

Rivers, streams, floodplains and fluvial processes

(Substantial reviews in 2004 and 2007)

1. A Definition

Rivers and streams are among the most valued elements of our natural environment in Devon, both in terms of the characteristic wildlife that they support, but also and perhaps more fundamentally, as a source of water which is the basis for all life, human and non-human alike.

Rivers, however, are also natural geomorphological systems typically including an active channel with marginal floodplains. In naturally evolving river systems, sinuous meanders often develop in the channels, eroding their banks on the faster flowing outsides of the bends, but depositing sediments on the insides. At times of flood the river expands beyond its channel and flow can occupy the entire floodplain area, these being also associated with the deposition of silt as net flow slows down accordingly.



Devon's rivers systems have evolved over 100s of 1000s of years and often record this history as terrace deposits on very gently sloping platforms above the level of the modern system. These terraces are fragments of earlier floodplains, left high and often dry when the entire system suddenly cut down in response to the changing sea-levels of the cycle of ice ages and interglacials of the last 600,000 years or so. These terraces are not only crucial to the understanding of the evolution of the landscape of modern Devon, they also occasionally yield evidence of some of the County's earliest inhabitants in the form of Palaeolithic stone tools.

This Action Plan concerns all flowing perennial or seasonal rivers and streams, including tidal rivers down to the point where saline influence becomes dominant. It also includes artificial channels such as canals and ditches. Floodplains are included irrespective of size, as are associated features such as actively eroding river cliffs. Features of the ancient forebears of modern systems are also included, in particular river terraces and their associated sediments. As rivers are active geomorphological systems, the factors that

affect these fluvial processes, such as abstraction, canalisation, flood defence works, etc, are all relevant to this plan.

Rivers and their valleys are important wildlife corridors along which animals and plants move to new areas of habitat. Where floodplains function naturally they have multiple benefits: they accommodate floodwaters, reducing the severity and delaying the onset of flooding further downstream; they often include areas with high wildlife value, including wetlands; and they can have a positive influence on the quality of water draining to the river. Unmodified fluvial processes may result in the creation of new areas of natural habitat.

Devon rivers are typically fairly short and steep, with the downstream sections truncated by historic geological processes. Most are not heavily modified, canalised or extensively maintained outside of specific flood defence schemes. However, the lower reaches of several rivers (e.g. Tamar, Taw, Clyst) are embanked, separating river and floodplain. In addition, less obvious historic modification is fairly widespread, though in many cases rivers have readjusted. While routine river management is less common than was once the case (like many other land management tasks), more emphasis is now placed on managing for game fishing. Water quality is generally fairly good, although nutrient levels are often elevated above the naturally low conditions of many rivers. Higher plant floras are locally important and invertebrate communities, both aquatic and associated terrestrial species, tend to be of high value although not necessarily diverse.

2. Why an Action Plan?

Devon's rivers and streams have created much of the County's landscape character. Fluvial processes have carved valleys and created floodplains. Their well-being underpins much of our characteristic wildlife habitats and species, as well as the most fundamental activities of man. These systems are often also of geomorphological interest and a number of Devon's rivers contain features considered to be of national importance, including well studied meander belts and floodplain depositional systems.

Rivers and their flood plains have significant economic importance to Devon, for fishing and agriculture respectively, and the natural beauty of our rivers is a vital element in making Devon's landscape so attractive for leisure and tourism.

Rivers are subject to many pressures, however, both direct and indirect, and from a wide range of human activities. Modern agricultural practices in this predominantly rural area can result in increased sediment and nutrient run-off. An expanding population results in increased demands for water and building land which can include level floodplain areas. Flood defence and other river management activities can result in significant modifications to the physical structure and natural processes of river systems.

Ancient river features are also vulnerable as they form often ideal level building sites above active floodplains. They can also include gravel deposits which have locally been extensively exploited in the past.

3. Characteristic features and wildlife of Devon's river systems

Devon rivers and streams have a variety of types; many are "flashy" fast-flowing upland watercourses, but the County also contains slow flowing and more meandering lowland rivers. They flow over a varied geology and have diverse landforms and land-uses. Devon's river catchments have a relatively high density of streams per hectare of land compared to the average for England, due to the County's high rainfall combined with predominantly impervious bedrock or superficial deposits and locally steep slopes.



