADAS 2012; JACOBS 2012; APEM AND PLYMOUTH UNIVERSITY, 2013; APEM AND PLYMOUTH UNIVERSITY, 2014a; APEM and PLYMOUTH UNIVERSITY,2014b; APEM AND PLYMOUTH

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			to the Gilwiskaw Brook. The lack of coarse sediment within the banks across the rest of the system means that the natural supply of gravel to the channel to form riffles and discrete deposits will be restricted. Excessive phosphate-rich fine sediment is currently being supplied to the River Mease from within its catchment, primarily from diffuse sources from both agricultural and urban use. Modelled results have confirmed that the sub-catchments to the west of the SAC are at higher risk of delivering fine sediment to the system; although results of a wet weather walkover survey, which was completed during 2014, show that incidents of diffuse pollution are occurring across the catchment.	UNIVERSITY, 2014c; WESTCOUNTRY RIVERS LIMITED 2015,
	Thermal regime	Restore a natural thermal regime to the river (subject to a changing climate), ensuring that water temperatures should not be significantly artificially elevated	Increases in river temperatures can create stress for a range of characteristic riverine species, particularly those on the southern limit of their range. These effects may be compounded by other activities such as impoundment, abstraction, discharges and excessive tree removal. Restoration and management of riparian tree cover to suitable levels will be beneficial in many cases to regulate water temperature, particularly in headwater streams and reaches affected by alder phytopthora, ash dieback or low in riparian trees.	JACOBS 2012
	Biological connectivity	Ensure the movement of river wildlife characteristic of the H3260 feature at this site is not significantly artificially constrained.	Many riverine species, including fish and invertebrates, require natural freedom of movement to complete their life cycle and maximise their population size and genetic diversity. Connectivity both within the river channel and between the channel and the floodplain are both critical to this. Whilst natural constraints to movement such as waterfalls and material dams are a natural feature of rivers and add to the complexity and diversity of the habitat, new artificial constraints, including any reduction in the extent of the floodplain should be avoided and existing barriers to movement should be removed where ever possible to restore all aspects of habitat integrity - fish passes constitute a partial mitigation measure for longitudinal biological movement and should only be considered where it is not possible to remove the barrier.	JACOBS 2012
Structure and function (including its typical species)	Invasive, non-native and/or introduced species	Ensure any non-native species categorised as 'high-impact' in the UK are either rare or absent but if present are causing minimal damage to the H3260	Non-native species constitute a major threat to many river systems. Impacts may be on the river habitat itself (e.g. damage to banks and consequent siltation) or directly on characteristic wildlife (through predation, competition and disease), or a combination of these. For example, species such as signal crayfish have been responsible for much of the decline of native	APEM 2010 JBA CONSULTING 2014 TRENT RIVERS TRUST, 2011, 2012,

