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PLANNING FOR WATERCOURSES IN THE URBAN ENVIRONMENT

A Guide to the Protection of Watercourses through the use of Buffer Zones,
Sustainable Drainage Systems, Instream Rehabilitation, Climate / Flood Risk and Recreational Planning

**Including one-off developments*



Iascach Iníre Éireann
Inland Fisheries Ireland

A Guideline Developed by Inland Fisheries Ireland

Inland Fisheries Ireland

OUR VISION

To place the inland fisheries resource in the best sustainable position possible for the benefit of future generations.

OUR MISSION

To protect, manage and conserve Ireland's inland fisheries and sea angling resources and to maximise their sustainability and natural biodiversity.

Inland Fisheries Ireland is a statutory body operating under the aegis of the Department of the Environment, Climate and Communications (DECC).

Its principal function is the protection and conservation of the inland fisheries resource. Inland Fisheries Ireland promotes supports, facilitates and advises the Minister on the conservation, protection, management, development and improvement of inland fisheries, including sea angling. Inland Fisheries Ireland also develops policy and national strategies relating to inland fisheries and sea angling and advises the Minister on same.



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This guidance also aims to support planning processes which address predicted Climate Change impacts associated with water (Climate Change Adaptation) and encourages greater CO₂ sequestration along watercourses (Climate Change Mitigation).



Rivers, lakes and streams are an integral part of our environment and if managed appropriately can significantly improve the quality of life for people living in urban areas. They can be a setting of high visual and acoustic amenity, where people find respite from the busy humdrum and stress of urban life. In this context, they provide an opportunity to develop linear parks or walks close to nature, not often associated with urban living. However, they become fragmented and degraded, losing their intrinsic value, if not planned for and managed sensitively.

This guideline document outlines an integrated watercourse protection strategy, developed by Inland Fisheries Ireland through consultation with a wide range of experts in the area. Development management standards, policies and objectives should be set per watercourse. These could be mapped in County Development Plans, Local Area Plans & masterplans and integrated with flood risk, Natura 2000 designated sites, habitat and amenities mapping.

Implementation of this strategy should, not only protect watercourses and their associated riparian zones in urban areas, but also provide other benefits important for the well-being of people living nearby. It is important to note that, the riparian zone (i.e. the bank and the vegetation running along a watercourse) is an integral part of any watercourse, serving not just ecological, but also practical functions from a human point of view. For example, the vegetation in the riparian zone provides bank stability during flood conditions and filters pollutants out of surface water before it reaches a river or lake. Sufficient setaside space adjacent to the watercourse must be allocated at the planning stage, and it is strongly recommended that this space is planned for at the forward planning stage, such as during the compilation of County and Local Area Plans. Without this space, the four steps in this guideline cannot be accommodated. These steps are described in the context of an overall riparian buffer zone (i.e. strip of vegetated land running parallel to the river, which acts as a buffer against negative human development or activity). Again - this Riparian Buffer Zone MUST however be sufficiently wide to protect the river.

The recommended buffer zone width for larger river channels (>10m) is 35m to 60m and for smaller channels (<10m) is 20m or greater. The determined width should be tailored to site specific circumstances, river reach or lakeshore characteristics. It is important that the buffer

zone is wide enough to protect the ecological integrity of the river (including emergent, marginal and bankside vegetation) and takes into account the human history of the area. Wider buffer zones can be multifunctional in the urban environment if linked and managed appropriately, bringing greater benefits to the wider community.

This riparian buffer is subdivided into three separate zones, each with a different function, width, vegetation type and use. It is important to note that, the urban landscape, unlike agricultural land comprises of many hard non-biological features and therefore a greater buffer width is needed than that normally associated with the protection of water courses from farming or forestry.

THE FOUR MAJOR STEPS IN THE STRATEGY ARE:

- STEP 1. PROTECT THE STREAMSIDE RIPARIAN ZONE.
- STEP 2. CREATE A MIDDLE RIPARIAN ZONE – CAN INCLUDE AMENITY INFRASTRUCTURE, EG. FOOTPATHS.
- STEP 3. CREATE AN OUTER ZONE TO INCORPORATE SUSTAINABLE URBAN DRAINAGE SYSTEMS
- STEP 4. REHABILITATE THE RIVER ITSELF TO RECREATE DIVERSITY OF INSTREAM FEATURES FOUND IN NATURAL CHANNELS

Protection of the riparian zone doesn't preclude amenity use, and this guide strongly advocates the incorporation of amenity uses (walks, angling etc) into the (middle or outer) Riparian Buffer Zone, so long as it is done sensitively and with minimal impact on the water and riparian environment. The outer zone can be linked to a network of linear parks, picnic areas and other amenity areas where appropriate. These can provide greater space for flood protection and Sustainable Urban Drainage Solutions.

Culverting and piping of small streams and drains should not be permitted except under exceptional circumstances and only through agreement with Inland Fisheries Ireland. Drains should be incorporated into a SUDS network

Wild Irish Rivers



Wild watercourses are three dimensional systems, the channel sculpted by water from the surrounding landscape and moulded by local vegetation over time. Marginal vegetation, such as reeds and sedges, together with the bank vegetation form an important part of river ecosystems, providing rivers with much of their character, whether they are small upland cascading streams or large slow moving lowland rivers. Even underwater there are holes, nooks, crannies and shallow gravelly areas which scientists refer to as "riffles" where salmon and trout spawn. Deeper pools hold eel, adult salmon and trout, and often coarse fish species, such as roach, pike and even eel. The bank vegetation not only protects the river from pollutants, but is also important for cover and as a food source for fish and other aquatic animals such as otters, dippers, herons, bats, crayfish and even freshwater pearl mussels. A wild river, with the riparian zone intact is not only good for biodiversity and wildlife generally, but is pleasing to the eye. Therefore, wild rivers are of high amenity value to the public, providing a range of recreational pursuits from fishing to walking.