Dartmoor is the source for many of Devon's rivers, including the Teign, Dart, Avon, Erme, Yealm, Plym, Tavy, Okement and Taw, while Exmoor is where the Exe, Barle, Lyn and many of the North Devon coastal streams begin. From the upland moorland and blanket bogs where they rise, they flow through steep wooded gorges, down to the rich pastoral and arable areas of lowland Devon where they increasingly gather silt and nutrients, and where features such as gravel and pebble beds, and earth and silt banks are formed.

The upper courses of these rivers support animals and plants adapted to fast-flowing water conditions, such as dippers, grey wagtails, salmon, bullheads, mosses and liverworts (but few aquatic higher plants). The lower courses of these rivers have an abundant higher plant flora, due to their more constant flows and higher nutrients, and provide the habitat for a plethora of invertebrates including the dazzling damselflies and dragonflies. Locally, extensive gravel bars provide an important habitat for a diverse range of invertebrates. Birds such as the heron and kingfisher are found predominantly on these lower courses since here the water is less turbulent and allows for easier fishing. Certain permanent grasslands are important for wildlife including many bird species like breeding lapwing and snipe and wintering black-tailed godwit.

In the west of the county the Torridge and Tamar rise on the moors and wetlands of Hartland on the Carboniferous 'Culm'. The upper reaches of these rivers have a lowland style and are fed mostly by tributaries which mainly flow across agricultural land. They also include, however, tributaries which originate on Dartmoor, bringing more acidic and "flashy" water to rivers which are otherwise relatively nutrient-rich for Devon. Although they are gravel-bedded,

they also carry large amounts of silt, which is locally deposited within the course, providing a home for many invertebrates.

The Abbey River and Hartland Coastal Streams are short, tumbling into the sea through deeply-cut and wooded valleys, and often pouring over a waterfall to reach the sea. These streams are relatively undisturbed and support brown trout, bullheads and otters, and provide the moisture for mosses and liverworts in the oak woodlands of the valleys.



The East Devon rivers of the Axe, Sid and Otter are very different in nature from the other rivers of Devon, emerging along the spring lines of the Blackdown Hills and from the important groundwater aquifers which underlie these catchments. These springs also feed rare mire communities and species-rich wet alder woodlands. The Axe is the only truly lowland river in Devon that is not “flushed” by fast-flowing water from the upland areas of the county. It also has some of the most important higher plant communities of any of the County’s rivers. The Sid valley, however, is shorter, narrower and steeper than those of the Axe and Otter and a network of small tributaries feed it as it falls steeply to the sea.

Important habitats of the County’s river systems include:

- Quaking bogs (now defunct) associated with water courses in the Blackdowns, known as “Schwingmoor”.
- Ponds and seasonally water-filled hollows.
- Floodplain woodland, wet woodland and alder-lined banks.
- Fen and ditch systems rich in invertebrates and plants.

4. Special species

The following species of conservation concern are associated with estuaries in Devon. Species marked (p) are ‘Species of Principal Importance in England’ (NERC Act, S.41).

- **Mammals**: Daubenton’s bat, Natterer’s bat, otter (p), water vole* (p), water shrew
- **Birds**: kingfisher, dipper, grey wagtail, sand martin, reed bunting (p), sedge warbler, goosander, snipe, grey heron

* Currently believed extinct in Devon
Devon BAP
Version: May 2009

- **Fish:** Atlantic salmon (p), bullhead, brook lamprey, river lamprey (p), sea lamprey (p), brown trout (p)
- **Invertebrates:** river shingle beetles, especially *Perileptus areolatus* and *Hydrochus nitidicollis* (p), white-legged damselfly, beautiful demoiselle, golden ringed dragonfly, white-clawed crayfish (p), freshwater pearl mussel (p), fine-lined pea-mussel (p)
- **Lichens:** river jelly lichen (p), *Dermatocarpon luridum*, *Ephebe lanata*, *Massalongia carnosa*
- **Bryophytes:** multi-fruited river moss (p), tiny fern-moss (p), *Fontinalis antipyretica*
- **Vascular plants:** triangular club rush (p), three-lobed water crowfoot (p), stream water-crowfoot, short-leaved water-starwort, Cornish moneywort *Sibthorpia europaea*



5. Special geodiversity features

Devon's rivers and stream systems include a wide range of geomorphological features, including:

- Old channel features (including meanders and oxbow lakes)
- Gravel bars and silt beaches
- Debris dams
- Backwaters
- Gorges (such as Lydford and Teign)
- River cliffs
- Alluvial fans
- Waterfalls
- Springs
- Pot holes
- Terraces and terrace deposits

