

Appendix 1

Draft SSSI and cSAC Conservation Objectives for the River
Itchen cSAC and SSSI

Draft SSSI Conservation Objectives (Source: English Nature)

Note: Attempting to assess the sustainability of the habitat is important when using this guidance, as this is an integral part of the concept of favourable conservation status (FCS). For habitats, the key components used for assessing FCS include habitat extent, habitat structure and functioning, and typical species. The appropriate FCS component is included in square brackets below each attribute.

Attribute	Targets	Method of assessment	Comments
Flow [Habitat structure and functioning]	Flow regime should be characteristic of the river. Ecological flow criteria already laid down for the river (e.g. for passage of migrating salmon) should also be complied with. No obvious problems with water availability within the monitoring unit.	Data and expert opinion from relevant environment agency Field observations	River flow affects a range of habitat factors of critical importance to characteristic flora and fauna, including current velocity, water depth, wetted area, substrate quality, dissolved oxygen levels and water temperature. The maintenance of both flushing flows and seasonal base flows, based on natural hydrological processes, is vital. Detailed investigations of habitat-flow relationships may indicate that a more or less stringent threshold may be appropriate for a specified reach; however, a precautionary approach would need to be taken to the use of less stringent values. As a guideline, at least 90% of the naturalised daily flow should remain available to the river throughout the year. Naturalised flow is defined as the flow in the absence of abstractions and discharges. This may be modified according to the specific sensitivity of the river type, with regulated rivers having somewhat lower sensitivity than unregulated ones. However, any relaxation of the guideline figure should relate to the desirability and ecological sustainability of regulating structures. The availability and reliability of data is patchy – long-term gauged data can be used until adequate naturalised data become available, although the impact of abstractions on historical flow records should be considered.
Water quality [Habitat structure and functioning]	Biological GQA Class: a/A or b/B depending on reach type. In addition, no drop in class from existing situation. Chemical GQA Class: a/A or b/B depending on reach type. In addition, no drop in class from existing situation. Water Quality Class: A1 or A2 depending on reach type. In addition, no drop in class from existing situation.	England, Wales and NI only (EA and EP standard monitoring protocol) England, Wales and NI only (EA and EP standard monitoring protocol) Scotland only (SEPA standard monitoring protocol)	A wide range of water quality parameters can affect the status of interest features, but standard biological monitoring techniques provide a reasonably integrated picture in relation to many parameters. The chemical module of the GQA scheme sets standards for dissolved oxygen, biochemical oxygen demand and total ammonia. It therefore covers a number of water quality parameters that commonly cause problems within river systems. The system in Scotland differs from that used elsewhere in the UK. A scale of five Water Quality Classes is used (A1, A2, B, C, D) for assessing water chemistry, biology, nutrients, aesthetic condition, and toxic substances. The lowest class derived from these values gives the overall classification of water. All classified reaches within the site that contain, or should contain, Atlantic salmon should comply with the targets given.
Water quality (contd.)	Precautionary target No unnaturally high loads of suspended solids Soluble Reactive Phosphorus: <0.02, 0.04, 0.06 or 0.1 mg L-1 depending on reach (ECS) type	Un-ionised ammonia (95-percentile) Field observations Annual mean	The un-ionised form of ammonia is highly toxic to freshwater fauna. As a guide, a target of <0.025 mg L-1 should be used, based on the EC Freshwater Fish Directive. Many characteristic species of different river types are susceptible to elevated solids levels, through reduced light availability (for photosynthesis), the clogging of respiratory structures, impaired visibility or siltation of coarse substrates. Lowland clay and alluvial river sections are more depositional in character and resident biota are generally more tolerant. As an approximate guide, a target of 25 mg L-1 can be used, based on the EC Freshwater Fish Directive – a more precautionary target of 10mg L-1 is proposed for most river reaches. A yet more stringent target may be appropriate for some river sections where solids levels are currently very low (such as chalk streams through the growing season) – an analysis of available data is suggested to verify target selection. Most of the monitoring unit should have clear water (except where natural peat staining occurs) – as an approximate guide, this should occur in at least 90% of the length of river observed. Elevated phosphorus levels interfere with competitive interactions between plant species, leading to dominance by attached forms of algae and a loss of characteristic plant species (which may include lower plants such as mosses and liverworts) The respiration of artificially large growths of benthic algae may generate poor substrate conditions (reduced oxygen availability and increased siltation) for fish and invertebrate species.
Substrate [Habitat structure and functioning]	No excessive siltation No evidence of excessive algal cover	Field observations	Most river SSSIs/ ASSIs do not extend to the entire catchment. Some species or life-cycle stages (e.g. juvenile pearl mussels, salmon eggs and fry) are potentially susceptible to damage from siltation, the source of which may lie elsewhere in the catchment outside the site boundary. Sources of silt include run-off from arable land and land trampled by livestock, sewage and industrial discharges. Where there is a perceived risk of damage occurring, or where the designated species is already believed to be in decline, a fluvial audit of the catchment is recommended. This is a relatively new approach developed by fluvial geomorphologists in the UK; further guidance should be sought from the appropriate freshwater specialists in the country conservation agencies. The level of siltation that occurs naturally in a reach varies depending upon the hydrodynamic regime; as a general guide, it should not exceed 10% of the length of the river observed. As an approximate guide, the cover of filamentous and epiphytic algae should not exceed a mean of 10% for the length of river observed.
Habitat structure [Habitat structure and functioning]	Channel form should be generally characteristic of river type with predominantly unmodified planform and profile. Bank and riparian zone vegetation structure should be near-natural. No or minimal impact on river flow from instream structures	Assess river morphology using RHS (see river SSSI protocol for details).	The river should support all of the habitat features necessary for designated interest features to thrive, in characteristic proportions*. RHS provides a general indicator of habitat diversity and character. Widening or deepening of channels, and extensive artificial reinforcement of banks, are indicators of unfavourable condition. Headwater sections are particularly vulnerable to reprofiling.
Plant community [Typical species]	Presence of characteristic plant species; absence of indicators of unfavourable condition. Full details of targets are given in the river SSSI protocol.	Survey of representative stretches at intervals of ca 5 km (see river SSSI protocol for details).	In-channel vegetation of the river should be dominated by characteristic species.
Non-native/introduced species [Typical species]	No impact on native biota from non-native or introduced species	Aquatic macrophytes – method contained within river SSSI protocol. Other organisms – expert judgement on the basis of external reports	Non-native species constitute a major threat to many river systems. For example, species such as signal crayfish have been responsible for much of the decline of native crayfish through competition, habitat damage and the introduction of crayfish plague.

