6 Navigation, recreation and amenity

6.1 Introduction

Rivers form an important part of our heritage. They have been used for centuries as a source of water and as a means of transport. Rivers also have a long history of use for recreation and they are an important amenity. In this chapter we discuss how navigation, recreation and amenity can be enhanced and how to avoid adversely affecting these functions when implementing works in rivers. Although this chapter is devoted to streams and rivers, much of the guidance is equally applicable to canals and other artificial channels.

Most rivers and streams have some amenity value; many are used for recreation and some for navigation. Construction works in or adjacent to rivers, together with channel maintenance activities, have the potential to disrupt, damage or even destroy the amenity value. It is therefore vital that the planners and designers of river works appreciate the full spectrum of river-based activities. Factors to be considered include:

- whether it is a private or a public water space;
- whether there are any access interests (footpaths, bridleways, cycleways, slipways);
- whether adjacent land is private or public.

If the river is open to public navigation, the appropriate navigation authority must be consulted.

If the river is private, the landowner owns the rights to navigation and should be consulted to find out whether they have granted rights to any organisations (for instance, angling or canoeing) for access to the river.

Any construction on a main river requires:

- a licence from the navigation authority;
- the consent of the Environment Agency, particularly in respect of flood risk.

For the River Thames, any structure that affects the bed, bank or flow requires a licence under the Thames Conservancy Acts. Currently the Environment Agency issues a joint licence for this and the flood risk assessment.

Certain works require planning consent and Building Regulations approval. Advice on this can be obtained from the local planning authority.

6.2 Navigation

6.2.1 Use of the river

Most navigable rivers (about 2200km in the UK) are managed by navigation authorities. In England and Wales, the Environment Agency and British Waterways are the largest and are funded by government grant-in-aid. Navigation authorities are granted by an Act of Parliament and thus are statutory bodies having statutory rights under the Permitted Development Act. These bodies, together with the Broads Authority, manage about 1600km of river; the remainder are managed by a number of smaller authorities. In addition, there are about 900km of managed non-navigable waterways (including canals). Most navigation authorities belong to the Association of Inland Navigation Authorities (AINA).

Information on navigation authorities and the rivers they manage can be found on the following websites:

- Environment Agency (www.environment-agency.gov.uk)
- British Waterways (www.britishwaterways.co.uk)
- The Association of Inland Navigation Authorities (www.aina.org.uk)
- River Thames Alliance (www.visitthames.co.uk)
- Port of London (www.portoflondon.co.uk)

For a pleasant and safe experience, boaters using the river depend on the design and condition of the supporting infrastructure. Where weirs control the water level on the river, there are locks to enable navigation through the change in level on the river. Most Environment Agency locks, the majority of which are on the Thames, are manned, but many navigation authorities do not man their locks. Much of the existing infrastructure is designed for experienced boaters and so is not appropriate for the casual user of hired craft.

When designing any river infrastructure, the navigation authority and the lock-keeper should be consulted to:

- understand the constraints and use of that reach of river;
- ensure that facilities are provided for all.

Other organisations to consider are any trade associations such as the Thames Boating Trades Association (TBTA) and recreational associations – as discussed in Section 6.3.

6.2.2 Boating

The type and size of boats depends on the depth and width of the river, and constraints such as bridge heights or the size of the infrastructure (length and width of locks, for example). On the River Thames, for example, the size and type of craft varies from a 200-tonne tanker to a solo canoe. Most navigation authorities publish a river users' guide listing these constraints, the distance between control structures and the maintained depth of river. The design of infrastructure depends on the type of boat using it. The size of the infrastructure is an important constraint when considering access to the river and the movement of construction plant along the river.

Passenger steamers – primarily carrying tourists – operate between some urban areas. The size of boat is constrained by the size of locks. Boat-hire companies are often based in more rural areas, hiring holiday boats. Day-hire fleets rely on passing trade, so are also based in urban areas. Narrow-boats are becoming increasingly popular for hiring and private ownership. There is a growing trend of less competent boaters using the rivers and infrastructure design must take account of this.

The main use of rivers for freight is for river-related engineering works, but also bulk haulage.