This guide aims to provide a basic template for the protection and enhancement of rivers in urban areas, and bring the positive benefits of the wild river to built up areas. By using this guide during the forward planning process, we are confident that "wild rivers" and other watercourses not only have a future in Ireland, but will enhance urban environments, if adequately protected in Local, County, Regional and National Development Plans and processes. This will require prescriptive planning requirements to be incorporated into planning permissions to ensure that developments do not degrade watercourses nor reduce their value as a public good. Developed appropriately, a river can enhance a development and even increase the value of properties.

Gently flowing watercourse with protective riparian vegetation



Typical example of a wild Irish cascading watercourse illustrating a good range of instream and bank habitat diversity

Urban Impacts



EXAMPLES OF DAMAGED WATERCOURSES DUE TO INSENSITIVE URBAN DEVELOPMENT

To plan for appropriate development along watercourses in urban or expanding urban centres, it is helpful to learn from past experiences. The following “what not to do” examples of developments proximal to watercourses have been identified by fisheries staff as problematic. A brief explanation is given for each case, all of which demonstrate that these impacts can be wide ranging; from amenity loss and loss of biodiversity to increased flooding and pollution impacts. All of these developments have been built too close to the watercourse.

COMMONLY ENCOUNTERED PROBLEMS ARE:

RESTRICTED PUBLIC AND ANGLER ACCESS.

INCREASED SURFACE RUNOFF LEADING TO UNNATURAL RIVER FLOW REGIMES.

INCREASED FLOODING AND EROSION PROBLEMS.

LOSS OF COVER AND FOOD FOR FISH AND AQUATIC ANIMALS.

LOSS OF FOOD AND HABITAT FOR RIPARIAN ANIMALS AND PLANTS.

LOSS OF RIPARIAN AREA AND FRAGMENTATION OF RIPARIAN CORRIDOR RESULTING IN A REDUCTION IN BIODIVERSITY.

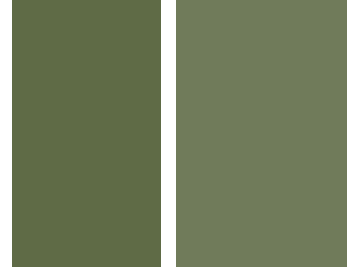
OFTEN THE INTRODUCTION OF NON NATIVE PLANTS (SUCH AS JAPANESE KNOTWEED) IN IMPORTED SOIL.

LOSS OF AESTHETIC VALUE AND A POTENTIAL QUALITY AMENITY FOR PUBLIC UTILISATION.

POORLY DESIGNED CULVERTS AND BRIDGES RESULTING IN BARRIERS TO FISH PASSAGE / NATURAL MOVEMENT OF RIVERBED MATERIALS



The riparian corridor is permanently fragmented by this development, part of which now sits on the riparian zone. There is no bank cover for fish and the movement of mammals such as otters are affected by the absence of bank vegetation, which they often use for cover. Surface runoff from the adjacent carpark and building enters the river untreated. Public access is completely restricted. If this type of development continues further up the catchment, the river will be in serious trouble.



This river has been straightened and canalised. All the larger instream material has been removed, resulting in the loss of pools and instream habitat variability (riffles and runs etc.) necessary to support older fish, invertebrates and other aquatic fauna and flora. The river banks have been engineered, leaving bank slopes that are unnaturally steep. In addition, the bank to the right of the picture has been planted with non-native vegetation, which is of lower biodiversity value to fish and other aquatic animals. Also, on closer inspection, it will be noted that grass cuttings (the light brown material) from the adjacent lawn have been dumped over the fence. These in turn will leach nutrients into the river. Dumping of grass cuttings is a common problem associated with developments, which have gardens bordering water courses. Public access to this river is completely restricted.

The riparian zone has been replaced with vertical rock armouring. There is no buffer between the carpark above and surface water runoff. Hydrocarbons, heavy metals, surfactants and other pollutants associated with motor vehicles, will enter untreated into the river through the drainage pipe, every time it rains. In addition, soil brought in by the developer has brought in an invasive non-native plant, Japanese knotweed (green plant growing between rocks). This plant is undesirable along river banks as it can outcompete native vegetation and is of low biodiversity value. The area covered by Japanese knotweed, will become much bigger over time and bring more ecological problems to the river. Japanese knotweed often causes infrastructural problems to a development itself; in this case it will undermine the rock armouring. *Japanese knotweed is an invasive species listed on the Third Schedule of the EU Habitats Regulations 2011 as amended.*

Riverbank Infilling



PROTECT THE STREAMSIDE ZONE FROM INFILLING

Infilling of land adjacent to rivers, prior or during development, is a recurring problem which can have serious consequences for flooding, local biodiversity and the riparian zone. Frequently, land is raised to accommodate a development and imported soil and/or builders' rubble is dumped right up to the water's edge. This is sometimes done under a waste permit (prior to the construction of the development itself) and it is important that local authorities don't license such activities close to watercourses. Builders' rubble (cement, building blocks, plastic, steel bars etc.) is not only unsightly but will alter the pH of the soil and its permeability, reducing its ability to support marginal vegetation associated with the area. The resulting steeper riverbank slopes present problems for public and angler access and interfere with natural flood conveyance. In some instances the spoil can be hazardous and potentially dangerous.