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		feature	crayfish through competition, habitat damage and the introduction of crayfish plague. High impact species that have been found in and along the River Mease include North American signal crayfish, Japanese knotweed and Himalayan balsam.	2013 and 2014.
	Key structural, influential and distinctive species	Restore the abundance of the typical species listed below to enable each of them to be a viable component of the H3260 habitat: River water crowfoot *Ranunculus fluitans,* stream water crowfoot *R.penicillatus spp. pseudofluitans,* water-starworts *Callitriche* spp. flowering rush *Botumus umbellatus* Pondweeds *Potamogeton* spp*,* bur-reeds *Sparganium* spp. Water plantain *Alisma plantago-aquatica,* spiked milfoil *Myriophyllum spicatum,* yellow water-lily *Nuphar lutea,* arrowhead *Sagittaria sagittifolia,*	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure and function of an Annex I habitat feature at a particular site. These species will include; - Structural species which define or are critical to the structure and therefore the health of an Annex I feature on a site (see also attribute for 'vegetation community composition'). - Influential species which have an important positive impact on the structure and function of an Annex I feature on a site (such as bioturbators (mixers of soil/sediment), grazers, borers or predators) - Site-distinctive species which are considered to be a particularly special and distinguishing component of an Annex I feature on a particular site. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available.	
Structure and function (including its typical species)	Fisheries	Maintain fish densities at a level at or below the natural environmental carrying capacity of the river	Fish stocking can cause elevated levels of competition and predation that may damage the characteristic biological community of the river. Ideally, fishery management should be based on natural recruitment, with an emphasis on restoring characteristic river habitat in ways that promote natural recruitment. Exploitation of fish should be controlled to suitable levels, and net limitations and catch-and-release techniques used where necessary to avoid population impacts. Fish introductions, exploitation and other removals	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			should not interfere with the ability of the river to support self-sustaining populations of characteristic species. Stocking should be undertaken so as to avoid risks of disease transfer, including crayfish plague where white-clawed crayfish populations are at risk Exploitation and removals should not cause significant suppression of characteristic fish species (e.g. Atlantic salmon, eel, pike) or affect the balance of the fish or wider biological community. The stocking of carp to still waters immediately adjacent to SAC rivers is undesirable if there is continuity between river and still water during periods of flood and no effective biosecurity measures are in place. There has been no authorised fish stocking operations since the River Mease was notified as a SSSI and measures have been put in place to prevent non-native Zander from entering the river from the Ashby Canal	
	Vegetation structure: riparian zone	Restore grazing activity in the riparian zone and in the river channel at or to suitably low levels.	Ideally, grazing levels should be managed at low levels across whole riparian fields. Where this is not feasible, set-back fencing may be established with access provision for limited grazing within the riparian zone; particularly sensitive areas (e.g. exposed riverine sediments likely to support good invertebrate communities) may need to be fenced off to avoid any concentration of livestock activity, even if only present in low numbers. Close bankside fencing that excludes the development of a functional river corridor is not appropriate.	JACOBS 2012
	Vegetation structure: cover of submerged macrophytes	Maintain a sufficient proportion of all aquatic macrophytes to allow them to reproduce in suitable habitat and unaffected by river management practices	Removal of submerged aquatic vegetation (often called 'weed-cutting') might be undertaken for flood risk management or fishery purposes. Except in situations of extreme flood risk, best practice is for cutting to leave a mosaic of submerged and marginal vegetation, and should promote a characteristic diversity of plant species. It is recommended that where appropriate a weed management plan is developed for the site, allowing for higher levels of cutting at flood risk pinch-points, balanced by lower levels of cutting in other stretches. Any weed-cutting operations should be undertaken to leave a sufficient proportion of in-channel and marginal vegetation in the river to support characteristic river wildlife (in terms of cover, food supply and spawning substrate). Weed-cutting should not interfere with the ability of the river channel to downsize through encroachment of marginal vegetation during the summer flow recession.	SCOTT WILSON, 2010 JBA CONSULTING 2014
Structure and	Supporting off-	Restore any supporting riverine	This feature and its characteristic biological communities may be dependent	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
function (including its typical species)	site habitat	habitats present beyond the site boundary upon which the H3260 feature of the site depends.	on the integrity of sections of river channel, riparian areas, and transitional and marine waters that lie outside of the site boundary. For example, headwater areas and tributaries may not fall within the site boundary, yet a range of species characteristic of the site may use these areas for spawning and juvenile development and be critical for sustaining populations within the site. Fully developed riparian zones are essential to site integrity, yet part of this zone may lie outside of the site boundary, particularly if the river channel is operating under natural processes and moves laterally over time within the floodplain. Otter, Bullhead and Spined Loach are known or likely to use the tributaries, which will also act as refuges from high flow conditions and pollution incidents.	
Supporting processes (on which the feature relies)	Water quality - nutrients	Restore a natural nutrient regime to the river Mease, with any anthropogenic enrichment above natural/background concentrations limited to levels at which adverse effects on characteristic biodiversity are unlikely. Maximum phosphorus concentrations (µg L-1 SRP) should be 50 (River Trent-Snarestone) and 40 (Snarestone-Packington). These are applied as growing season means (March to September inclusive) and annual means.	Elevated nutrient levels can lead to the dominance of more competitive plants and algae and a loss of characteristic plant species (which may include lower plants such as mosses and liverworts). Through changes to plant growth and plant community composition and structure they also affect the wider food web, altering the balance between species with different feeding and behavioural strategies. Artificially large growths of benthic or floating algae may also reduce dissolved oxygen and create poor substrate conditions (increased siltation) for fish and invertebrate species. The management focus is typically on the soluble reactive phosphorus ('SRP') in rivers, on the assumption that it can be more easily controlled at levels that limit the growth of plant species. However, nitrogen may also be important in river eutrophication and ideally co-limitation would be the management aim. Any development within the catchment should ensure that appropriate measures are incorporated at the design phase, to ensure that sustainable urban drainage components are included which address water quality impacts as well as flood attenuation. Current water quality for the River Mease is currently not meeting these targets.	NATURAL ENGLAND, 2014. ENVIRONMENT AGENCY (Water Quality data) JBA CONSULTING 2014
	Water quality -	Restore organic pollution levels	Organic pollution affects river habitat and its typical species in a number of	

<table>
<tr><th colspan="2">Attributes</th><th>Targets</th><th>Supporting and Explanatory Notes</th><th>Sources of site-based evidence (where available)</th></tr>
<tr><td></td><td>organic pollution</td><td>to the following levels that will have minimal impact on the H3260 feature and its characteristic species;

<table><tr><th>Attribute</th><th>Target</th></tr><tr><td>10%ile Dissolved Oxygen (% saturation)</td><td>85</td></tr><tr><td>Mean Biological oxygen Demand (BOD) (mg L^{-1})</td><td>1.5</td></tr><tr><td>90%ile total ammonia (NH_3-N, mg L^{-1})</td><td>0.25</td></tr><tr><td>95%ile un-ionised ammonia (NH_3-N, mg L^{-1})</td><td>0.021</td></tr></table></td><td>ways, including direct toxicity (from ammonia and nitrite), reduced dissolved oxygen levels (from microbial breakdown of organic material), and nutrient enrichment. Reducing organic pollution levels reduces toxic effects but unmasks enrichment effects.