Navigational use of rivers often leads to bank erosion and adds to the pressure for hard engineered banks, or for the lowering of speed limits.

6.2.3 Locks

The ideal experience is for the boater to navigate directly into and out of the lock but, at busy times, the boats have to moor up and wait. The siting of mooring facilities must be considered to ensure that, wherever possible, the lock-keeper is able to see the boats mooring and approaching both upstream and downstream of the lock.

Falls onto hard surfaces or into the water are the most common types of accident at locks. Most locks have fences set back from the edge, so boaters within the lock can disembark and embark, but discouraging passers-by from standing close to the edge. The Natural England website (http://www.naturalengland.org.uk) has guidance on the appropriate use of fencing in the open countryside, which may help with decisions about the need to fence around rivers.

Signage can be used to:

- warn of deep water;
- delineate where the public is allowed;
- provide information on how the lock operates.

The design of signs must be attractive and informative, so as not to detract from the visual amenity.

Steps around the lock site should be designed for easy access by the lock-keeper from the office, particularly in the case of emergencies. Figure 6.1 shows the improved access at Benson lock in Oxfordshire.

Figure 6.1 Benson lock

This lock is narrow and deep, and the previous access steps were narrow. The path around the lock and the access steps into the lock were widened. The access from the lock office was improved by constructing corner access steps, enabling easy access from all areas of the lock site. It is important to ensure safe access from the office to the lock chamber for quick response to any emergencies.

River Thames near Wallingford

Most sluices for filling and emptying the lock are built into the lock gates, although it is possible to operate the lock through sluices built outside the gates using an appropriate pipe system (such as at Hambleden lock on the River Thames).

Filling and emptying should be as smooth as possible to minimise excessive turbulence. High flows on emptying can cause scour downstream, undermining the structure and disturbing wildlife in the river. When the lock-keeper is not available, out-of-hours operation of locks by the users (who may be inexperienced) should use a dampened system. This is safer but slower. Many locks are now fitted for electrical operation, but locks with less traffic, generally further upstream, are often beam-operated.

If designing a new lock, the size of the lock and the method of emptying and filling must be decided taking account of the numbers and types of craft using the lock. For example, some small locks on the Thames have a waiting time of two hours at busy periods.

6.2.4 Moorings

Safe mooring for boats is required either for short duration – for example waiting to get through a lock – or for longer durations including overnight stays and permanent mooring. A useful reference that includes information on moorings is available from The Yacht Harbour Association (2007).

Moorings should be provided at the head and tail of locks. Experienced boaters are able to use their power to ‘hover’ in the river while waiting to enter the lock. The less experienced need to moor up. At

the upstream (head) end of some lock cuts, the entrance to the weir stream, or the weir itself, is near the lock. Moorings should be sited to avoid boats waiting in this area of river.

Mooring can be either offshore (platforms supported in the river with or without access to the bank) or onshore (built into the bank). Common considerations are the width of channel available and the ecological constraints (if disturbing a natural bank). Onshore moorings are often a solution close to locks, where a concrete mooring can be combined with hard bank protection. The design must minimise the visual and ecological impact, taking into account the types of craft using the mooring and the flow and level of the river throughout the year. Data on flows and levels can be obtained from the navigation authority, and the potential effects of climate change should be considered.

At the downstream (tail) side of weirs and locks, provision for a large change in water level should be made. The weir generally controls upstream (head) levels, but downstream levels can rise quickly. During high flows, hire boats are not allowed to travel, so safe moorings are required. Sometimes this can be managed by a pair of single mooring posts installed at a suitable place near the lock. Alternatively a two-stage mooring platform can be provided, giving safe access to the bank when the lower stage is flooded. Another option is a pontoon, which rises with the water.

Box 6.1 contains some mooring case studies illustrating the points made above.

Box 6.1 Mooring case studies

Penton Hook lock tail lay-by improvements (River Thames near Staines)

Steel/timber lay-by before replacement

This shows a typical lay-by construction comprising a narrow walkway cantilevered from piles in the river bed, so not encroaching on the bank (known as an offshore construction).