PROTECT IMPORTANT FEATURES ASSOCIATED WITH WATERCOURSES.

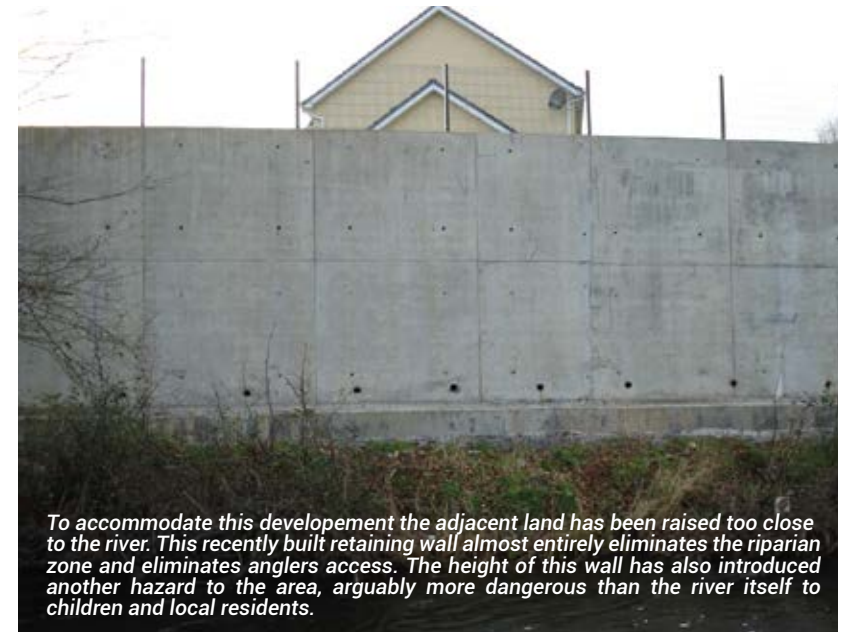
The development of the Riparian Buffer Zone should not impact or replace important ecological or geological features such as wetlands or glacial valleys of high amenity. In some instances it will be necessary to prescribe protection for these important ecological features adjacent to the riparian zone from infilling in local and county development plans. Work around them and incorporate their protection into the forward planning process.

The streamside zone should not be infilled as this impacts on its ecological characteristics and increases flood risk. Where wetlands occur, these must be protected as they provide important functions such as water regulation and retention. Wetlands are of high biodiversity value.

Note: Special Areas of Conservation and Special Protection Areas may require measures beyond the scope of this document and should be considered on a case by case basis taking into account the conservation objectives and special conservation interests of the sites.



Site left in a dangerous condition with vertical upstanding rebar (almost invisible amongst the autumn leaves) along the river bank. A potential hazard to children and anglers.



To accommodate this development the adjacent land has been raised too close to the river. This recently built retaining wall almost entirely eliminates the riparian zone and eliminates anglers access. The height of this wall has also introduced another hazard to the area, arguably more dangerous than the river itself to children and local residents.



Builders rubble is unsightly and reduces biodiversity value of the riparian zone



Areas of high amenity should be protected from encroachment and be clearly demarcated on GIS, and should be readily accessible to planners. This river is not only an area of high amenity but also a Special Area of Conservation. The development on the left hand bank is much too close to the river. Public access is annexed and significant ecological impact has occurred to the riparian zone and to the river itself. The gabions in the foreground (part of a separate development) are also undesirable, and should not be used on river banks as they are unsightly and restrict riparian vegetation growth. Areas of high amenity value can include, areas of high aesthetic appeal due to unusual or dramatic morphology caused by geological or ecological features such as glacial valleys or alluvial woodlands.



Natural floodplains. Infilling of natural floodplains and other natural features move the flooding problem elsewhere, often with catastrophic consequences to local communities. Floodplains should be protected and never infilled or built upon.



Land reclamation. Infilling of land with a view to future development, alters the natural channel bank profile resulting in unnaturally steep banks and a potentially more hazardous watercourse during flood conditions. This bank should be rehabilitated by sloping its profile back to mimic the natural river.



Infilling of a high amenity glacial valley area. In this example, the river is down to the right. Not only does this infilling of material (several meters high in places) introduce silt to the river during high rainfall events, but also degrades the riparian woodland and the area as an amenity for the wider community.



Builders' rubble on the rivers edge. Infilling of riparian zone with builders' rubble, which is unsightly and hazardous. The valley, a high amenity area, has also been infilled and degraded.

Four Steps to Good Riparian & River Planning for Urban Areas



STEP 1 – PROTECT STREAMSIDE ZONE >10M

- ENSURE SUFFICIENT SPACE IS SET-ASIDE , I.E. >10M.
- LEAVE INTACT IF IN AN UNDISTURBED NATURAL SITE.
- IF DISTURBED, LANDSCAPE APPROPRIATELY.
- PLANT WITH NATIVE MARGINAL AND EMERGENT VEGETATION.