* At the time of writing, techniques for assessing whether habitat features are characteristic of the river are under development by the Environment Agency.

Aspects of environmental disturbance to be noted as an accompaniment to assessing favourable condition

Objective	Specified assessment method (If appropriate)	Comment
No artificial barriers significantly impairing characteristic migratory species from essential life-cycle movements.		Barriers may take the form of weirs, barrages or intakes/off-takes that entrain characteristic species.
Fish introductions should not interfere with the ability of the river to support self-sustaining populations of characteristic species.	Use stocking consents	Many priority species can be affected by fish introductions, through increased predation, competition or genetic introgression, or through disease transfer. Stocking is undesirable within SSSIs/ASSIs unless undertaken as an agreed emergency interim measure for priority species whilst underlying adverse environmental factors are resolved.
Exploitation should not interfere with the ability of the river to support self-sustaining populations of characteristic species.	Assessed through recorded exploitation and status of target species	Key interest features under threat are Atlantic salmon, brown trout, and sea and river lampreys. Exploitation should be licensed at sustainable levels.

Tentative classification of river reaches

Dominant catchment geology		River Size		
		1	2	3
A	Hard upland geologies (all land over 330 metres) - impermeable poor geologies.	Headwater	River	Large river
B	Other Cambrian-Devonian geologies - hard mudstones and sandstones	Headwater	River	Large river
C	Jurassic and Cretaceous limestones - soft limestone and chalk.	Headwater	River	Large river
D	Triassic sandstones and mudstones - soft sandstones and mudstones in lowland areas.	Headwater	River	Large river
E	Mesozoic clay vales and Tertiary clays - impermeable rich geologies	Headwater	River	Large river

River size to be determined from Environment Agency flow categories



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RIVER ITCHEN SSSI _____

Conservation objectives for the European Interest on the SSSI

The conservation objectives for the European interests on the SSSI are [please retain relevant interests from list below]:

to maintain*, in favourable condition, the river as a habitat for:

- floating formations of water crowfoot (*Ranunculus*) of plain and sub-mountainous rivers;
- populations of Atlantic salmon (*Salmo salar*)
- populations of bullhead (*Cottus gobio*)
- populations of brook lamprey (*Lampetra planeri*)
- populations of white-clawed crayfish (*Austropotamobius pallipes*)

and the river and adjoining land as habitat for:

- populations of southern damselfly (*Coenagrion mercuriale*)
- populations of otter (*Lutra lutra*)

*** maintenance implies restoration, if the feature is not currently in favourable condition.**

The Conservation Objectives for the River Itchen SAC are, in accordance with para C 10 of PPG 9, the reasons for which the SAC was classified/designated.

FAVOURABLE CONDITION TABLE

The Favourable Condition Table will be used by English Nature and other relevant authorities to determine if a site is in favourable condition. Favourable condition is achieved when the targets given below are met.

The Favourable Condition Table should inform the scope and nature of any ‘appropriate assessment’ under the Habitats Regulations, but an ‘appropriate assessment’ will also require consideration of issues specific to the individual plan or project. The favourable condition table does not by itself provide a comprehensive basis on which to assess plans and projects as required under Regulations 20-21, 24, 48-50 and 54 - 85. The scope and content of an ‘appropriate assessment’ will depend upon the location, size and significance of the proposed project. English Nature will advise on a case-by-case basis.