The decking is in poor condition and is narrow, and the lay-by is submerged under high tailwater conditions. Raked handrails provide slightly more space to move, but safety does not meet current standards.

After improvement works

This shows the replacement for the lay-by. The platform width is increased, two-level design provides mooring at high water levels, and the access ramp from the road at the far end provides disabled access. In this case, the lay-by is easily approached by road.

Boveney head lock cut improvements (River Thames near Maidenhead)

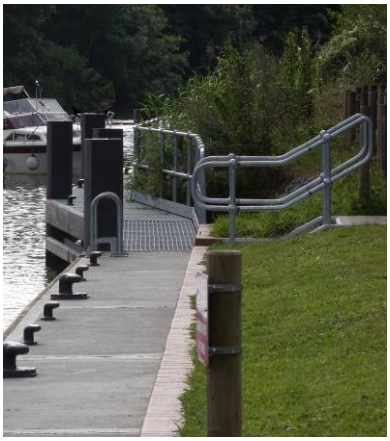
Before improvement works

The typical offshore steel and timber lay-by does not comply with current safety standards and is too short for the number of boats waiting to move through this relatively small lock.

The bank on the opposite side of the lock cut is slipping into the water, in some places eroding the public footpath that it supports.

After improvement works

This shows the new onshore lay-by near lock to minimise encroachment into the navigation channel, with an offshore lay-by upstream. The original offshore lay-by was removed.



The upstream offshore section of the new lay-by minimises disturbance to the natural bank. Bank protection is provided by low maintenance steel piling; access to the bank behind is restricted by the lay-by. Piling is finished 300mm above headwater level.

Eldridge's lock (River Medway near Tonbridge, Kent)

Dilapidated moorings before refurbishment

This and similar structures on this stretch of river were underused, but the Environment Agency was trying to encourage greater use.

The structure was unsafe due to the makeshift design of supports. The mooring posts made access for canoes very difficult and the platform was too short. It was aesthetically unpleasing, with the cheap looking handrailing and timber discouraging use.

Successfully refurbished moorings

An example of successful refurbishment to suit boat and canoe users, with a low level platform giving easy access for canoeists. The wider platform provides better safety for both larger and smaller craft.

Sustainable hardwood fendering provides a long-term solution (softwood is not strong enough for boats mooring or for wet/dry situations). Sustainable softwood timber handrails improve the look of the structure and make it more inviting for river users.

Moorings should be designed for a range of abilities to increase the confidence of inexperienced users. In the past, the typical mooring of timber beam with a narrow platform was designed for competent boaters. This construction, particularly in wet or poor conditions, presents a different experience for the less able.

Permanent moorings may be provided. On many rivers, boaters have constructed ad-hoc moorings using scaffold poles and planks. Navigation authorities should endeavour to replace these with safer bespoke moorings, with floating pontoons to accommodate changes in water level where needed.

Access details are important in the design. Canoes and rowing boats need something to tie up to at a lower level. The spacing of mooring posts depends on the size of boats likely to use the structure. The inclusion of steps and their positioning relative to the mooring posts is a small detail during design, but makes a significant difference to the safe use of the structure. These details are difficult to add to a structure once built. It is also worth ensuring that access to adjacent land, via steps or gangways, is only provided where safe and with the landowner's permission.

Careful choice of materials is necessary to minimise the visual and ecological impact – concrete and steel are perceived as unsympathetic to the environment.

Egress ladders from the water should be provided; it is useful to consider how people could get out of the water after an accident, since throwing lifebelt rings is not always effective. This applies to any structures installed on the river such as small weirs. Features such as posts or grab rails can be installed on the riverbank to aid egress.

Navigation authorities welcome consultation on these details. The Environment Agency encourages pre-planning approval consultation.

6.2.5 Construction work

Construction work on rivers must be planned carefully. Many sites do not have adequate – or indeed any – suitable access from the highway. Often work can only take place from the river, and materials and plant must be transported by river. Sometimes the alternative is to track across farmland, which can mean lengthy negotiations and compensation payments to landowners, but also ecological damage, which must be mitigated against. There may be archaeological or cultural heritage assets present which will act as a constraint.