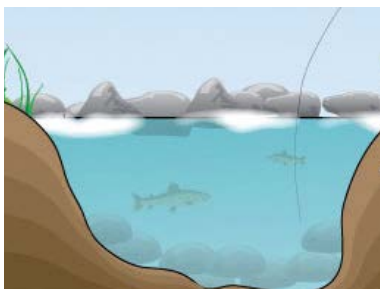
STEP 2 – CONSTRUCT MIDDLE ZONE 15M-30M

- ENSURE SUFFICIENT SPACE SET-ASIDE , I.E. >15M.
- LEAVE INTACT IF IN AN UNDISTURBED NATURAL SITE.
- IF DISTURBED, LANDSCAPE APPROPRIATELY.
- CREATE AMENITY WALKS ETC.
- PLANT WITH NATIVE TREES AND VEGETATION.



STEP 3 – CONSTRUCT OUTER ZONE >8M

- ENSURE SUFFICIENT SPACE SET-ASIDE , I.E. >8M.
- LEAVE INTACT IF IN AN UNDISTURBED NATURAL SITE.
- IF DISTURBED, LANDSCAPE APPROPRIATELY.
- INCORPORATE SUDS (E.G. SWALES, RETENTION PONDS ETC.).
- ENSURE SUDS LINK APPROPRIATELY TO DEVELOPMENT IN A TREATMENT TRAIN.
- CONSIDER WIDER AMENITY USES IF APPROPRIATE.



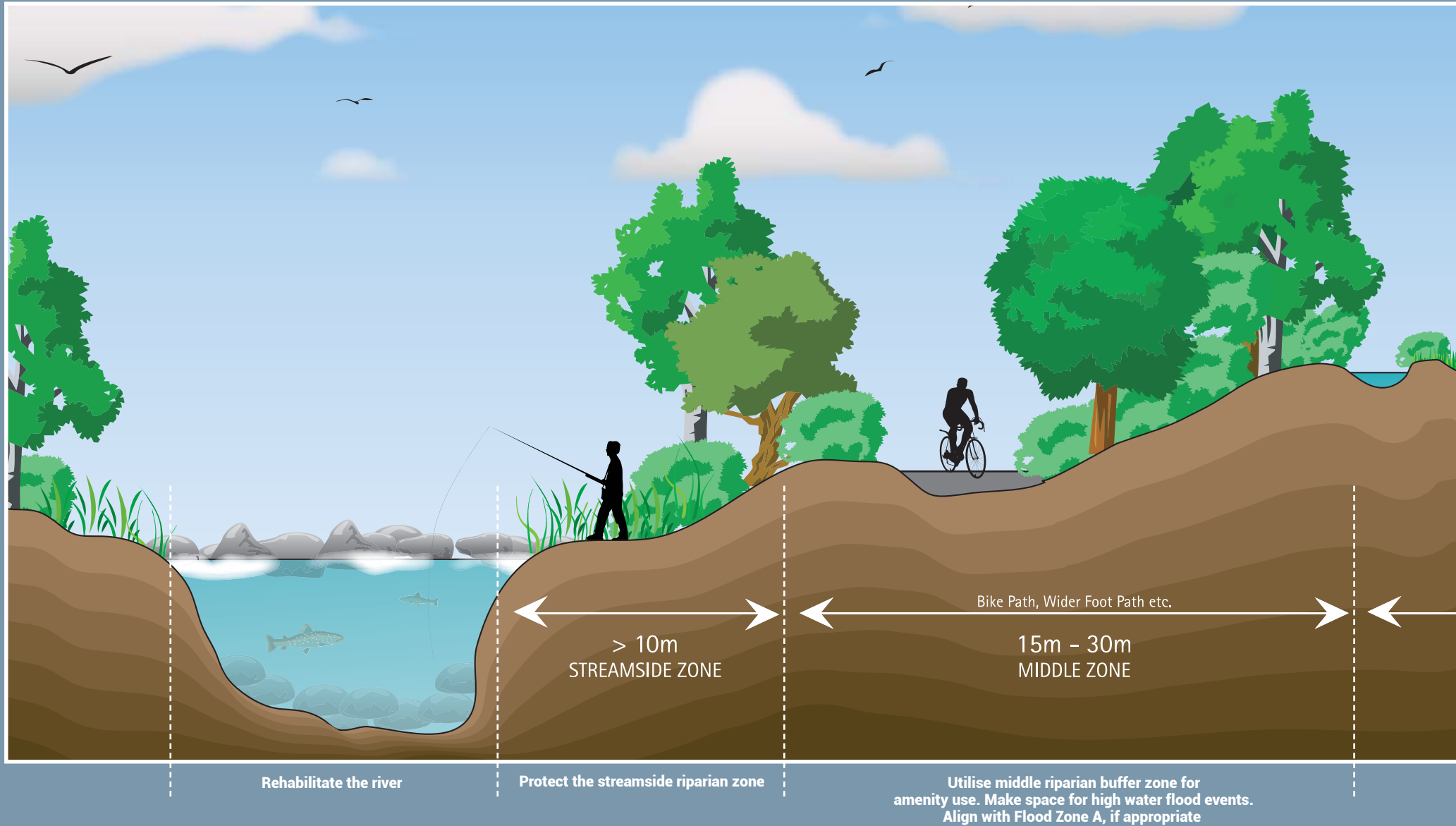
STEP 4 – REHABILITATE INSTREAM CHANNEL

- IF WATERCOURSE WAS PREVIOUSLY DEGRADED BY DRAINAGE, REHABILITATE WITH APPROPRIATE HABITAT RESTORATION TECHNIQUES.
- CONTACT INLAND FISHERIES IRELAND FOR ADVICE.
- RECREATE HABITAT VARIABILITY.
- CONSIDER CREATION OF ANGLING POOLS IF APPROPRIATE.
- CONSIDER SAFETY REQUIREMENTS (E.G. AVOID STEEP BANKS.)
- ENSURE WORK IS CARRIED OUT TO A HIGH ECOLOGICAL STANDARD. *CONSULT WITH IFI FOR FURTHER ADVICE*