Controlling the continuous input of low levels of organic material is critical to controlling the enrichment effect. The values given apply throughout the site not just at routine sampling points - assessment can be made by modelling (assuming full mixing of effluents at the point of discharge).</td><td></td></tr>
<tr><td>Supporting processes (on which the feature relies)</td><td>Adaptation and resilience</td><td>Maintain (or restore where resilience is degraded) the H3260 feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site</td><td>This recognises the increasing requirement for natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning.

Such environmental changes may include changes in precipitation and temperature, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. Climate change modelling predicts significant changes in rainfall patterns, including increased frequency of prolonged droughts and more frequent storm events. These effects are likely to impose significant stress on mire systems through drying out, increased risk of fire, threat of erosion and increased variation in water levels.

The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment</td><td>NATURAL ENGLAND, 2015.</td></tr>
</table>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this particular SAC to climate change has been assessed by Natural England as being *high*, taking into account the sensitivity, fragmentation, topography and management of its habitats and supporting habitats. Such sites are considered to be the most vulnerable sites overall and are likely to require the most adaptation action, most urgently. This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so appropriate monitoring would be required.	
Supporting processes (on which the feature relies)	Water quality - other pollutants	Achieve at least 'Good' chemical status (i.e. compliance with relevant Environmental Quality Standards) by 2021.	A wide range of pollutants may adversely impact on habitat integrity depending on local circumstances. Achieving 'good chemical status' includes meeting Environmental Quality Standards (EQS) for individual pollutants and will protect aquatic wildlife with a necessary level of precaution. These values should be applied throughout the site, not just at routine sampling points. At this SAC, elevated levels of copper, zinc and lead concentrations have been observed in stream sediments that are in proximity to A class roads with hotspots at crossings with the A42, other A roads and pollution from urban development. The elevated levels of sediment contaminants coupled with the high residence time of fine sediment in the Mease is a problem. There is evidence that the pollution legacy from historic mining activity is having an impact within the catchment. Pollutants associated with mining are thought to being slowly released into the water course through leaching.	APEM AND PLYMOUTH UNIVERSITY, 2014d; APEM AND PLYMOUTH UNIVERSITY, 2014e; APEM AND PLYMOUTH UNIVERSITY 2015; APEM 2015
	Conservation measures	Maintain the management or other measures (within and/or outside the site boundary as appropriate) necessary to restore the structure, functions and supporting processes associated with the H3260 feature	Active and ongoing conservation management is needed to protect, maintain or restore the features of this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the	NATURAL ENGLAND, 2014b; JACOBS 2012

Attributes	Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		underpinning SSSI and/or management agreements.	

Version Control
Advice last updated: 19 April 2016 on receipt of comments from the Environment Agency. Amendments made to the text to provide further clarification on water quality and biological connectivity within the explanatory notes.

Variations from national feature-framework of integrity-guidance: [*adviser to give details of what has varied and why*]

Acidification and alkalinity attributes not considered appropriate to this feature at this site.