In addition, associated exposures of bedrock geology in the river bed and banks include the following Key Geological Features:

- Stratigraphical (Phanerozoic): Devon (marine) carbonates and clastics
- Igneous and metamorphic geology: Igneous rocks linked to the northern European Variscan fold-belt
- Igneous and metamorphic geology: Permian-Carboniferous igneous rocks of Britain
- Mineralogical, economic: Sn-Cu-AS veins associated with Cornubian batholith
- Mineralogical, economic: Contact metamorphic assemblages

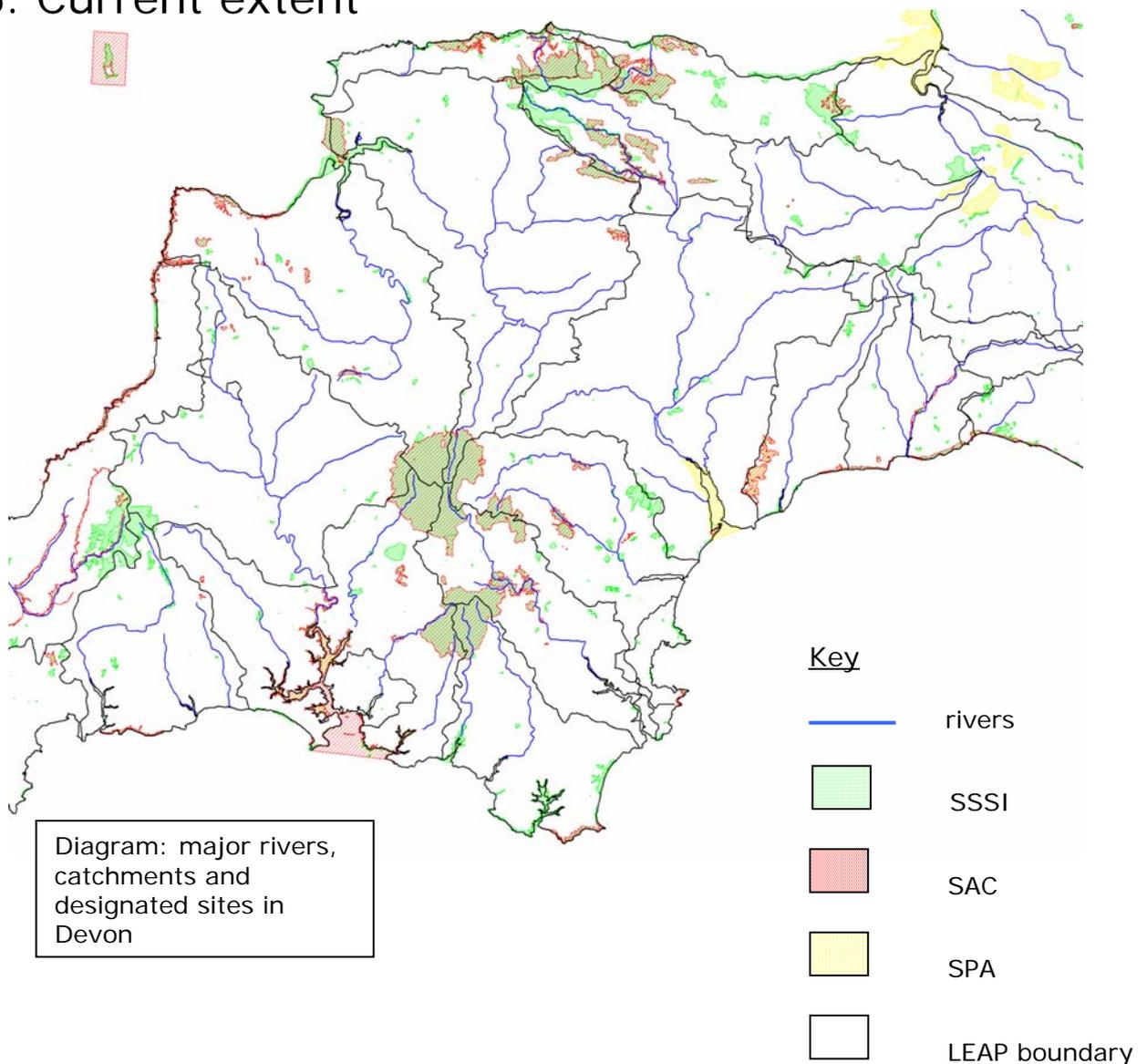
- *Structural: Variscan nappes and allochthon/ parautochthon of Devon and Cornwall