Following an ‘appropriate assessment’, competent authorities are required to ascertain the effect on the integrity of the site. The integrity of the site is defined in para C10 of PPG9 as the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified. The determination of favourable condition is separate from the judgement of effect upon integrity. For example, there may be a time-lag between a plan or project being initiated and a consequent adverse effect upon integrity becoming manifest in the condition assessment. In such cases, a plan or project may have an adverse effect upon integrity even though the site remains in favourable condition.

Common targets for river habitat and selected species

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
River	Floating formations of water crowfoot (<i>Ranunculus</i>) Atlantic salmon bullhead brook lamprey white-clawed crayfish southern damselfly	Flow	Limits on licensed abstractions after modelling impacts. Audit every 6 years, if possible via CAMS.	Flow regime should be characteristic of the river. As a guideline, the impact (at any point in the SAC) of abstractions should be less than 10% of the naturalised daily mean flow throughout the year. Flow criteria already laid down for the river (e.g. for passage of migrating salmon) should also be complied with.	River flow affects a range of habitat factors of critical importance to designated interest features, including current velocity, water depth, wetted area, substrate quality, dissolved oxygen levels and water temperature. The maintenance of both flushing flows and base flows, based on natural hydrological processes, is vital. Detailed investigations of habitat-flow relationships may indicate that a more or less stringent threshold may be appropriate for a specified reach; however, a precautionary approach would need to be taken to the use of less stringent values. Naturalised flow is defined as the flow in the absence of abstractions and discharges. The availability and reliability of data is patchy - long-term gauged data can be used until adequate naturalised data become available, although the impact of abstractions on historical flow records should be considered. Springs are characteristic of chalk rivers and should be maintained. Headwater sections are particularly vulnerable to abstraction, and downstream migration of perennial heads, other than in drought conditions, is a sign of unfavourable condition.
	Floating formations of water crowfoot (<i>Ranunculus</i>) Atlantic salmon bullhead brook	Water quality	Biological class - Environment Agency's General Quality Assessment scheme. Assess every 5 years.	salmon - 'a' bullhead - >='b' lamprey species - >='b' white-clawed crayfish >='b' In addition, no drop in class from existing situation.	Generally, water quality should not be injurious to any life stage. A wide range of water quality parameters can affect the status of interest features, but standard biological monitoring techniques provide a reasonable integrated picture in relation to many parameters. The Biological Module of the Environment Agency's General Quality Assessment scheme is based on assessment of the macroinvertebrate community. All classified reaches within the site that should contain the interest feature

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
	lamprey white-clawed crayfish southern damselfly		River Ecosystem Class. Assess against Environment Agency monitoring results. Suspended solids (annual average). Assessment methods to be agreed with Environment Agency.	salmon -RE1 bullhead - >=RE2 lamprey species - >=RE2 >=RE white-clawed crayfish >=RE3 In addition, no drop in class from existing situation salmon >=10mg/l ¹ bullhead - >=25 mg/l ¹ lamprey species >=25 mg/l ¹ white-clawed crayfish >=25mg/l ¹	under conditions of high environmental quality should comply with the targets given. The River Ecosystem Classification 1995 sets standards for dissolved oxygen, biochemical oxygen demand, total and un-ionised ammonia, pH, copper and zinc. It, therefore, covers a number of water quality parameters which can cause problems within river systems. All classified reaches within the site that should contain the interest feature under conditions of high environmental quality should comply with the targets given. Elevated levels of suspended solids can clog the respiratory structures of the listed species, with salmon being the most susceptible. Suspended solids measurements are also essential to the estimation of particulate loads within the river network (in combination with gauged flow data), which provides an indication of the risk of siltation problems. The target of 25mg/l ¹ is based on the EC Freshwater Fish Directive - a more precautionary figure has been used for salmon to help protect substrates used for salmon spawning.
			Soluble Reactive Phosphorus (annual mean) (Total Reactive Phosphorus as measured by the Environment Agency is	0.06mg/l mid-altitude watercourses on hard substrates. Lowland, small and medium-sized watercourses on chalk and sandstone.	Elevated phosphorus levels interfere with competitive interactions between different higher plant species and between higher plants and algae, leading to the loss of characteristic higher plants and large diurnal sags in dissolved oxygen levels. <i>Ranunculus</i> habitat is extremely vulnerable. The respiration of artificially large growths of benthic algae may generate poor substrate conditions for species such as the lampreys (in the larval stage).

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
			acceptable)		
	Floating formations of water crowfoot (<i>Ranunculus</i>) Atlantic salmon bullhead brook lamprey white-clawed crayfish	River substrate	Silt content (Optimal form of measurement to be decided in consultation with the Environment Agency.)	Channels should be dominated by clean gravels. Maximum silt content: Ranunculus - <20% in top 10cm of mid-channel gravels; salmon -<10% in top 30cm of spawning substrates; lampreys - use salmon target; bullhead - no excessive siltation on the surface of coarse substrates.	Siltation of riverine sediments, caused by high particulate loads and/or reduced scour within the channel, is a major threat to interest features. Elevated silt levels can interfere with the establishment of <i>Ranunculus</i> plants, and with egg and fry survival in salmon, lampreys and bullhead. The requirements of species vary depending upon use of the substrate. Some relate to the level of aeration within the substrate and some to the ability of the substrate to physically catch eggs or plant fragments in surface interstices. The target for salmon has been used for lamprey species in the absence of species-specific information (although it is recognised that lamprey utilise only the top few centimetres for spawning). Where there are upwelling springs within the river bed, the target for salmon can be revised upwards, due to increased substrate aeration. Sources of silt include - run-off from arable land and land trampled by livestock, sewage and industrial discharges.