Table 2: Supplementary Advice for Qualifying Features: S1355 Otter *Lutra lutra*

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	Habitat quality - river habitat	Restore the quality of supporting river habitat features, based on the advice for the H3260 feature, based on natural river function, which provides characteristic habitats for otters.	Dense bank vegetation, marshes and reedbeds are important for otters, but they will use a long stretch of river and this won't necessarily fall within a protected site. Dense bank vegetation and reedbeds are favoured as resting areas, but otters will often travel some distance to a preferred 'couch' and this will not necessarily be along the edge of the river. The structure and quality of bankside vegetation, reedbeds and other nearby habitats should be maintained, restored and/or created, particularly where there is evidence of use by otters. However, it is thought that the most significant determinant of otter usage of a habitat is the abundance of prey	JBA CONSULTING 2014 JACOBS 2012
	Habitat quality - waterway habitat	Restore the quality of supporting waterway habitat	Smaller tributaries of larger river systems (streams, becks etc) are extremely important for otters and have been shown to have been used more frequently by otters than larger rivers. This is thought to be in part due to differences in fish density and preference for hunting in shallow water with areas of riffles and boulders.	
	Food availability	Maintain fish biomass within expected natural levels for the supporting habitat (subject to natural fluctuations).	In freshwater, key fish prey sources for otters include eels, salmonids, roach and sticklebacks. Frogs can also form an important part of the diet, depending on the habitat and time of year. Crayfish and water beetles may also form part of the diet, as well as an occasional waterbird (young coots, moorhens, ducks) or mammal (rabbits, water voles - although this is uncommon). The diet of otters varies depending on the availability of prey, which in turn varies with the time of year. There should be a diverse range of food sources available throughout the year, within the normal expectations of each particular water course. It should be noted however, that otters may take prey from adjacent fisheries which are stocked to an artificially high level, especially where there are numerous stocked gravel pits on a floodplain. This can lead to artificially high prey densities adjacent to European sites, which might be expected to, in turn, result in artificially high densities of otter on the designated sites. This highlights the importance of biosecurity around stocked fisheries, and if implemented at all artificial still water fisheries on a floodplain might result in a legitimate reduction in otter density.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
	Abundance of breeding and resting places	Restore an abundance of natural breeding and resting sites within the SAC	Otters are highly mobile and are likely to spend their time within wider territories, where designated sites only form a proportion of their range and make a contribution to their wider requirements. Otters are a European protected species, and it is an offence to disturb their resting places. Otters will often use many holts at any one time. They may give birth in one, but raise their young in another. Important features of a successful breeding site are the availability of food, limited disturbance and safety from the risk of flooding. It is important to consider the whole site and not just the known holts as appropriate management will influence all of these factors. Some natal den structures have a limited lifespan (e.g. hollow tree trunks, piles of timber etc.) and if alternative opportunities for natal dens are limited, suitable replacements can be created or constructed. Maintaining dense bank vegetation, areas of reed etc will ensure that there are suitable areas for resting couches.	JACOBS 2012 JBA Consulting 2014
Supporting habitat: structure/ function	Availability of refugia	Restore an abundance of dense bankside vegetation to limit significant disturbance to otters	For rivers, most of the floodplain is outside the boundary of the site, yet the integrity of the interest feature will often be dependent upon the quality of the adjacent habitat out with the boundary of the site. This is likely to be the case where bankside vegetation may be an important barrier to disturbing activity but may lie adjacent to and outside the boundary. Nevertheless it will be important to maintain, or in some cases, to restore dense bankside cover.	
	Water flow	Restore the natural flow regime of the river to that close to what would be expected in the absence of abstractions and discharges (the 'naturalised' flow).	Permanent or long-lasting reductions in river flow may affect the availability and diversity of prey for otters. This could lead to otters moving into new areas, increasing the likelihood of conflict with other otters. This may also alter the prey targeted by otters as they may hunt for low-preference food such as birds, rabbits, fish carrion or frogs, depending on the time of year.	
	Water quality/quantity	Restore river water quality and quantity to a standard which provides the necessary conditions to support otter	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing and feeding habitats. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SAC Conservation Objectives but in some cases more stringent standards may be needed to support the SAC feature.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Further site-specific investigations may be required to establish appropriate standards for the SAC. The main impact of water quality on this feature is its effects on the food supply. For example, moderate levels of levels of eutrophication may increase certain fish populations, but excessive eutrophication can be detrimental. Excessive acidity in watercourses may also affect fish populations. Impacts from toxic pollutants can be devastating and were the major cause of otter population declines in the past.	
Supporting processes (on which the feature and/or its supporting habitat relies)	Water quality : Toxic chemicals	Reduce the presence of pollutants within the SAC, which are potentially toxic to otters.	The major cause of the historic decline in otter populations in the UK was toxic chemicals such as dieldrin and related pesticides. Such contaminants can have indirect effects (e.g. on food supply through organic pollution, eutrophication, acidification from mine waste) or mainly direct effect (e.g. oil spillage, radioactivity) or effects of bioaccumulation (e.g. metals, especially mercury, cadmium and lead; pesticides and PCBs).	ENVIRONMENT AGENCY Pollution Incidents data.
	Connectivity within and to the site	Ensure there are no significant artificial barriers to the safe passage and movement of otters into, within and away from the SAC	Barriers such as roads and weirs can generally increase the risk of harm to animals as they traverse or avoid them. If these artificial barriers are considered a problem then mitigating measures could be taken. Otter populations using the SAC are dependent on the integrity of sections of river channel, riparian areas, freshwater still-waters, floodplains and transitional and marine waters that lie outside of the site boundary. Headwater areas and tributaries may not fall within the site boundary, yet otters may use these areas for breeding and feeding and these will be critical for sustaining populations within the site.	
Population (of the feature)	Population abundance	Restore and then maintain a continued presence of an actively-breeding otter population within the SAC, whilst avoiding deterioration from its current level as indicated by the latest mean peak count, estimate or equivalent.	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population abundance or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period. The values given here may also be	JBA CONSULTING 2014

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. Unless otherwise stated, the population size or presence will be that measured using standard methods, such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise that the figures stated are the best available.	
Population (of the feature)	Anthropogenic mortality	Restrict levels of otter mortality as a result of anthropogenic (man-made) factors so that they are not adversely affecting the overall abundance and viability of the otter population.	High numbers of otter casualties within or adjacent to SAC catchments will adversely affect the condition and viability of the wider population and mitigation measures should be initiated as quickly as possible. Causes of mortality may include roads, accidents with fishing equipment (nets, lobster creels), poisoning, pollutants, hunting and acidification/contamination of water courses (which reduces prey populations). It is an offence to disturb, capture, injure or kill an otter (either on purpose or by not taking enough care), or to damage, destroy or obstruct access to its breeding or resting places,	
Version Control Advice last updated: 19 April 2016, typographical errors amended and additional wording added to provide clarification within the explanatory notes				
Variations from national feature-framework of integrity-guidance: N/A				