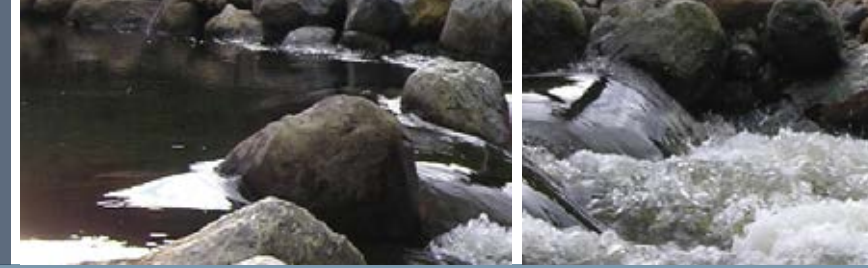




Three Buffer Subzones



Potentially align middle and outer zones with Flood Zones (<https://www.floodinfo.ie>) & Local Authority information.



CHARACTERISTICS	STREAMSIDE ZONE >10M	MIDDLE ZONE 15M-30M	OUTER ZONE >8M
FUNCTION	Protect the physical integrity of the stream ecosystem	Provide distance between upland development and streamside zone. Acts as a sump/filter for nutrients and sediment	Prevent encroachment and filter hard surface runoff
WIDTH	Minimum 10m plus wetland and other habitat	15-30m depending on stream	8m minimum setback to structures
VEGETATIVE TARGET	Native riparian vegetation	Managed woodland, some clearing/open space allowed	Woodland encouraged, but usually-turfgrass
ALLOWABLE USES	Very restricted except for fishing or walking trails	Restricted, e.g. some recreational uses such as bike path or larger footpaths can function as a flood zone*	Unrestricted e.g. residential uses, including lawn, swales, most stormwater treatment will occur here
SUPPORTING OTHER PLANNING OBJECTIVES	<p>All zones but especially the streamside zone should support Biodiversity including EU Habitats Directive objectives</p> <p>Potentially Align with Flood Zones (https://www.floodinfo.ie) & Local Authority information.</p> <p>Walking trails should not run through sensitive ecological habitats. It is recommended that a multi-disciplinary team including an ecologist and flood risk expert determine the appropriate zonation and allowable uses.</p> <p>No artificial lighting is recommended for the streamside zone and artificial lighting should be restricted unless absolutely necessary in the middle zone. LEDs should be warm white to minimise disturbance to wildlife</p>		

- Steps 1 (i.e. create stream side zone) and 3 (i.e. create outer zone) are essential for all streams irrespective of size.
- Steps 4 (i.e. rehabilitate channel) and 2 (i.e. create middle zone) are strongly recommended and arguably necessary for rivers with amenity potential, particularly in the context of social cohesion in urban areas.

LEGEND

- Commercial
- Residential
- Open Spaces
- Outer Zone
- Middle Zone
- Streamside Zone
- Watercourse

INCORPORATE BUFFER ZONATION INTO LOCAL AREA PLANS

Incorporation of this guideline into local area plans will protect the watercourse and ensure sufficient space is set aside for appropriate amenity and SuDS provision.

Climate change is expected to have diverse and wide ranging impacts on Ireland's environment, society and economic development, including managed and natural ecosystems, water resources, agriculture and food security, human health and coastal zones. The most immediate risks to Ireland which can be influenced by climate change are predominantly those associated with changes in extreme events, such as floods, precipitation and storms. These factors should be integrated in every decision made when planning for watercourse management.

* It is recommended to use this guide in association with the OPW Flood Maps (<http://www.floodmaps.ie/>).

Utilise outer riparian buffer for treatment & reduction of stormflow runoff from development (SuDS)
Align with Flood Zone B, if appropriate

Step 1: Protect Streamside Zone



THE STREAMSIDE ZONE



**STREAMSIDE RIPARIAN ZONE
MINIMUM WIDTH >10M**

The streamside zone is the zone nearest the river and provides essential habitat for marginal aquatic plants and food and cover for aquatic animals, including fish.

This is the most ecologically sensitive zone and should be either left alone if in its natural state, or if degraded, planted with appropriate emergent aquatic vegetation and a mixture of native trees along the bank itself. Suitable native tree species include:- alder, birch, aspen and willow, all of which do well on wet soils. In time, they will overhang the streambank providing shade and food insects for fish. Ash and oak are also suitable but require dry acid soils. Holly, rowan, hazel, guelder rose, elder and

crab apple grow well on drier fertile banks (Fossitt, 2000; Anon, 2000). Plant with Irish rather than imported "native varieties" as the vegetation community should ideally be genetically similar to that which occurs naturally in the locality. This zone is suitable for angling if appropriately managed, e.g., leave occasional open space for casting of bait into fishing areas such as pools. The local Inland Fisheries Ireland office can provide advice on the construction of angling pools.