Extra targets for floating formations of *Ranunculus* of plain and sub-mountainous rivers

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
River	Floating formations of water crowfoot (<i>Ranunculus</i>)	Extent and composition	Mapping of representative sample stretches (to be identified) in June or July every 3 years.	Presence of characteristic plant species; absence of indicators of unfavourable condition.	<p>The chalk river component of this plant community comprises <i>Ranunculus penicillatus</i> var <i>pseudofluitans</i>, associated in the channel with <i>Callitriche obtusangula</i> or <i>C. platycarpa</i>, rarely with <i>Oenanthe fluviatilis</i> or <i>Potamogeton lucens</i>, and up to 5% cover of <i>Myriophyllum spicatum</i>.</p> <p>In shallow bankside margins the following plants may be present: <i>Berula erecta</i>, <i>Apium nodiflorum</i>, <i>Rorippa nasturtium aquaticum</i>, <i>Myosotis scorpioides</i>, <i>Veronica anagallis-aquatica</i> and <i>Veronica beccabunga</i>.</p> <p>In-channel vegetation of the river should be dominated by this community.</p> <p>The absence of <i>Ranunculus</i> and presence of blanket weed and other algae, or dominance of <i>Potamogeton pectinatus</i> are signs of unfavourable condition.</p>
		Reproduction	Mapping of flowering <i>Ranunculus</i> in sample stretches (to be identified) every 3 years. Annual observations in June/July. Audit of consents every 3 years (Environment Agency and English Nature).	<i>Ranunculus</i> should be able to flower and set seed, in suitable habitat.	<p>Flowering later than mid-July and weed cutting or other activities which do not leave patches (at least 25% in every 100 metres of river) to flower and set seed are indicators of unfavourable condition.</p> <p>Use of herbicides should be avoided.</p>
		River form	Measure channel profile as baseline by RHS (?) and identify stretches for restoration. Audit progress with restoration every 6 years.	Channels should be generally characteristic of river type and appropriate to naturalised flow conditions.	<p>Widening or deepening of channels, and extensive artificial reinforcement of banks, are indicators of unfavourable condition. Headwater sections are particularly vulnerable to reprofiling. Restoration of degraded channels to a more characteristic state should be undertaken, where practical, within a</p>

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
					strategic framework and using techniques that work with nature. This may include removal of structures within rivers, after individual assessment.
		Flow		<i>See 'common targets'</i>	
		Water quality		<i>See 'common targets'</i>	
		River substrate		<i>See 'common targets'</i>	

Extra targets for Atlantic salmon (*Salmo salar*)

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
River	Atlantic salmon	Flow		See 'common targets'	
River	Atlantic salmon	Water quality		See 'common targets'	
River	Atlantic salmon	River substrate		See 'common targets'	
River	Atlantic salmon	Habitat structure	Area of spawning habitat. <i>(Form of assessment to be decided for measures in this column.)</i>	Maintain and where necessary restore	This habitat is defined as stable coarse substrate without an armoured layer, in the pebble to cobble size range (16-256mm) but with the majority being <150mm. Water depth during the spawning and incubation periods should be 15-75cm.
			Area of nursery habitat.	Maintain and where necessary restore	Fry habitat is indicated by water of less than 20cm deep and a gravel/pebble/cobble substrate. Parr habitat is indicated by water of 20-40 cm depth and similar substrate.
			Number of adult holding areas.	Maintain and where necessary restore	Holding areas are defined as pools of at least 1.5 m depth, with cover from features such as undercut banks, vegetation, submerged objects and surface turbulence.
			Area of submerged and marginal plants	Maintain patchy cover	Submerged and marginal vegetation is used by juvenile salmon in chalk rivers. Cutting operations should aim to leave at least 50% of the vegetation
			Extent of bankside tree cover with submerged tree root systems	Maintain to an extent characteristic of the river type	Overhanging trees provide valuable shade and food sources, whilst tree root systems provide important cover and flow refuge for juveniles.