Table 3: Supplementary Advice for Qualifying Features: S1092 White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	Population abundance	Restore the presence and a moderate level of abundance of the white-clawed crayfish population, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	See explanatory notes above in table 2 above A moderate level of abundance is indicated by a catch per unit effort (CPUE) averaging between 0.1 – 1 individuals. In 2010 and 2014 no White-clawed crayfish were found during trapping. Several North American signal crayfish were found in the lower reaches but these were absent in the mid to higher reaches. It is felt that pollution incidents close to the headwaters could have had a detrimental impact.	APEM 2010 JBA CONSULTING 2014,
	Population health	Restore the absence of non-native crayfish species from within the SAC and the catchment surrounding the site	Once non-native crayfish species (such as signal, red-swamp and spiny-cheeked crayfish) are established in a waterbody, native populations of crayfish may be eliminated rapidly by them through direct competition for food, predation and/or the transfer of disease. The white-clawed crayfish has a relatively slow reproductive rate and if a population declines it may take several years for it to recover. These non-native species can also cause physical damage to supporting habitat.	
		Restore the absence of individuals within the site infected with crayfish plague or porcelain disease		
		Ensure human activities within or around the SAC do not pose a significant risk of plague transfer to the crayfish population	Human activity, such as angling and fish farming, is able to inadvertently facilitate the spread of non-native species and the spread of this disease if existing legislative controls and best management practices are not followed.	
Supporting habitat: structure/ function	River morphology	Restore the physical structure of the river channel and its banks to a natural state	Habitat conditions for white-clawed crayfish vary naturally in rivers. Some river sections may provide optimal habitat whilst others may be largely unsuitable. Optimal conditions typically occur in relatively shallow, fast flowing reaches with coarse substrates. A characteristically diverse biotope mosaic allows the white-clawed crayfish and other species to move within the channel to locate optimal habitat conditions in the face of a fluctuating flow regime. Physical features such as in-channel pools, exposed tree root systems and marginal shallows are important high-flow refugia for the species. Impounding structures in particular can have a dramatic effect on white-clawed crayfish habitat, generating heavy siltation and loss of coarse substrates on which white-clawed crayfish depend.	JACOBS 2012
Supporting habitat:	River bed	Restore an abundance of naturally-occurring cobbles,	Habitat conditions for white-clawed crayfish vary naturally in rivers. Some river sections may provide optimal habitat whilst others may be largely	APEM, 2010 JACOBS 2012

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
structure/ function		rubble and boulders on the river bed	unsuitable. Optimal conditions typically occur in relatively shallow, fast flowing reaches with coarse substrates. A characteristically diverse habitat mosaic allows the white-clawed crayfish move within the channel to locate optimal habitat conditions in the face of a fluctuating flow regime. Pools, exposed tree root systems and marginal shallows are important high-flow refugia for the species. Impounding structures such as dams and weirs in particular can have a dramatic effect on white-clawed crayfish habitat, generating heavy siltation and loss of coarse substrates on which white-clawed crayfish depend.	JBA CONSULTING 2014
	Woody material	Restore an abundance of large woody material within the river channel	Woody material is an important component of river habitat for white-clawed crayfish as well as the wider biological community. Fallen branches and trees accumulate packs of leaf litter which are an important source of food for crayfish and many other invertebrates. It provides an alternative source of cover from predators and floods.	JACOBS 2012
	River vegetation	Restore the extent of submerged and marginal vegetation within the river channel	Habitat conditions for white-clawed crayfish vary naturally in rivers. Some river sections may provide optimal habitat whilst others may be largely unsuitable. Optimal conditions typically occur in relatively shallow, fast flowing reaches with coarse substrates. A characteristically diverse biotope mosaic allows the white-clawed crayfish to move within the channel to locate optimal habitat conditions in the face of a fluctuating flow regime. Pools, exposed tree root systems and marginal shallows are important high-flow refugia for the species. Impounding structures in particular can have a dramatic effect on white-clawed crayfish habitat, generating heavy siltation and loss of coarse substrates on which white-clawed crayfish depend.	APEM 2010 JBA CONSULTING 2014,
Supporting habitat: structure/ function	River banks	Increase the extent of bankside tree cover including their root systems to 30%	Habitat conditions for white-clawed crayfish vary naturally in rivers. Some river sections may provide optimal habitat whilst others may be largely unsuitable. Optimal conditions typically occur in relatively shallow, fast flowing reaches with coarse substrates.	JACOBS 2012

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			A characteristically diverse habitat mosaic allows the white-clawed crayfish to move within the channel to locate optimal habitat conditions in the face of a fluctuating flow regime. Features such as pools, exposed tree root systems and marginal shallows are important high-flow refugia for the species. Impounding structures in particular can have a dramatic effect on white-clawed crayfish habitat, increasing siltation and loss of the coarse substrates on which white-clawed crayfish depend.	
	Shoreline refugia	Restore the extent and diversity of shoreline refuges associated with the river channel, such as submerged tree roots, bank crevices and marginal vegetation	White-clawed crayfish of all ages need refuges, or places to shelter or hide. Juvenile crayfish are especially vulnerable to predation by fish, ducks and other water birds, otter and mink, carnivorous dragonfly larvae and other predatory invertebrates, including adult crayfish. Crayfish are also vulnerable to high flows in watercourses, when they can be washed away from favourable habitats and stranded, crushed or eaten. Pools, exposed tree root systems and marginal shallows are important high-flow refugia for the species.	JBA CONSULTING 2014
	Water quality: biological	Restore supporting habitat to 'Good' biological status (i.e. compliance with relevant Environmental Quality Standards) throughout the site.	Good water quality is important to this feature to ensure sufficient availability of prey which includes worms, insect larvae, snails, small fish, macrophytes and algae. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this supporting habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.	This attribute will be periodically monitored as part of Natural England's site condition assessments, with water quality data being provided by the Environment Agency
Supporting habitat: structure/ function	Water quality: chemical	See target for the H3260 habitat feature above.	Good water quality is important to ensure the availability of prey preferred by white-clawed crayfish which includes worms, insect larvae, snails, small fish, macrophytes and algae. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed.	This attribute will be periodically monitored as part of Natural England's site condition assessments, with water quality data being provided by the Environment Agency