Other important Earth heritage features which are represented in river and stream bed and bank exposures include:

- Devonian Igneous rocks
- Lower Carboniferous stratigraphy and palaeontology (marine)
- Upper Carboniferous stratigraphy and palaeontology (marine and non-marine)
- Permian and Triassic stratigraphy and palaeontology in central and east Devon (non marine)
- Quaternary glacial and periglacial deposits and landforms

Although not natural features, the headwaters of many streams on Dartmoor include significant areas of alluvial workings for tin, which are readily recognisable as hummocky fills of artificially broadened valleys.

6. Current extent



Devon has a very large resource of rivers and streams; the stream frequency of Devon's river catchments (the number of stream junctions per km of channel) is high (1.01) compared to the average for English rivers (0.79). Particularly high stream densities occur on the Torridge and Tamar (NERC 1975). The causes of this are high excess precipitation (precipitation minus evapotranspiration) and a mainly impermeable geology.

The major floodplain systems in Devon are found on the Axe, Exe (and its tributaries such as the Clyst and Culm), Teign, Tamar, Torridge and Taw. The total area of seasonally inundated grassland (also known as grazing marsh) in Devon is about 6000 ha. Floodplain is found in all catchments, so it is likely that there are further areas of small floodplain strips which are not accounted for in this figure.



The River Axe

7. Current problems for fluvial systems in Devon

- Water quality in Devon is generally good, as measured for statutory purposes. However, from an ecological viewpoint, water quality is sometimes inadequate, due to the agricultural uses of the flood plain and the wider catchment. High input farming systems result in fertiliser (especially from arable land) and inadvertent slurry run-off into rivers, causing increased concentrations of phosphorus and nitrogen in river water, and leading to excessive growth of algae and weed, and changes in the animal communities.
- Other sources of pollution are sewage (storm discharges, effluent), industrial discharges, mining (operational and abandoned) and atmospheric fallout (acid rain, *etc.*). Although standards are set by the

Environment Agency to control the quality of discharges to watercourses, pollution from diffuse or point sources can enter the aquatic environment, with often deleterious and sometimes disastrous results. These sources can be difficult to locate and control, particularly from diffuse sources; the responsibility for them lies with the individuals and organisations from which they originate.

- There are links between water *quality* and water *quantity*. Where river flows are lowered by drought, or by abstractions, there is less dilution of any pollutants in the water feature and often less dissolved oxygen available to wildlife. The first significant rainfall following prolonged dry periods may cause high levels of pollutants to be flushed into rivers.
- Groundwater abstraction has the potential to impact on other water interests or features in the area, including spring-fed wetlands. Where abstraction requires a licence, the impact of that abstraction on other water interests and features in the area are assessed by the Environment Agency and appropriate conditions attached to the licence to protect those interests and features. Where appropriate, there may be a requirement for the abstraction site to be moved to a more suitable location, or there could be a refusal to grant an abstraction licence. In some areas, the underlying geology is such that any groundwater storage present in the rock will be so localised that that there will be no connected features to affect. Due to this and other factors some areas in Devon are exempt from groundwater licence. Abstractions for private domestic supplies (of up to 20 cubic metres per day) are also exempt from licensing, due to the relatively small volume likely to be consumed.
- Reduction of groundwater and surface water levels due to agricultural drainage (occasionally pumped) modifying flood plain wetland habitats.
- Alteration of the flow regime of a river, such as the regulated flow of a river which results from construction of headwater impoundments like reservoirs. Such rivers have their spate characteristics modified, with a resulting impact on their geomorphological evolution. Reservoirs may also have an impact upon the temperature of water flowing downstream.
- Physical modification of bed or banks is a fairly common problem. The reasons for the work are varied, but include erosion control, fisheries management and informal flood defence. Work can involve straightening channels, bank revetment, removal of gravel bars, dredging of pools and construction of in-stream features such as croys or groynes. Not only do these works modify the natural features of the river, but they also affect natural fluvial processes, often causing other effects (such as increased erosion or deposition) elsewhere up or downstream.



Two faces of the Alphin Brook as it flows through Exeter.