It is not always easy to find suitable loading access along the river, particularly since many wharves are being sold for commercial development. The size of locks and the height of bridges are constraints in being able to access the site from other parts of the river. This is particularly the case for most of the current piling rigs, which are too wide for most locks.

Any construction work affecting the normal navigation on rivers must be advertised by the relevant navigation authority. Most authorities are only allowed to close locks or reaches of river outside the boating season (that is, between November and March) so that they are open in time for Easter. This increases the risk of construction work experiencing high water levels and flooding, which are usually more common in the winter months.

6.2.6 Facilities

Consideration should be given to the provision of the following facilities:

- freshwater supply;
- pumping out of effluent;

- disposal of contained effluent;
- electricity;
- public toilets with access and facilities for the disabled;
- showers.

Many navigation authorities have a plan detailing the required level of service for that river.

6.2.7 Disabled access

Many structures along the river, including locks and their moorings, are only accessible by foot. When considering whether it is appropriate to provide for disabled access onto mooring structures, it is essential to ensure conditions are not made more dangerous. For instance, when providing access from a mooring to a natural bank or narrow path, it is not advisable to provide disabled access. But where there is good vehicular access or in an urban environment, disabled access ramps to the moorings should be encouraged. Some boats have been adapted for wheelchair access, so appropriate facilities must be made available. Current legislation under the Disability Discrimination Act must be taken into account and any local stakeholders, such as disability forums, must be consulted.

6.2.8 Landscape

Rivers and their historic structures have a rich landscape heritage (see Chapter 5). The effect of any works on the landscape character of the river must be considered by consulting a landscape architect when considering the feasibility of the project, and then again during the detail design stage.

Some locks and lock houses may be listed, or may be noted as important architectural structures in documents such as the *Audit of the heritage assets of the non-tidal River Thames* (Trueman, 2004). Consultations with English Heritage, Cadw (Wales) and Historic Scotland are advised. Design manuals may be available; for example, the Environment Agency is working on a revision of the *Thames environmental design handbook* (NRA, 1992).

Materials used in construction must take into account the local characteristics of the area, using natural materials to blend in with the area. A landscape architect can advise on this. Suitable materials must be chosen that do not cause pollution into the watercourse, or are not treated with any harmful chemicals likely to leach into the river. For government contracts, procurement of timber must be legal and sustainable, with Forest Stewardship Council (FSC) or similar certification.

6.2.9 Bank protection

Fluvial flow has an erosive effect on riverbanks. In natural channels, such erosion is often acceptable, and may be encouraged where it offers an ecological advantage (such as nesting sites for kingfishers and sand martins). Where erosion would destabilise structures or threaten the integrity of flood defences, some form of revetment may be necessary (Gaba *et al*, 2003).

In lock cuts and near mooring structures, the erosive power of boat wash can have a bigger impact, depending on the depth and width of the river and the size, speed and power of the boats. The biggest impact is where boats are manoeuvring close to the bank and where a number of boats are close together at moorings; the impact is greatest close to the lock structure. The materials used should be natural where possible. Willow spiling can be used where the regular maintenance task of cutting back this fast-growing plant is not a problem.

The bank can be protected from boat wash by piling or by a range of alternative methods (see Chapter 8). Piling is ecologically damaging and encroaches into the river. This can be mitigated by sensitive design. An example is where the top pile level is maintained at just above standard water level, and cutouts or holes are provided for water to flow behind the piles and form beach areas (depending on the topography of the bank) or for propagation of planted coir rolls. This maintains some continuity between the bank and the river. Current Environment Agency guidance (NRA, 1992; Environment Agency, 1996) recommends that hard vertical revetments (steel pile or concrete) should be clad (with timber or brick) unless there are strong arguments against. Further guidance is given in Chapter 8 and examples of cladding are given in Chapter 5.