In this example the river bank has been replaced by builders rubble and is too steep. Builders rubble is not a suitable substrate for riparian plants and river edge vegetation with the consequence of a severely diminished riparian zone.

BENEFITS OF STREAMSIDE ZONE

The streamside zone, if sufficiently wide and managed appropriately, will

- Filter out pollutants and sediment from overland surface runoff.
- Provide a refuge for insects and animals with close affinity to rivers (e.g., otters, kingfishers and dragonflies).
- Provide habitat necessary to support diverse fish and other aquatic life.
- Provide amenity and recreation for local people and visitors to the area (fishing, birdwatching, etc.).
- Enhance flood alleviation through increased channel stability and improved resilience to the impacts of climate disruption.
- Bring about greater public appreciation and reduce the risk of dumping of unwanted rubbish.



Example of a suitable riparian zone showing marginal vegetation.

Step 2: Construct Middle Zone



THE MIDDLE ZONE



**MIDDLE RIPARIAN ZONE
RECOMMENDED WIDTH 15M-30M**

The next zone out from the river is the middle zone. This zone is best developed as a narrow woodland area and planted with an appropriate mixture of native woodland species.

This zone is suitable for human usage and the habitat is also important for wildlife. Recreational activities such as walking (permeable paved or gravel footpaths) or cycle lanes can be planned for incorporation into this zone. Planting of appropriate tree and shrub species is important; species such as poplar, Scots pine, European larch, ash, oak, alder, birch, aspen, willow, holly, rowan, hazel, guelder rose, elder and crab apple are suitable.

Plant with Irish rather than imported "native varieties" as the vegetation community should ideally be genetically similar to that which occurs naturally in the locality. This zone could also be planned to provide for projected extra water retention. Take EU Habitats and Birds Directive objectives into consideration if applicable.

BENEFITS OF MIDDLE ZONE

The middle zone, if sufficiently wide and managed appropriately, will

- Provide amenity and a recreation area for local people and visitors (fishing, scenic walks, etc.). This zone is suitable for high impact recreational pursuits, such as cycling and horse riding.
- Provide a refuge for a range of woodland and grassland species.
- Filter out pollutants and sediment from overland surface runoff.
- Act as a carbon sink between the outer and streamside zone.



A path through the middle zone surrounded by native trees makes for a very pleasant walk and is an attractive amenity for people living in urban areas. The path should be kept sufficiently well back from the watercourse to minimise disruption to aquatic wildlife. Smaller tracks can be constructed to designated fishing or viewing points closer to the watercourse itself, if appropriate. Consult with local IFI office for advice

Step 3: Construct Outer Zone



THE OUTER ZONE



**OUTER ZONE
MINIMUM 8M SET BACK FROM
HARD SURFACES**



The outer zone is the first line of defense against urban development. It is recommended that it is also developed to receive and treat surface water runoff, through the incorporation of Sustainable Urban Drainage Systems (SuDS). All development sites, not just those adjacent to watercourses should incorporate SuDS, and these should be arranged in a treatment train to maximize their effectiveness (see below for more detail). The outer zone can be expanded to merge with recreational playing fields or picnic spaces. The outer zone must not be enclosed or incorporated into private gardens. If enclosed, home owners may subsequently pave or build on it, effectively impacting on the zone.

SUSTAINABLE URBAN DRAINAGE SYSTEM (SUDS)

Culverting, draining, direct piping of storm waters and the construction of hard surfaces too close to watercourses reduces their aesthetic qualities, impacts on and eliminates fish and other wildlife, and reduces stream function from a human health perspective. Sustainable Urban Drainage Systems (SuDS) is a suite of techniques developed to manage and reduce the impact of storm waters on river systems, by reducing the surface run off rate from developed sites compared to conventional systems (shores, pipes etc.). They are also effective at removing certain pollutants. Developed internationally, the efficiency of these techniques have been conclusively demonstrated by scientific research and now form an integral part of the Greater Dublin Drainage Strategy Strategy and most County Development Plans to manage surface waters from developed areas.

It is recommended that the outer zone is developed to incorporate some of these SuDS techniques such as SWALES (constructed watercourses, which are shaped or graded in earth materials and planted with site suitable vegetation) and constructed wetlands. These can be linked back into the SuDS treatment train, starting from site specific techniques (such as water butts or tanks and permeable paving) and subsequently linking onto larger wetlands prior to discharging to the watercourse. For further information on SuDS check out (CIRIA, 2015). Excellent examples of the different SuDS methods available can be found on www.dublincity.ie.

BENEFITS OF OUTER BUFFER SUB-ZONE AND SUDS

If Sustainable Urban Drainage Systems are incorporated into the outer zone then the following should occur:

- A significant reduction in stormwater runoff rates to the watercourse.
- An improvement in flood alleviation, reducing erosion and other flood impacts downstream.
- Increased water quality - filtering out of pollutants and sediment from overland surface runoff.
- A provision of additional habitat for species and an overall increase in biodiversity of the area.
- Depending on SuDS type, additional amenity value can be added to an area (e.g., parks, playing areas etc).

Management of SUDS should ensure that invasive species are controlled should they occur and good biosecurity protocols followed.