- Flood alleviation schemes can alter or destroy natural features when watercourses are channelised or banks stabilised. Examples of this are in the urban areas of Exeter and Tiverton where the rivers now flow through concrete channels with no natural features retained or allowed to develop. However, the amount of channelisation in Devon is low compared to other parts of the country, and modern flood schemes are usually designed in a way that reduces their impact on the natural environment.
- Unrestricted stock access to riverbanks can result in several damaging effects. Poaching (severe trampling) of banks destabilises them, resulting in increased erosion and large amounts of sediment entering the river. Constant grazing and browsing prevents the re-establishment of bankside trees, so that tree cover declines over time. Cattle, in particular, often access the river to drink and may stand in it for long periods, fouling the water and stirring up fine sediments that infiltrate gravels and damage fish spawning habitat.
- New development usually results in additional impermeable surface such as roads, car-parks and roofs, reducing infiltration. This causes more run-off from the catchment and resulting in larger flood discharges. Developers are now encouraged to adopt sustainable urban drainage systems, using soakaways, detention ponds and grass swales to reduce the above effects.
- Soil run-off from agricultural land, especially arable plough, can clog otherwise clean river bed gravels, leading to changes in the habitat of invertebrates and fish. Land drains and ditches with no vegetative buffer to prevent soil run-off from adjacent ploughed fields carry quantities of soil to the main water courses. The increased area of maize grown leaves more bare fields vulnerable to washing during the winter.

- Debris dams are often cleared for fisheries purposes, yet can provide valuable wildlife habitats. While it is recognised that individual fallen trees need to be removed where they might cause flooding of property, the build-up of large debris dams can cause local changes to the course of a river, which is a natural part of a river's evolution and, where there is no danger to property or life, this could reasonably be allowed to take place.
- In-filling or neglect of old flood plain features, such as ditches, ox-bow lakes, terraces, dry beds and secondary river channels, causing loss of the record of the geomorphological evolution of the river and its flood plain, as well as a loss of capacity to store flood water.
- Intensive fish-farming, leading to potential problems of water quality and quantity, and possible escape of non-native species.
- Spread of invasive and non-native plant species such as Japanese knotweed, Himalayan and Japanese Balsam, giant hogweed and other pernicious weeds.
- Widespread and increasing use of rivers and the flood plain as areas for recreation, leading to problems of bank erosion, litter, disturbance of wildlife.
- Gaps in our knowledge of the ways in which water quality impacts upon animals and plants is an issue in itself. Gross pollution events are known to kill biota, but little is known about, for instance, tolerances of species and habitats to pollutants or cocktails of pollutants, and what might be an optimum water quality to most benefit different species.
- Although a number of sections of Devon's rivers have been selected as fluvial geomorphology SSSIs through the Geological Conservation Review process, there remains no systematic review of systems in the County and many other important features remain to be identified. Without such a survey potentially important geomorphological features are at risk from damage by inappropriate works, either directly or indirectly.
- Similarly, the lack of a comprehensive survey and assessment of river terrace features in the County, means that these features and any associated archaeology remain at risk from development.

8. Recent changes in extent

Relatively little total loss of watercourse occurs, although local losses by modification such as culverting do occur. Where floodplain has been identified, its loss is strongly resisted, or replacement required. It is the degradation or modification of the natural condition that is more significant, although there are no figures available to quantify this.

Some losses of floodplain area have occurred, however, in recent years due to development and small areas of terrace deposits have also been lost.

9. Current site protection

All rivers, unless severely degraded, are considered to be County Wildlife Sites. Criteria to refine this definition are being considered.

Lower Tamar is a Special Protection Area (under the EC Birds Directive) and a Special Area of Conservation (under the EC Habitats Directive). Part of the River Axe is also an SAC. Other rivers lie within areas designated as SAC and may support interest features of the SAC. For example, many Devon rivers rise within the Dartmoor SAC and support salmon, which is an interest feature. The rivers themselves are not, however, the primary reason for designation.

Parts of the River Barle and River Axe are biological SSSIs – the latter including geomorphological GCR sites (River Axe SSSI), while sections of the River Lyn, the River Lyd at Lydford Gorge (Lydford Gorge SSSI) and the River Exe at Brampford Speke SSSI, are geomorphological SSSIs. Cholwell Brook SSSI, however, is notified solely for geological features exposed in its bed and banks and key exposures exist in the Red-a-ven Brook in Meldon Aplite Quarries SSSI.