Soft engineering bank protection can be provided using natural materials (such as brushwood fascines), but it generally has a shorter design life than engineered solutions and needs more maintenance. This is suitable for areas where there is no mooring and where it is easily accessible for maintenance. It is not suitable in inaccessible areas such as behind mooring structures. Whole-life costs of soft engineering (with higher maintenance costs) and hard engineering (with higher capital costs) should be compared to make sure the best option is chosen.

Box 6.2 contains some bank protection case studies illustrating the points made above.

Box 6.2 Bank protection case studies

Culham tail lock cut (River Thames near Abingdon)

Original eroded bank

This shows the steep bank, which is backed by private land, heavily eroded and supported only by the willow roots.

After bank stabilisation

The solution was steel sheetpiling with timber capping. Extensive consultation with biodiversity experts was necessary to gain permission to remove the willow trees.

Mitigation was provided by installing planted coir rolls behind the piles and leaving holes in the piles to allow the river to wash onto the bank to give ecological value.

Boveney lock head bank protection (River Thames near Maidenhead)

Soft bank protection at upstream end of new mooring lay-by, shortly after construction

Timber stakes hold stone-filled gabion baskets into position, which support planted coir rolls to stabilise the eroding bank. While these are establishing, a post and wire fence acts as a barrier to prevent the public encroaching onto the works.

Two years later

Showing the establishment of vegetation post-construction.

Boveney lock tail bank protection

This shows steel pile bank protection capped with hardwood (from a sustainable source). Planted coir rolls were placed behind and were protected against ducks during their establishment using wire netting (later removed).

The piles were driven to approximately 300mm above standard tailwater level. Regular overtopping (tailwaters vary greatly in depth) allows the establishment of plants to interface with the river ecology.

Mitigation for steel sheetpiling

Steel sheetpiling – an effective and long-term method of protecting the bank – creates a barrier between bank and water ecology, with consequent environmental damage.

Some mitigation can be achieved by piling to a level only 300mm above mean water level (to protect the bank from boat wash), but dropping a pile every 5m or so to below water level to enable water to flow behind the piles and provide some ecological continuity.

6.3 Things to do along our rivers (recreation)

6.3.1 Water-based recreation

The active use of the water space includes rowing, sailing, motor boating, canoeing and triathlon swimming. Designers should consult the relevant sporting bodies to find out how the river is used and what the requirements are. There is a move to segregate high-powered boats (water ski, jet ski, powerboats) from the river environment, for instance onto gravel pit lakes. The Port of London Authority allocates separate zones on the tideway for these activities.

Particular organisations to consult include the Amateur Rowing Association, the Royal Yachting Association, the British Marine Federation and the British Canoe Union. There may also be local interest groups in the area.

Safety interests for all sports relate to the provision of suitable access from water to land. Fencing can obstruct safe access. Depending on the local use of the river, the provision of slipways, canoe portages

and boat access must be considered. For instance, consultation with the local canoe club or the British Canoe Union would help in designing structures with suitable dimensions and materials sympathetic to glassfibre vessels.

Canoe portages are particular arrangements at locks, weirs and sluices where canoes can be lifted out of the river and transported manually to the other side of the lock, so that canoeists do not have to wait for the lock to operate. These portages must be carefully designed, in consultation with the British Canoe Union, to allow unobstructed passage by making the pathway wide enough and ensuring safe access and egress (see Figure 6.2).

Figure 6.2 Chertsey lock canoe portage

This shows wide access and railing on one side for unimpeded but safe use. It is shown immediately after construction, before vegetation has been able to grow on the coir roll baskets.

River Thames, Chertsey, Surrey

Weirs and sluices are often attractive structures for canoeists, but can be hazardous. Particular problems are experienced with weirs that have a steep downstream face. This can result in hydraulic conditions that trap a swimmer or a canoeist underwater in the reverse roller downstream of the weir. Particular care is therefore needed to avoid such conditions when designing new weirs or rehabilitating existing structures. Consultation with local users is also important (see Figure 6.3). Further information on the design of weirs is given by Rickard *et al* (2003).

Designers also need to make sure the channel banks in the vicinity of structures used for water-based recreation are designed to allow easy egress by anyone in trouble in the water (for example, by avoiding vertical walls).