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
			River form (use RHS ?)	Maintain and where necessary restore the characteristic physical form of the river channel	The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the spawning, juvenile and migratory requirements of the species. The close proximity of different habitats facilitates movement to new preferred habitats with age. Operations that widen, deepen and/or straighten the channel reduce variations in habitat. New operations that would have this impact are not acceptable within the SAC, whilst restoration <i>may/will</i> be needed in some reaches.
River	Atlantic salmon	Access	Artificial obstructions (Baseline survey, then check every 6 years).	No artificial barriers significantly impairing adults from reaching existing and historical spawning grounds, and smolts from reaching the sea.	In all river types, artificial barriers should not exceed 3 m in height, less where this is inadequate depth below the obstruction for salmon to leap effectively (<i>in chalk rivers the height should not exceed 45cm</i>). Natural barriers to potentially suitable spawning areas should not be circumvented without an appropriate assessment of the impact on resident biota in these areas. Appropriate steps should be taken to ensure that migrating smolts are not entrained in off-takes from the river (such as in fish-farm intakes).
River	Atlantic salmon	Biological disturbance	Fish introductions (Check against Environment Agency licences.)	No stocking of salmon, unless agreed by English Nature to be in the best interests of the population.	Genetic differences have been found between Atlantic salmon populations in different catchments, and between different tributaries within a single catchment. These differences may have adaptive significance and, therefore, need to be conserved. Population enhancement by habitat improvement and control of exploitation is the main nature conservation focus; stocking should only be considered as an emergency interim measure, and it is not currently considered to be in the best interests of the SAC.

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
				No stocking of other species at excessively high densities in salmon spawning and nursery areas.	The presence of artificially high densities of other salmonids creates unacceptably high levels of predatory and competitive pressure on juvenile salmon.
				Effective screening on all fish farm intakes and discharges.	Escapes from fish farms are a form of uncontrolled introduction and should be prevented.
			Exploitation (Application of voluntary agreements and Environment Agency byelaws.)	Steps taken to ensure that exploitation does not interfere significantly with the ability of the river to achieve its Minimum Biological Acceptable Limit (see biological criteria in the annexe 'Guidance on verifying favourable condition').	Where an SAC is not achieving its MBAL 4 years out of 5, river-specific controls on exploitation need to be put in place irrespective of the underlying causes of poor performance. These should consist of a package of measures operating over a period of 10 years, to be implemented as a matter of urgency (preferably within 1 year). The choice of exploitation controls depends on the degree of non-compliance with the MBAL and a range of river-specific considerations. [<i>Insert current performance of site as a 3-year mean percentage of the MBAL.</i>] Controls on exploitation should cover migratory passage to the SAC within territorial waters, including estuarine and coastal net fisheries.

[Note (not for inclusion in Favourable Condition Tables)]

The performance of each SAC is recorded in the annual salmon catch statistics published by the Environment Agency, with adult run-size for each river being expressed as a percentage of the MBAL (or Conservation Limit). English Nature Local Teams should present the most recent 3-year mean value. Various control options are available, including the mandatory release of all multi-sea-winter fish; additional restrictions on the angling season; bait and method of capture restrictions; and a complete no-kill policy. Controls would need to be implemented through the Environment Agency's byelaw-making powers, requiring liaison with their local office. Further generic guidance on negotiating exploitation control regimes will be produced in the near future.]

Extra targets for bullhead (*Cottus gobio*)

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
River	Bullhead (<i>Cottus gobio</i>)	Flow		See 'common targets'	
		Water quality		See 'common targets'	
		River substrate		See 'common targets'	
		Habitat structure	Extent of gravel/pebble-dominated substrate. (Assessment methods in this column to be agreed with Environment Agency.)	Maintain and where necessary restore	Females lay sticky eggs on the underside of stones. Larger stones on a hard substrate, providing clear spaces between the stream bed and the underside of pebbles/cobbles, are therefore important. There should be >5 cm water depth over riffles in the summer.
		Extent of slack-water refuges	Maintain and where necessary restore	These provide important refuge against high flow conditions. Suitable refuges include pools, submerged tree root systems and marginal vegetation with >5cm water depth.	
		Extent of high canopy tree cover	Maintain intermittent cover [where characteristic of the river/reach]	The relative importance of shade compared to the provision of woody debris is unclear, but the maintenance of intermittent tree cover in conjunction with retention of woody debris ensures that habitat conditions are suitable. <i>In lowland reaches without any riparian trees, it may be desirable to introduce a limited amount of cover.</i>	
Extent of submerged higher plants	Maintain patchy cover [where characteristic of the river/reach]	The importance of submerged higher plants to bullhead survival is unclear, but it is likely that where such vegetation occurs it is used by the species for cover against predators. Weed-cutting should be limited to no more than ½ of channel width in a pattern of cutting creating a mosaic of bare substrate and beds of submerged plants.			

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
			Extent of woody debris	Should be retained [<i>where characteristic of the river/reach</i>]	Bullheads are particularly associated with woody debris in lowland reaches, where it is likely that it provides an alternative source of cover and spawning substrate.
			River form	Maintain and, where necessary, restore the characteristic physical form of the river channel.	The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the spawning, juvenile and migratory requirements of the species. The close proximity of different habitats facilitates movement to new preferred habitats with age. Operations that widen, deepen and/or straighten the channel reduce variations in habitat. New operations that would have this impact are not acceptable within the SAC, whilst restoration <i>may/will</i> be needed in some reaches.
		Access	Artificial obstructions	No significant impediment to movement between reaches.	Vertical drops of more than 18-20 cm are sufficient to prevent upstream movement of adult bullheads. They will therefore prevent recolonisation of upper reaches affected by lethal pollution episodes, and will also lead to constraints on genetic interactions that may have adverse consequences.
		Biological disturbance	Introductions	No stocking/transfers of bullhead unless agreed by English Nature to be in the best interests of the population.	Bullheads are relatively sedentary and interactions between populations in different parts of the catchment and in different catchments are likely to be limited, suggesting the existence of genetically discrete populations. Since they are of no angling interest, deliberate transfers between sites are unlikely to have been undertaken in the past, such that the genetic integrity of populations is likely to be intact.
				No stocking of other fish species at excessively high densities in salmon spawning and nursery areas.	The presence of artificially high densities of salmonids and other fish will create unacceptably high levels of predatory and competitive pressure on juvenile and adult bullhead.