A number of rivers pass through important SSSIs. Examples include the Torridge (Halsdon SSSI and DWT reserve), the Culm (Killerton SSSI) and the Exe, Barle and Hoarook Water (all in North Exmoor SSSI) and the River Lemon (River Lemon Valley Woods SSSI). Many estuaries in Devon are SSSIs (Erme Estuary SSSI, Exe Estuary SSSI, Otter Estuary SSSI, Taw-Torridge, Plymouth Sound, Shores and Cliffs SSSI, Salcombe to Kingsbridge Estuary SSSI), and although this status often only extends to the tidal limit, some protection of the lower reaches of rivers is afforded. Slapton Ley is an NNR and as well as coastal lagoon includes several small feeder streams.

Areas of floodplain are found within some river valley SSSIs such as Halsdon, Killerton, Kismeldon Meadows and River Barle. Other rivers and streams are present in the SSSIs on Dartmoor, including East Dartmoor, Merrivale, North Dartmoor and South Dartmoor.

Broom Gravel Pit is an SSSI for Pleistocene terrace gravels containing an important Palaeolithic industry.

Several County Geological Sites include fluvial features such as river terraces. The recent establishment of a database of CGS in Devon will ultimately facilitate the listing of such sites.

10. Current positive initiatives for fluvial systems in Devon

- The County Geological Sites (CGS) and County Wildlife Sites (CWS) schemes identify non-statutory sites of (at least) County importance for their geology, geomorphology and wildlife, and provide planning authorities with this information to steer development away from such sites or to mitigate potential damage.
- Devon RIGS (Regionally Important Geological/Geomorphological Sites) Group promotes geological conservation, by working with local authorities, landowners and others, and provides advice, on request, on County Geological Sites and the management needed to retain or enhance their geological interest. The RIGS Group is undertaking detailed district by district surveys - completed projects include for the North Devon AONB, mining districts in West Devon, Torbay, Exeter, South Hams, East Devon, Teignbridge, the Teign Estuary and Dartmoor. A number of selected sites are for fluvial features, including river terraces.
- Local Environment Agency Plans, or LEAPs, were produced by the Environment Agency. They cover all aspects of EA's work and detail the status, uses and issues in each river catchment. Many of the proposed actions have now been incorporated into the Environment Agency's Local Contribution, which sets out key work areas.
- The Environment Agency has statutory powers over activities affecting rivers and their flood plains. Some of these are achieved through consents to discharge to land or water, consents for works in rivers, and the issuing of licences to abstract water.
- Statutory bodies are required by Regulation 50 of the Habitats Regulations to review all existing consents that may affect European sites (SACs and SPAs). The Environment Agency is currently undertaking such a review and has carried out detailed studies to facilitate this work.
- Defra's agri-environment schemes contribute to the protection and enhancement of rivers. Environmentally Sensitive Areas (ESAs) agreements, although in Devon not targeted specifically at rivers or flood plains, may benefit them by promoting low input agriculture on land bordering water courses, and by creating ponds. The Environmental Stewardship scheme also includes a number of options, particularly in the Higher Level scheme, that will help to maintain the aquatic environment in good condition.
- Defra has required Water Level Management Plans to be drawn up for SSSIs where it is possible to control water levels on site. English Nature's (now Natural England) priorities for Devon were Braunton and Exminster Marshes. The Environment Agency has carried out extensive

hydrological investigations in developing these plans, and their production is now almost complete.

- The Dartmoor Biodiversity Project, through its Action for Wildlife initiative, has been a highly successful example of achieving positive action on the ground. It has expanded from the Dart catchment to cover the whole of Dartmoor National Park and is a partnership between DNPA, Environment Agency, Duchy of Cornwall and others. Since its inception in 1998 many conservation actions have been completed by the Project Officers, based on the Dartmoor BAP and other plans. These have included work on Salmon Action Zones. Go to www.actionforwildlife.org.uk for more information.
- The Cycleau Project is a wide-ranging project with European funding and many partners in SouthWest England, western France and Ireland. In Devon, individual projects are located on the Axe and Char, the Exe, the Teign, the Dart, and Slapton Ley. The overall aim is to find innovative ways of managing the water environment, sharing knowledge about it and involving local communities in the management process. Go to www.cycleau.com for more information.
- Westcountry Rivers Trust (see www.wrt.org.uk) is an environmental charity that seeks to protect and improve rivers, streams and lakes in South West England. A partnership approach is adopted and WRT has worked closely with the agricultural sector in particular to reduce impacts on the water environment.
- The Environment Agency has a considerable Research and Development programme, dealing with all aspects of its work. Policies to protect rivers and their habitats and species are also being developed.
- Research in the University of Exeter (Department of Geography) includes studies of sediment dynamics and flood plain formation on the Exe and its tributaries.
- The Palaeolithic Rivers of South-West Britain has been a collaboration between the University of Exeter (Department of Geography) and several other universities and institutes. It has included a detailed assessment of the terrace deposits of several of Devon's rivers and revealed important insights into the evolution of the county's landscape through the Quaternary Period.
- A very large body of research has been conducted and continues on the Slapton catchment in south Devon, based at the Field Studies Centre of Slapton Ley.
- The Ussher Society is a forum for presenting and discussing the results of geological and geomorphological research into Earth heritage sites in the South West of England. These results are published annually in *Geoscience in south-west England*.