The Environment Agency encourages pre-planning application meetings with designers to consider safety and the design of steps, steps and access points.

Figure 6.3 Hambleden Weir, where remedial works ruined a good canoeing spot

Remedial works were carried out at the weir, without consulting the local users.

This improved the hydraulic conditions generally, but led to the loss of an important canoe slalom facility. Further (expensive) works were required to reinstate the hydraulic conditions favoured by the canoeists.

River Thames, near Henley

6.3.2 Land-based recreation

The enjoyment of water also comes from the use of riverside footpaths and cycleways. Organisations to contact include Sustrans, the Ramblers Association and National Trails (now part of Natural England).

Footpaths designated by the local authorities as public rights of way must be kept open unless permission is obtained for a temporary closure or re-routing. This must be applied for about eight weeks before the closure is required to allow for public consultation by the local planning authority. Applications for permanent closures must be agreed by the Secretary of State. These take correspondingly longer.

During construction, the temporarily re-routed footpath must be well-notified and signed for the duration of the works, in consultation and agreement with the local planning authority. Materials used must be sensitive to the landscape and a landscape architect must be consulted on the design.

The Countryside and Rights of Way Act 2000 (CRoW) gives public access to large areas of the countryside. This means that there may be public movement in the area, even though no public right of way is designated. Maps are available online (http://www.countrysideaccess.gov.uk/static_pages/further_information/access_land_maps) or can be obtained from the local surveying authority (usually county councils or unitary authorities). Current editions of 1:25 000 Ordnance Survey maps also show 'open access land'.

Developments next to the river should also be considered when planning construction work. Commercially, any property near a river has a premium value and local residents are often very protective of their environment. Land ownership near rivers is often difficult to establish, since historically what may have started decades ago as temporary or holiday dwellings may have become permanent homes.

Footbridges across rivers often carry national trails (http://www.nationaltrail.co.uk) and are important for amenity. Again, ownership is often uncertain and many have been poorly maintained. Access for replacement is often difficult and may have to by water, with the replacement being floated down the river. The headroom at other bridges, and the width and length of adjacent locks, may restrict the passage.

Rivers are an important visual amenity, particularly in the urban environment. Paths by rivers offer green transport routes to access shops and employment, and are an escape from the fumes of road traffic. Feeding the ducks is an important leisure activity, so appropriate platforms with provision for wheelchairs and pushchairs should be considered. In park areas and public places, this could be extended to the provision of benches and picnic tables, as long as these are positioned where it is safe for the public to go, and spaces for wheelchairs are provided near seats. Standard details for fencing and drainage can be found in a Highways Agency publication (2004).

Where there are steep banks near public areas, planting suitable hedging or thorns is often an effective alternative to fencing, acting as a deterrent rather than a solid barrier.

6.3.3 Angling

Angling is a very popular sport, bringing considerable revenue for private river owners and is an important business for some country estates. The banks of many main river tributaries are rented to angling clubs. When considering structures on these banks, consultation with the relevant clubs and businesses is vital.

Access from the land and safe fishing pegs and platforms on the bank should be provided. Where appropriate and practical, suitable access routes and platforms with raised fronts can be provided for the wheelchair users (see Figure 6.4). The materials used must be sympathetic to the local ecology and landscape.

Irrespective of the commercial arrangements with riparian owners, most angling on rivers in England and Wales requires the purchase of a 'rod licence' from the Environment Agency. On some stretches of river (for example, the River Thames from Teddington to Staines) the public have angling rights, so there is no charge apart from the rod licence fee. Further information is available on the Environment Agency website (http://www.environment-agency.gov.uk/homeandleisure/recreation/fishing/default.aspx).

Maintenance and construction works carried out in rivers can be very disruptive to angling activities. It is therefore crucial that the timing of such works avoids periods of heavy angling activity (for example, when there are competitions going on). Angling clubs should be advised well in advance of the works being executed. Other considerations are the periods of fish migration and nesting birds.