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
				Effective screening on all fish farm intakes and discharges	Escapes from fish farms are a form of uncontrolled introduction and should be prevented.
				Absence of non-native crayfish	Bullhead densities have been found to be negatively correlated with densities of non-native crayfish in the River Great Ouse, suggesting competitive and/or predator-prey interactions.

Extra targets for brook lamprey (*Lampetra planeri*)

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
River	Brook lamprey (<i>Lampetra planeri</i>)	Flow		See 'common targets'	
		Water quality		See 'common targets'	
		River substrate		See 'common targets'	
		Habitat structure	Area of spawning habitat. (Assessment methods in this column to be agreed with the Environment Agency.)	Maintain and where necessary restore	This habitat is defined as well-oxygenated gravel/pebble-dominated (1.5-11cm) substrate of at least 10cm depth, overlain by a range of water depths (0.2-1.5m). Typical spawning locations are upstream of riffles and downstream of weirs. River and sea lamprey typically spawn in deeper water than brook lamprey, but in larger river reaches brook lamprey also spawn in deeper areas.
		Area of nursery habitat	Maintain and where necessary restore	This habitat is defined as open-structure, aerated, silty and sandy substrates, between 2 and 40cm depth, typically overlain by less than 0.5m of water. Slack-water channel margins are particularly important, whilst silt accumulations behind weirs can also be valuable in impounded sections. Brook lamprey will be the only species present above impassable weirs.	
		Area of emergent riparian vegetation	Maintain a high extent throughout the river system	Emergent vegetation within marginal nursery habitat stabilises the substrate and greatly increases habitat suitability.	
		Extent of bankside tree cover	Maintain to an extent characteristic of the river type	This helps to provide temperature micro-gradients within the channel, which provides greater flexibility in habitat selection.	

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
			River form	Maintain and where necessary restore the characteristic physical form of the river channel	The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the spawning, juvenile and migratory requirements of the species. The proximity of different habitats facilitates movement to new preferred habitats with age. Operations that widen, deepen and/or straighten the channel reduce variations in habitat. New operations that would have this impact are not acceptable within the SAC, whilst restoration <i>may/will</i> be needed in some reaches.
		Access	Artificial obstructions	No artificial barriers significantly impairing adults from reaching existing and historical spawning grounds.	Lampreys can pass some potential barriers by attaching themselves to structures or river banks by their suckorial discs and creeping up by strong bursts of swimming. The passibility of barriers by lampreys should be assessed on a site-specific basis, most sensibly by survey of the upstream limit of distribution of .
		Biological disturbance	Introductions	No stocking/transfers of lampreys unless agreed by English Nature to be in the best interests of the population.	It is uncertain whether there are significant genetic differences between lamprey populations of the same species. Since they are of no angling interest, deliberate transfers between sites are unlikely to have been undertaken in the past, such that the natural genetic character of populations is likely to be intact. The degree of fidelity to natal spawning grounds is unclear. Any agreed introductions should involve local stock as a precaution.

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
			Exploitation	Zero exploitation until further notice	Lampreys have recently become popular in the UK as bait for pike-fishing. There are also indications that UK populations are sought after as a delicacy in Europe, where stocks are declining. Adult lampreys are usually caught by trapping, whilst juvenile lampreys can be removed by sieving, netting or digging out nursery habitat. Anecdotal evidence of adult trapping suggests heavy losses of fish on some rivers. In the absence of adequate knowledge of population dynamics and sustainable yields, exploitation is not acceptable within cSACs.

Extra targets for white-clawed crayfish (*Austropotamobius pallipes*)

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
River	White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Water quantity		Rivers - as per 'common targets'.	
		Water quality		Rivers - as per 'common targets'.	
		Habitat structure	Extent of cobbles/ boulders	Maintain to an extent characteristic of the river type	Where they occur naturally, cobbles and boulders are used extensively by crayfish as refuge. Engineering works can result in the loss of large material - any works should at least replace the pre-works availability of such refuges.
			Extent of large woody debris	Retain [where characteristic of the river/still water]	Where they are present, fallen branches and trunks are used extensively by crayfish as refuge. Woody debris is typically removed during maintenance operations, but it is important to retain as much as possible, particularly where other forms of refuge are in short supply.
			Density of bankside refuges	Submerged tree root systems and/or crevices in banksides should be available at intervals	These provide important refuges and are often lost during engineering operations. Any works should at least replace the pre-works availability of refuges.
			Extent of submerged and marginal vegetation	Maintain patchy cover where characteristic of the river type.	Submerged higher plants provide cover away from the banks, and also represent a valuable food source. Marginal emergents also provide important cover and feeding opportunities. Vegetation management should be limited to no more than 50% of the channel width (submerged plants) and 50% of bank length (marginal fringe).
			Extent of overhanging riparian vegetation	Should be present intermittently along the bank throughout the year.	This should cover at least 10% of bank length, distributed in patches along the margins, and considerably more where other forms of refuge are in short supply.