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. Native crayfish are particularly susceptible to pollution incidents and supporting crayfish habitat should not be at significant risk of effluent pollution from within the site's immediate or wider catchment.	
	River flow	See target for the H3260 habitat feature above.	The natural flow regime both shapes and sustains characteristic biotope mosaics, affecting factors such as current velocities and bed hydraulics, water levels and depths, wetted area, temperature regime and dissolved oxygen regime, All parts of the natural flow regime are important, including flushing flows, seasonal base-flows and natural low flows. Natural seasonal flow recession is critical in supporting the full expression of supporting habitats (marginal and riparian vegetation, exposed riverine sediments, ephemeral headwaters). Any significant impacts on the natural flow regime should be rectified sustainably by reducing flow modifications, not by artificial augmentation, or by altering channel form to fit reduced levels of flow.	JBA Consulting 2014,
Supporting habitat: structure/ function	Water pH	Maintain freshwater pH levels at within the range 6.5 - 9	Higher pH levels as part of supporting water habitat chemistry maximise the survival and growth of animals.	
	Un-ionised Ammonia	Reduce ammonia levels to less than 0.6mg NH^3 l-1 throughout the site	High levels of ammonia in watercourses, derived from organic pollution, are likely to be toxic to white-clawed crayfish.	This attribute will be periodically monitored as part of Natural England's site condition assessments with data obtained from the Environment Agency
	Total Nitrogen	Restore levels typically at or below 0.2 mg.l-1 NO^2 suggested as reflecting the EPA limit for salmonid waters.	High levels of nitrogen are likely to be toxic to crayfish. There seems to be a tolerance of nitrates in this species, with food consumption being impacted before other physiological impacts are noted, though mortality climbs with increasing concentration.	This attribute will be periodically monitored as part of Natural England's site condition assessments with data obtained from the Environment Agency
	Oxygen levels	Maintain supporting habitat in a well-oxygenated state, typically with a dissolved oxygen standard	Good water quality, reflected in high oxygen levels, is important to ensure availability of food which includes worms, insect larvae, snails, small fish, macrophytes and algae.	This attribute will be periodically monitored as part of Natural

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		of >70%		England's site condition assessments with data obtained from the Environment Agency
	Turbidity: rivers	Maintain an annual mean level of typically less than 25 mg/l of suspended solids throughout the river	The supporting riverine habitat of the feature should be characterised by clean gravels; excess siltation can obstruct crayfish gills which they use to breathe. These gills are very delicate and are covered by the crayfish's carapace, or shield, which allows water to run through in a channel over the gills, which provides a continuous source of oxygen.	This attribute will be periodically monitored as part of Natural England's site condition assessments with data obtained from the Environment Agency
	Calcium levels	Maintain river calcium levels at or above 5mg/l	Because of their thick protective exoskeletons and regular moult cycles, freshwater crustaceans such as crayfish have high calcium needs. When calcium levels drop, their exoskeletons become weaker reducing the abundance, size, and weight of these crustaceans. A reduction in size can slow the onset of sexual maturity, making them more vulnerable to predators. This may further affect the overall size of their population. Finally, affected crustaceans may become less tolerant of other factors such as temperature, toxic metals, and Ultra-Violet radiation.	
Supporting habitat: structure/ function	Supporting off-site habitat	Restore the quality of any supporting habitat present beyond the site boundary upon which the white-clawed crayfish population of the site depend	White-clawed crayfish populations within the designated boundary of the SAC may be dependent on the continued or restored integrity of sections of river channel and riparian areas that lie outside of the site boundary. For example, headwater areas and tributaries may not fall within the site boundary, yet white-clawed crayfish may use these areas for spawning and juvenile development and be critical for sustaining populations in the SAC further downstream.	
	Biological connectivity	Ensure the movement of white-clawed crayfish within the site is not artificially constrained.	Vertical drops are sufficient to prevent upstream movement of adult white-clawed crayfish. Even low weirs will therefore prevent re-colonisation of upper reaches affected by lethal pollution episodes or drought, and more generally will also lead to constraints on life cycle movements and genetic interactions throughout the river that may have adverse consequences.	JACOBS 2012
	Water temperature	Maintain water temperature at naturally-occurring levels	Good water quality is important to ensure availability of food which includes worms, insect larvae, snails, small fish, macrophytes and algae	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature and/or its supporting habitat relies)	Fish density	Maintain fish populations at densities low enough to avoid significant predation of juvenile crayfish	Predatory fish species may include chub, eel, perch, pike and trout	
Version Control Advice last updated: 19 April 2016 on receipt of comments from the Environment Agency				
Variations from national feature-framework of integrity-guidance: N/A				