River Thames near Staines

Figure 6.4 Angling platforms suitable for wheelchair users

6.3.4 Access for the disabled

Disabled access is not solely for wheelchair users; disabilities include poor sight and restricted mobility. The designer has to do their best to provide for disabled access. All boating clubs have a policy for access by people with disabilities and certain boats are designed for this purpose. The Fairfield Trust is a charity that designs modifications for the disabled.

The type of surfacing must be suitable for wheelchairs and must be consistent throughout; there is no point having a wheelchair-friendly footpath by the river if the car park surfacing is unsuitable. The requirements of the Disability Discrimination Act 1995 must be accounted for.

6.3.5 Opportunities for recreation and amenity in flood schemes

When designing flood alleviation schemes, wetland or ecology features introduce an important amenity – particularly in urban areas. Landscape design and the input of a landscape architect are essential at the feasibility stage and throughout the design process for:

- effective landscape character assessment;
- environmental site planning and design;
- effective choice of native plants and trees and landscape features.

Early consultation with planning authorities and local interest groups should occur to ensure benefits compatible with the design objectives are achieved.

Features such as gravel beaches to allow safe access to the water's edge for the public and to allow access for boats (if appropriate) can be included.

Opportunities also exist for providing ecological interest where there was none before (such as meanders, wetlands and features such as reed beds and other similar planting) and can also help meet UK Biodiversity Action Plan (BAP) targets. An award-winning example is the Sutcliffe Park development, part of the Quaggy flood alleviation scheme, in southeast London (see Figure 6.5).

Figure 6.5 Sutcliffe Park

As part of the flood alleviation scheme, major visual and ecological enhancements were made to the park, providing a variety of habitats for local wildlife. Prior to the works, the section of the River Quaggy running through Sutcliffe Park was contained underground in a concrete culvert, with loss of natural habitats, and lack of fish. Restoring the river to a more natural state provides a variety of habitats for local wildlife. Visual improvements include a board-walk, bridges, footpaths, avenues of trees and wildflower meadows.

River Quaggy, southeast London

Where a flood alleviation structure is available for public access (for example, a grassed flood embankment) paths must have a suitable surfacing and be of appropriate gradient, with rest areas and passing places for wheelchairs. Local gravel or hoggin surfacing is preferred, making sure that the surface is suitable for wheelchair and buggy use if appropriate.

If the structure is designated a reservoir under the Reservoirs Act 1975, compliance with the Act takes precedence. Chapter 10 gives further information on flood storage reservoirs and the requirements of the Reservoirs Act 1975.

References

Gaba, A R, Simpson, B, Powrie, W and Beadman, D R (2003). *Embedded retaining walls – guidance for economic design*, Report C580. CIRIA.
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Highways Agency (2004). *Manual of contract documents for highway works: Highway construction details, Volume 3*. The Stationery Office. Available from: http://www.standardsforhighways.co.uk/mchw/index.htm.
Consult this document for standard details such as fencing, drainage.

Rickard, C E, Day, R and Purseglove, J (2003). *River weirs – good practice guide*, R&D Publication W5B-023/HQP. Environment Agency. Available from: http://publications.environment-agency.gov.uk/pdf/SW5B-023-HQP-e-e.pdf.

The Yacht Harbour Association (2007). *Code of practice for the design, construction and operation of coastal and inland marinas and yacht harbours*. The Yacht Harbour Association.
This is particularly useful for design guidance for pontoon moorings.

Trueman, M (2004). *Audit of the heritage assets of the non-tidal River Thames*. Report prepared for the Environment Agency and English Heritage.

Standard construction details for navigation structures are currently being updated, but are not yet available. Please contact the navigation departments in the Environment Agency's Thames, Anglian or Southern regions for current information. The following are available from Environment Agency and provide some useful background guidance, but in some cases do not reflect current best practice. Updated versions are being prepared.

Environment Agency (1996*). Standard lay-by designs,* Ref 5652, prepared by Halcrow Group Ltd for the Environment Agency (Thames Navigation and Recreation Departments*)*.
Contains physical data of lay-bys and design detail drawings.

National Rivers Authority (1992). *Thames environment design handbook.* NRA.
Provides design guidance on the preparation of landscape plans, characteristics of different geographical areas and site-specific landscape details, paving, fences and planting.