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
			Extent of bankside tree cover	Maintain to an extent characteristic of the river type	Overhanging trees provide valuable shade and food sources, and additionally supply woody debris to the river. Submerged tree-root systems provide important cover and refuges from flood flows.
			River form [<i>not on standing waters</i>]	Maintain and, where necessary, restore the characteristic physical form of the river channel	A natural channel morphology provides a diversity of refuge and feeding opportunities. The proximity of different refuges facilitates foraging and the movement of individuals to different habitats with age. Operations that widen, deepen and/or straighten the channel reduce variations in habitat. New operations that would have this impact are not acceptable within the SAC, whilst restoration <i>may/will</i> be needed in some reaches.
		Biological disturbance	Introductions	No stocking/transfers of white-clawed crayfish unless agreed by English Nature to be in the best interests of the population.	Little work has been undertaken on crayfish genetics. This advice takes the precautionary principle and assumes genetic diversity needs to be maintained and that there may be genetic differences between populations that could be of conservation significance. Care should be taken in any captive breeding programmes that genetic diversity is not reduced by in-breeding.
				No stocking of fish species at excessively high densities	The presence of artificially high densities of fish creates unacceptably high levels of predatory pressure on juvenile crayfish. A protocol for determining excessively high densities needs to be determined - in the absence of this, any stocking exercise raising fish densities within the stocked reach by more than 10% of the estimated carrying capacity for the size class being stocked should be regarded as high risk.
				Effective screening on all fish farm intakes and discharges	Escapes from fish farms are a form of uncontrolled introduction and should be prevented.

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
				Absence of non-native crayfish species	Once non-native crayfish species are established in a water body, native populations are usually eliminated quite rapidly, if not by competition and predation then by crayfish plague. If already present in the SAC, measures should be taken to control their spread and, if possible, reduce their numbers.
				Absence of individuals infected with crayfish plague	Crayfish plague can be introduced by the entry of non-native crayfish species into a site, but also by a variety of other routes, including contaminated equipment (nets, boots etc.) and stocked fish from infected waters. Outbreaks of crayfish plague typically result in 100% mortalities, unless there are isolated headwaters with crayfish in the catchment. This target requires that the utmost care is taken in terms of fish stocking and general surveying/monitoring to ensure that plague vectors are not introduced. Disinfection or thorough drying of equipment (or perhaps dedicated equipment for use only in native crayfish rivers) and sourcing of stocked fish from uninfected waters are vital elements.
				Thelohianiasis (Porcelain Disease) should not affect more than 10% of the population	This disease rarely causes mass mortalities and may be present in a population at low levels without apparent harm. However, a prevalence higher than 10% is of concern.

Extra Targets for the Southern Damselfly (*Coenagrion mercuriale*)

Operational Feature	Criteria Feature	Attribute	Measure	Target	Comments
chalk stream		Water quality	GQA River Ecosystem Class Suspended solids	see 'common targets' for rivers GQA = 'a', RE1, suspended solids 25mg/l'	
		Water quantity		see 'common targets' for rivers	No values can be given for flow requirements. Future research funded by EN and EA will investigate this.
		Vegetation composition	frequency or percentage cover	Channels in the occupied area with frequent to dominant cover of <i>Apium nodiflorum</i> , <i>Rorippa nasturtium-aquaticum</i> and/or <i>Veronica beccabunga</i> . Tall marginal vegetation (e.g. <i>Glyceria maxima</i> , <i>Sparganium erectum</i>) not entirely obscuring channels by the end of July along three-quarters of channels in the occupied area.	
		<i>Extent of suitable larval habitat</i>	comparison with reference point map	No year-on-year reduction of channels, runnels or the area of seepages.	Reductions may result from scrub encroachment, excessive development of coarse grasses, drainage, deepening of channels, or installation of wells. 'No reduction' may be too rigorous since variation will occur with natural changes in climate.
		Shade	percentage cover	Not more than 10% increase in cover of trees and scrub, compared with baseline map over six years.	The damselfly does not use channels shaded by scrub. It is expected that scrub will be managed close to suitable channels.