Table 4: Supplementary Advice for Qualifying Features: S1149 Spined loach *Cobitis taenia*; S1163 Bullhead *Cottus gobio*

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	Juvenile densities	Restore juvenile densities at those expected under un-impacted conditions throughout the site, taking into account natural habitat conditions and allowing for natural fluctuations. For spined loach, at least 40% of the population should consist of 0+ fish	Adverse impacts on the physical, chemical or hydrological attributes of the river, or from non-native species, may suppress juvenile densities of both spined loach and bullhead. Few spined loach young-of-year (YOY) fish were found during the 2010 fish survey with the population consisting of 1+ and 2+ fish. The 2014 survey found 30% of to be YOY.	APEM 2010; JBA CONSULTING 2014,
	Population abundance	Restore the abundance of the populations to the levels below, which are similar to that expected under un-impacted conditions throughout the site (subject to natural habitat conditions and allowing for natural fluctuations), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent; For spined loach, adult population densities should be greater than 0.2/m², with at least three year-classes should be present at significant densities. At least 40% of the population should consist of 0+ fish and the largest females attain a fork length >85mm.	This will ensure there is a viable population of each feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period. The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is	APEM 2010 JBA CONSULTING 2014

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		For bullhead, densities should be not less than 0.5 m² and young-of-year fish should occur at densities at least equal to adults. There should be four age classes with 0+ individuals at least 40% of population and the largest females attain a fork length >75mm	evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. Unless otherwise stated, the population size or presence will be that measured using standard methods, such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise that the figures stated are the best available. The 2010 survey found a **spined loach** density of 0.05m² whilst the 2013 survey found a density of 0.152m². The average density in 1999 was 0.32 individuals/m² The 2010 survey by APEM assessed the **bullhead** density as 0.41m² across the system. A repeat survey by JBA in 2014 assessed the population across the system as 0.41m². APEM found that young of the year were generally concentrated in the higher reaches of the Mease, suggesting that the Gilwiskaw Brook may be important habitat for spawning and juvenile fish, but overall young of the year were poorly distributed across the SAC. The 2014 survey found that young of the year only occurred at 59%when compared to the density of adults. Only 3 age classes were found during both surveys, with the majority of the age class being 1+.	
Supporting habitat: structure/ function	Biological connectivity	See target for H3260 habitat feature in table 1	Even weirs with small vertical drops will prevent re-colonisation of upper reaches affected by lethal pollution episodes or drought, and more generally will also lead to constraints on genetic interactions that may have adverse consequences. Vertical drops of >18-20 cm are sufficient to prevent upstream movement of adult bullheads. They will therefore prevent re-colonisation of upper reaches affected by lethal pollution episodes or drought, and more generally will also lead to constraints on genetic interactions that may have adverse consequences.	JACOBS 2012

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
	River habitat mosaic	See target for H3260 habitat feature in table 1	Habitat conditions for both bullhead and spined loach vary naturally within rivers. Some sections may provide optimal habitat whilst others may be largely unsuitable. More natural river morphology provides the diversity of breeding/nursery habitat for fish, cover from predators, refuge against high flows, and feeding opportunities that best meet the full life cycle requirements of the species. The close proximity of riffles and pools is particularly important for the sedentary **spined loach**. For optimal conditions substrates should be at least 20% sand and no more than 40% silt. Whilst the species can tolerate silt and mud, it has a preference for sandy substrate and high sediment cohesiveness is likely to affect the feeding process. A mosaic of bare substrate and submerged beds of higher plants provides optimal conditions in relation to feeding, cover from predators and spawning (which occurs on submerged plants). Marginal emergent plants also provide important cover and feeding opportunities. Optimal conditions for **bullhead** typically occur in relatively shallow, fast flowing reaches with coarse substrates (used for egg-laying and juvenile/adult cover). A characteristically diverse biotope mosaic allows the bullhead and other species to move within the channel to locate optimal habitat conditions in the face of a fluctuating flow regime. Pools, exposed tree root systems and marginal shallows are important high-flow refugia for the species.	SCOTT WILSON, 2010 JBA CONSULTING 2014, JACOBS 2012