Surface runoff from a car park during a spell of heavy rain. This car park is covered in a hard impermeable surface with grit and organic matter clearly visible in the foreground, which eventually is washed into the watercourse. The high concentration of suspended solids can be seen clearly as it enters and discolours the watercourse (see left inset image)



A small constructed stormwater wetland removes pollutants and reduces the impact of stormflow runoff on the watercourse. Note the green channel in the foreground, which feeds the water from the development through a system of interconnected swales.

Table 1. Typical pollutant removal rates of a stormwater wetland

Pollutant	% Removal *
Total Suspended Solids	60-80%
Total Phosphorous	20-40%
Total Nitrogen	20-40%
Bacteria	60-80%
Copper	60-80%

• various sources; see page 18 for further information



A SWALE is a relatively simple but effective SuDS technique to construct. The example above is known as a **dry swale** and during storm water events, surface water runs off the adjacent hard surface (road), and attenuates in the SWALE, and is filtered out slowly to a receiving drainage network. This effectively slows water runoff and removes pollutants.

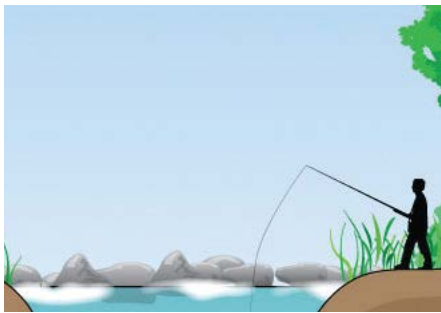
Table 2. Typical pollutant removal rates of a SWALE

Pollutant	% Removal *
Total Suspended Solids	80-90%
Total Phosphorous	29-65%
Total Nitrogen	30-50%
Bacteria	50%
Metals	14-19%
Hydrocarbons	100%

Step 4: Rehabilitate Instream Channel



REHABILITATE AND RESTORE



REHABILITATE WATERCOURSE

INSTREAM REHABILITATION

Wild watercourses are usually complex systems defined by the surrounding topography, geology, vegetation and hydrology. The natural form of rivers can range from slow meandering riffles, glide, pool sequences to steeper and straighter step pool sequences. In Ireland, this natural physical form is often lost in rivers close to urban environments due to river engineering. Drainage and straightening of river channels result in a loss of habitat for fish and other aquatic organisms. Therefore, when planning for rivers in urban areas, it is important that such channels are rehabilitated to compensate for this habitat loss. A range of instream rehabilitation techniques have been developed by Inland Fisheries Ireland. These techniques have the added advantage of increasing river stability, reducing unnaturally high rates of river bank erosion and bedload movement (both of which are flooding hazards), and improve river biodiversity. They can include soft-engineering techniques, which use

nature based solutions and native vegetation such as willow to work with natural river processes. In other situations, especially where natural river processes are constrained (e.g., in canalised river channels), a range of harder engineering techniques may be required; such as randomly placed boulders, deflectors, insertion of gravel and spawning beds, artificial riffles, weirs, log and Christmas tree bank protection, and rip-rap (stone armouring) to increase habitat availability inside the channel (see O'Grady 2006 for detail). In some cases it may be necessary to landscape the entire channel, for example to reduce bank slope and reintroduce meanders. It is essential that personnel with the appropriate experience in river rehabilitation advise on instream habitats and it is recommended that Inland Fisheries Ireland is contacted for advice. Angling pools for children to go fishing can be placed at desired locations using these instream rehabilitation techniques, the design of which will be determined by the target species and the type of watercourse. Consider also removing or adjusting barriers that prevent the passage of migrating fish and improving the flow of water and sediments - EU Biodiversity Strategy 2030.

BENEFITS OF INSTREAM REHABILITATION

If constructed to Inland Fisheries Ireland standards then instream rehabilitation works will:

- Improve channel stability by reducing excessive erosion and improving flood conveyance.
- Dramatically improve the rivers' holding capacity for fish (2-5 fold increases are not uncommon) by recreating habitat.
- Improve aesthetics of a watercourse and its value as an amenity.
- Improve biodiversity in the area, not only for fish but also crayfish, otters, dippers, grey wagtails and other wildlife.
- Provide angling pools for kids to fish.



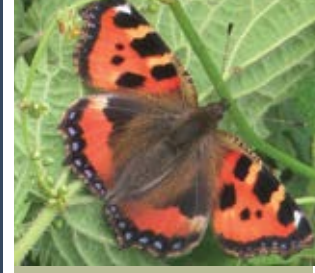
Example of rehabilitation works on the River Gloscha (Mulcair River catchment) in County Limerick. Here a series of alternating deflectors reintroduce sinuosity and riffle glide pools sequence characteristic for this type of channel



Random boulders were introduced into the channel for instream fish cover, greater hydraulic diversity and perching areas for dipper, yellow wagtail and otters. Emergent vegetation and grass have established themselves on the deflectors, significantly increasing local biodiversity and providing additional cover and food for fish, bats and birds.

This step will most likely require collaboration with the Local Authority and possibly other agencies to take a hydromorphological approach appropriate for the reach. It offers an opportunity to bring about an 'enhanced' amenity now required as a result of the higher density development prescribed under government guidance.