Extra Targets for the European Otter (*Lutra lutra*)

Operational feature	Criteria feature	Attribute	Measure	Target	Comments
River	Otter	Water quality	EA scale	“Good”, with no pollution incidents	Refer to Environment Agency for data
		Flow rate	Mean annual flow rate	No reduction attributable to increased abstraction.	Data from Environment Agency
		Site integrity	Total area	No reduction or fragmentation of area	
		Fish stocks	EA assessment	Fish stocks appropriate to the nutrient status of the river No significant decline in fish biomass or species diversity	Refer to Environment Agency for sample data
		Disturbance	Extent of public access to river	No significant change to river or bankside usage; no significant development	
		Bankside cover	Proportion of bank lined with trees, scrub or other thick cover	No overall permanent decrease	Some change acceptable as long as it is appropriately mitigated
		Presence of otters	Signs of otters	Signs of otters found at least once per year	Use data from national or county surveys

Site-specific aspects: general

*In many cases, habitat conditions will be impacted along certain river reaches, perhaps in terms of low river-flows due to abstraction; loss of spawning gravels due to river engineering; or poor water quality due to effluent discharges and agricultural loads. In these cases, **targets for restoring habitats should be included** in the conservation objectives for the site, with an indication in the 'comments' section of the human activities causing particular problems (such as abstraction, effluent discharges, and agricultural land-use practice, the latter particularly in relation to silt loads from unacceptably high levels of soil erosion).*

Additional parameters to consider within appropriate assessments

A range of specific parameters may be relevant to the assessment of the likely impact of a plan or project in addition to those specified in the favourable condition table. This should not be considered as an exhaustive list but indicates some key areas of concern.

Water column parameters

Consideration of the effects of **heavy metals, herbicides, pesticides** (particularly **sheep dip chemicals**) and **hydrocarbons** is essential. In particular, species such as white-clawed crayfish and salmon are highly susceptible to even very low concentrations of sheep dip. The risks of impact on *Ranunculus* habitat of riparian applications of atrazine and isoproturon on maize crops are also of particular concern.

Water hardness is a key issue for a number of species, particularly white-clawed crayfish. Pearl mussel almost always occurs in waters with a hardness of <10mg CaCO₃, whilst white-clawed crayfish is invariably found in waters greater than this value. The activity most likely to interfere with water hardness is the mass transfer of water from areas with different geologies.

Effects on **temperature regime** may have important consequences for a number of species. For instance, crayfish breeding is initiated by an extended period of water temperatures below 10 deg C during the autumn, and may be adversely affected by heated discharges.

Substrate quality

Elevated **sediment phosphorus** levels may lead to excessive growths of tolerant rooted-macrophytes and benthic algae, and may also result in enhanced release of soluble phosphorus to the water column.

Sediment oxygen levels are important to the survival of salmon eggs and fry, lamprey eggs and ammocetes and probably juvenile pearl mussels. Inorganic silt can interfere with aeration within coarse substrate, but in both coarse and fine substrate the sediment oxygen demand is a key consideration, driven by the presence of degradable organic matter. In siltbeds, levels of organic matter that generate anoxia or near-anoxia will make the habitat unsuitable for lampreys.

Guidance on verifying favourable condition in relation to designated species

Assessment of the population will help to determine whether the measures taken within the site to protect the population and its habitat are adequate. The following criteria are suggested for determining whether a population is in a favourable state both within SACs and in its wider range. This guidance may also be useful when considering possible effects on site integrity (in relation to the potential for off-site impacts to affect the population within the SAC). This guidance will be refined, when further planned research into monitoring and population assessment protocols has been undertaken.

English Nature is putting forward criteria for discussion with the Environment Agency and others. No decision has been taken on the frequency and extent of any monitoring programme.

Species	Attribute	Target	Comments
Atlantic salmon	Adult run	Total run size at least matching the Minimum Biological Acceptable Level (MBAL) for the river in 4 years out of 5, including a seasonal pattern of migration characteristic of the river and maintenance of the multi-sea-winter component.	A MBAL is set for each catchment by the Environment Agency, in terms of eggs per unit area of river, which can be extrapolated to an adult run size necessary to achieve it. Total run-sizes are reported annually in relation to the MBAL for each river. It is important that the MBAL takes account of the full potential of the catchment to support spawning <i>under conditions of low anthropogenic impact - this will require investigation at the national level of the derivation of MBALs.</i>
	Juvenile densities	These should not differ significantly from those expected for the river type/reach under conditions of high physical and chemical quality.	Expectation needs to be tempered by the intrinsic ability of the river type to support salmon. Fish classification schemes operated regional and nationally by the Environment Agency should permit an interpretation of performance.
Bullhead	Adult densities	There should be no reduction in densities from existing levels, and in any case no less than 0.2 m ⁻² in upland rivers and 0.5 m ⁻² in lowland rivers.	Routine Environment Agency monitoring is not capable of providing suitable data. A least-cost methodology for monitoring this attribute is being investigated, involving the sampling of representative reaches within an SAC.
	Age structure	At least 3 year-classes should be present at significant densities in upland rivers, 4 in lowland rivers.	As above
Lampreys		No advice available at present	As above
White-clawed crayfish	Spawning	Berried females present during the period November to April.	As above
	Population densities	These should not differ significantly from those expected for the river type/reach under conditions of high physical and chemical quality, and in any case should not drop below recent levels.	As above