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	Fisheries - introduction of fish species	Ensure fish stocking/introductions do not interfere with the ability of the river to support self-sustaining populations of spined loach and bullhead.	The presence of artificially high densities of fish can create unacceptably high levels of predatory pressure on bullhead and spined loach. The management aim is to provide conditions in the river that support healthy, natural and self-sustaining populations, achieved through habitat protection/restoration and the control of exploitation as necessary. Stocking represents a loss of naturalness and, if successful, obscures the underlying causes of poor performance (potentially allowing these risks to perpetuate). It carries various ecological risks, including the loss of natural spawning from brood-stock, competition between stocked and naturally produced individuals, disease introduction and genetic alterations to the population There has been no authorised fish stocking operations since the River Mease was notified as a SSSI	
	Flow regime	See target for H3260 habitat feature in table 1	The natural flow regime is critical to all aspects of the spined loach life cycle, maintaining the in-channel habitat mosaic that is optimal for the species, and similarly to the bullhead life cycle, maintaining the high current velocities and substrate conditions that are optimal for the species.	JBA CONSULTING 2014, JACOBS 2012
	Integrity of off-site habitats		Spined loach and Bullhead populations within the SAC may be dependent on the integrity of continuous sections of river channel and riparian areas that lie outside of the site boundary. Headwater areas and tributaries may not fall within the site boundary, yet both fish may use these areas for spawning and juvenile development and be critical for sustaining populations within the site.	
	Riparian zone		Active marginal vegetation including riparian trees provides important cover for spined loach. A mosaic of vegetation types and sward heights provides suitable conditions for the whole characteristic biological community including spined loach.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
	Screening of intakes and discharges Screening of intakes and discharges		Spined loach and bullhead can be entrained in intakes and discharges along with other fish species.	
Supporting habitat: structure/ function	Sediment regime	See targets for H3260 habitat feature above	Excessive delivery of very fine sediment, from sources within the catchment or artificially enhanced river bank erosion, can produce sub-optimal feeding conditions for spined loach and bullhead and can interfere with submerged plant communities on which the species relies for cover and spawning. Natural levels of coarse sediment supply are critical to the maintenance of high quality bullhead habitat, maintaining bed substrates in optimal condition for egg-laying and juvenile and adult cover. Excessive delivery of fine sediment, from the catchment or artificially enhanced bank erosion, can cause siltation of egg-laying sites and juvenile and adult refugia.	ADAS 2012; JACOBS 2012; APEM AND PLYMOUTH UNIVERSITY 2013; APEM AND PLYMOUTH UNIVERSITY 2014A; APEM AND PLYMOUTH UNIVERSITY 2014B; APEM AND PLYMOUTH UNIVERSITY2014C; WEST COUNTRY RIVERS LIMITED 2015.
	Vegetation composition: invasive non-native species	See targets for H3260 habitat feature above	Species such as signal crayfish may have a serious effect on spined loach habitat (by destabilising banks and enhancing very fine sediment input), and may predate heavily on fish if present at high densities. A 2013 condition assessment by JBA consulting confirmed the presence of signal crayfish in the lower reaches of the Mease. Chinese mitten crab has the potential to migrate long distances up rivers and may cause similar damage to spined loach and bullhead habitat.	APEM 2010 JBA CONSULTING 2014

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	Vegetation structure: cover of submerged macrophytes	See targets for H3260 habitat feature above	Submerged and marginal vegetation provides vital cover for spined loach. Submerged plants are used for egg-laying. In rivers where it naturally occurs, submerged and marginal vegetation can provide important cover for bullhead, particularly if coarse (cobble) substrates are in short supply for cover.	SCOTT WILSON, 2010 JBA CONSULTING 2014, JACOBS 2012
	Water quality - nutrients	See targets for H3260 habitat feature above	Nutrient enrichment can lead to loss of substrate condition for spined loach due to benthic algal growth and associated enhanced siltation. It also increases the risk of impacts on the submerged plant community, which the spined loach uses for cover. The spined loach is susceptible to both episodic and chronic organic pollution. Episodic pollution causes direct mortalities whilst chronic pollution affects substrate condition through the build-up of sediment oxygen demand and excessive microbial populations. If the organic content of the substrate becomes too high, reduced oxygen availability near the sediment/water interface may lead to enhanced egg and juvenile mortality.	SCOTT WILSON, 2010 JBA CONSULTING 2014, JACOBS 2012
	Water quality - nutrients	Restore the natural nutrient regime of the river, with any anthropogenic enrichment above natural/background concentrations limited to levels at which adverse effects on the feature are unlikely.	Nutrient enrichment can lead to loss of substrate condition for bullhead due to benthic algal growth and associated enhanced siltation. The bullhead is susceptible to both episodic and chronic organic pollution. Episodic pollution causes direct mortalities whilst chronic pollution affects substrate condition through the build-up of excessive microbial populations.	SCOTT WILSON, 2010 JBA CONSULTING 2014, JACOBS 2012
	Woody material	See targets for H3260 habitat feature above	Woody material is important in shaping natural habitat mosaics in rivers, on which the spined loach and other species depend. Bullheads are particularly associated with woody material in lowland reaches, where it is likely that it provides an alternative source of cover from predators and floods. It may also be used as an alternative spawning substrate.	JBA CONSULTING 2014, JACOBS 2012
Supporting Processes (on which the feature relies)	Conservation measures	Maintain management or other measures (within and/or outside the site boundary as appropriate) necessary to restore the structure, functions and supporting processes associated with the feature and/or its	Active and ongoing conservation management is needed to protect, maintain or restore the features of this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management	JACOBS, 2012. NATURAL ENGLAND, 2014b.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		supporting habitat	strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	
Version Control Updated on 19/04/2016 on receipt of comments from the Environment Agency. Also, further amendments made to include additional information.				
Variations from national feature-framework of integrity-guidance: Water quality (acidification)removed as not appropriate to this site				

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