- The British Geological Survey has recently completed new surveys of parts of the County (including Exeter, Plymouth, Torbay and Sidmouth). New geological maps have been published, supported by two descriptive memoirs (Exeter, Plymouth) and two brief reviews (Torbay and Sidmouth). A new survey of the Tiverton area is currently taking place (2007). These maps included important new mapping of river terrace deposits.
- The Devon Aggregates and Biodiversity Project, a partnership between Aggregates Industries UK and Devon County Council and funded by the Aggregates Levy Sustainability Fund produced Parish Geodiversity Audits for 10 parishes in the county. These PGAs not only document the geodiversity present, they also identify opportunities for conservation and community participation.
- Devon County Council and English Nature (now Natural England) have supported Devon RIGS Group in the establishment of a database of County Geological Sites, including descriptions, maps and photographs. Some of this information is available via the newly established [Devon RIGS website](#).



An example of good practice: 'Soft engineering' to stabilise a river bank.

11. Biodiversity planning context

The Devon Biodiversity Action Plan forms a key link in the chain of biodiversity planning running from the National Plan, through Regional guidance, to local delivery.

Although there is no equivalent national Geodiversity Action Plan, the Devon BAP fulfils the role of a Local Geodiversity Action Plan (LGAP) in an innovative and integrated approach to natural heritage conservation.

National BAP Context

Habitat of principal importance in England (NERC Act, S.41):

- Rivers

Current national BAP targets can be viewed on the [Biodiversity Action Reporting System](#) (BARS).

Regional BAP Context

Regional targets for priority BAP habitats can be found on the website of [Biodiversity South West](#).

Associated Action Plans within the Devon BAP:

- Atlantic salmon
- Barn owl
- Curlew
- Freshwater pearl mussel
- Greater horseshoe bat
- Marsh fritillary
- Otter
- Southern damselfly
- Water vole
- White-clawed crayfish
- Alder and willow wet woodland
- Caves, karst and limestone habitats
- Cities, towns and villages
- Freshwater reedbed
- Grazing marsh
- Periglacial landscapes
- Rhos pasture

12. Biodiversity objectives and targets for rivers, streams, floodplains and fluvial processes in Devon

Objective 1

Maintain and re-establish, wherever practicable, the natural processes of rivers, streams and their flood plains, and the connection between them as a functional whole.

Target: Significantly increase the area of flood plain where natural processes predominate.

Objective 2

Maintain the quality of existing natural channel and flood plain features.

Targets:

- No further net loss of water course length.
- No further loss of relict flood plain features.
- No further loss of key channel, including meander features and associated bar deposits

Objective 3

Manage and enhance the hydrological regime of rivers, streams and their flood plains in an optimum way for wildlife habitats and species, by restoring natural processes.

Targets:

- Establish low input management agreements on 20km of flood plain outside SSSIs by 2005.
- Restore 200 ha of arable land on the flood plains to permanent pastures by 2010.
- Increase the storage time of water on 100 ha of land by 2010, by decreasing connectivity of drainage systems to headwater channels, seeking to attain wetland habitat restoration.

Objective 4

Increase local habitat diversity within flood plains.

Targets:

- Re-create 50 ha of flood plain woodland by 2005, where this would not pose problems to flood defences.
- Re-establish 10 km of hedgerows with scattered trees on flood plains by 2005.
- Establish 20 km of low/zero input farming to banksides by 2010.

Objective 5

Maintain and enhance the water quality of Devon's rivers to defined standards.

Targets:

- Re-evaluate water quality standards based on research into the requirements of key invertebrate species of rivers and streams, by 2010.
- Establish the water quality standards required to support the key invertebrate species of rivers and streams by 2010.

Objective 6

Increase the understanding and knowledge base of all river types, the habitats and species which depend upon them and their geomorphological features and processes, both ancient and modern.

Target: Completion of a review of the geomorphological features of Devon's rivers and streams and the selection of a suite of County Geological Sites to highlight and hence safeguard key sections of channel, floodplain and terrace deposits based on appropriate criteria, by 2010.

13. Wider benefits from pursuing these objectives

The pursuit of the objectives and targets set out above will not only benefit the biodiversity of rivers, streams and flood plains. Conservation has wider benefits and advantages for society, by providing a resource which is the basis of many aspects of the local economy, and by adding to the quality of life of the people of Devon in ways which are beyond financial measure. Thus enhancing the interests of biodiversity will also enhance the interests of society as a whole. Some of these wider benefits are as follows.

Enhanced revenue to local economy from tourism, as the cleanness and naturalness of Devon's rivers and streams is a major part of the attraction of the County.

Healthy populations of fish in our rivers can support well-managed sustainable fisheries, encouraging associated services, such as hotels and guest-houses.



By allowing certain targeted areas to revert to natural flood plain, while concentrating defence efforts on key sites the need for flood defence maintenance is reduced in selected areas,

Establishment of a database of river terrace features and deposits can help inform decision-making processes, for instance in development planning, and help target archaeological resources more effectively where there is a potential for Palaeolithic finds.

14. Priority or indicative actions for river, streams, floodplains and fluvial process in Devon

Action	Key Partners
1. 1. Continue to develop policies and strategies to protect the water environment from inappropriate activities. Ensure that these are embraced by local planning authorities and other regulatory bodies.	EA; LPAs; Defra; NE; DWT
2. 2. Continue to implement management agreements where these will benefit flood plain, riparian or river habitats, key species and geomorphological features and processes.	Defra; NE; NPAs; FA; NT; FWAG; DWT; NFU; CLA
3. 3. Provide advice to landowners/users on best management practices for activities affecting rivers, streams and their flood plains. Establish demonstration projects and produce documents to disseminate information.	EA; NE; WRT; DWT; FWAG; RSPB; Landowners
4. 4. Carry out research into the effects of water quality and quantity on aquatic species, communities and habitats.	EA; NE; Universities of Plymouth and Exeter
5. 5. Raise public awareness of fluvial processes, habitats and species and the factors affecting them.	EA; NE
6. 6. Promote the wise use of Devon's water resource to gain the widest possible participation in the implementation of plans and	EA; SWWSL; LAs; DWT; NPAs; RDC;

Action	Key Partners
the wise use of water by industrial and domestic users.	Comm'ty Council
7. 7. Raise awareness of the importance of flood plains - their role in flood prevention and their value to wildlife - to the public and planning authorities to help reduce development on floodplains.	EA; DWT; NE; LPAs
8. 8. Compile a database of fluvial geomorphological features, both modern and ancient, and use it as a basis for the selection of an appropriate suite of CGS.	DRIGSG; LPAs; universities; museums
9. 9. Establish a geological records centre for Devon and promote the reporting and recording of geomorphological features, processes and associated finds	DRIGSG, museums, universities, LPAs

Rivers, Streams, Floodplains and Fluvial Processes Action Plan Champion: Environment Agency

Abbreviations used in text and table

AONB	Area of Outstanding Natural Beauty
BAP	Biodiversity Action Plan
CA	Countryside Agency
CGS	County Geological Site
CLA	County Landowners & Business Association
CS	Countryside Stewardship
CWS	County Wildlife Site
DEFRA	Department for Environment Food and Rural Affairs
DRIGSG	Devon RIGS (Regionally Important Geological/Geomorphological Sites) Group
DWT	Devon Wildlife Trust
EA	Environment Agency
FWAG	Farming and Wildlife Advisory Group
IGER	Institute of Grassland and Environmental Research
LAs	Local Authorities
NE	Natural England
NFU	National Farmers Union
NNR	National Nature Reserve
NPAs	National Park Authorities
NT	National Trust
RQOs	River Quality Objectives
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SSSI	Site of Special Scientific Interest
SWQO	Statutory Water Quality Objective
SWWSL	South West Water Services Limited
WRT	Westcountry Rivers Trust