Providing Tangible Benefits to Urban Communities: Climate Action, Flooding, Mental Health, Positive Living & Reduced Crime



WIDER BENEFITS TO SOCIETY

The rehabilitated watercourse with its Riparian Buffer Zone (incorporating SuDS) can be developed even further to improve the overall amenity value for the public. The benefits of nature to individuals stress-levels and mental health in general is well documented. More recently studies have shown that the impact of nature and green areas have significant health benefits for wider society. These include improvements in community well-being, recreation, recovery from serious illness and reduced anti-social behaviour.

Studies have even found a reduction in violent crime rates in greener areas. The incorporation of the Riparian Buffer Zone and the restored river into a network of linear parks, walks and cycle routes in the urban environment is a logical progression as the riparian buffer should provide some of the green space needed. Walking is now the most popular outdoor activity in Ireland, and schemes such as the Slí na Slàinte offer ways to manage such routes effectively. Rivers offer an ideal opportunity to develop waymarked walks in urban areas (away from hazardous traffic) which are not only safe, but have high visual and acoustic appeal. This must be an important consideration for urban planning, as obesity (in particular childhood obesity) has been identified as one of the biggest health threats in Ireland today. The design of the walk and green spaces can be planned on a site by site basis, but ideally should preserve and compliment the longitudinal riparian corridor.

THE WHOLE IS GREATER THAN THE SUM OF THE PARTS

Any one of the four steps will result in an improved watercourse and amenity in the urban environment. However, the combination of steps compliment each other, working cumulatively to maximise protection of the watercourse and ensuring that it serves as a high quality amenity for the local community. In addition flood risk to property and infrastructure should be significantly reduced. Therefore, it is recommended that this system is incorporated into future planning decisions with regard to local area and regional plans. These plans need to be prescriptive as to what is expected from developers, and the responsibility of implementation and maintenance needs to be examined carefully. In other words, set aside sufficient buffer width, landscape and plant appropriately, incorporate SuDS if possible, rehabilitate the watercourse itself including angling pools for kids, and design amenity infrastructure such as paths



for the middle and outer zones. Limited nature trails may be considered for the streamside zone. Set-aside riparian zones not only function as amenity areas but can also be important buffers for protecting urban buildings and infrastructure (and the local economy) against severe flood events such as the example above in Golden, Co. Tipperary on the River Suir. Here the river regularly floods into the park which alleviates pressure further downstream and making space for water. Implementation of the recommendations in this guidance document will increase the resilience of urban areas to predicted impacts of Climate Change. Making space for water and biodiversity will reduce flood risk and increase environmental quality for those living in urbanised areas.

Further Information



CLIMATE CHANGE AND FLOODING

IRELAND'S CLIMATE ACTION PLAN / SUSTAINABLE DEVELOPMENT

Department of the Environment, Climate and Communications. (<https://www.dccae.gov.ie>)

NATIONAL ADAPTATION FRAMEWORK

Planning for a Climate Resilient Ireland. 2019. Department of Communications, Climate Action and Environment (<https://www.dccae.gov.ie>)

FLOOD RISK MAPS

(<https://www.floodinfo.ie>)

GREEN INFRASTRUCTURE

GREEN INFRASTRUCTURE

Nature-based solutions – 'thinknature' (<https://platform.think-nature.eu/>) Integrating Ecosystem Approaches, Green Infrastructure and Spatial Planning (www.epa.ie)

SUSTAINABLE DRAINAGE SYSTEMS

SuDS The SuDS Manual C753 (2015) (<https://www.ciria.org>)

NATIVE WOODLANDS SCHEME & NEIGHBOURHOOD SCHEME

Department of Agriculture (<https://www.agriculture.gov.ie>)

COMMUNITY HEALTH / GREEN WALKS

The Slí na Sláinte Programme encourages people to walk more and get more health benefits from their walking (<https://www.irishheart.ie>) and Sport Ireland Trails listed at (<https://www.irishtrails.ie>)

OPW (2009)

The Planning system and flood risk management. Guidelines for Planning Authorities

INTEGRATED CATCHMENT MANAGEMENT

RIVER RESTORATION / FISHERIES HABITAT / IRELAND'S INLAND FISHERIES

(protection, management and conservation of Ireland's inland fisheries and sea angling resources) IFI Guidance / Research Documents (<https://www.fisheriesireland.ie>) River Restore (<https://www.restoreivers.eu>)

RIVER BASIN MANAGEMENT PLAN/WFD GUIDANCE

(<https://www.dhplg.gov.ie>) & (<https://www.epa.ie>)

INTEGRATED CATCHMENT MANAGEMENT

Catchments.ie (<https://www.catchments.ie>) and Local Authority and Waters Programme (<https://www.watersandcommunities.ie>)

WATER CONSERVATION

Taptips (<https://www.taptips.ie>)



Rivers can provide immense pleasure for children as well as providing a natural educational setting if managed with safety and biodiversity in mind. Degraded rivers on the other hand tend to be low in biodiversity, lacking character and amenity value, and by virtue of the damage caused by physical engineering are often more dangerous than their natural counterparts.

THE INFORMATION PROVIDED FROM THIS DOCUMENT IS DRAWN FROM INTERNATIONAL RECOMMENDATIONS & MODIFIED FOR THE IRISH ENVIRONMENT INCLUDING:

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http://www.dublincity.ie/shaping_the_city/environment/drainage_services/greater_dublin_strategic_drainage_study/
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8. Mahan B. L, Polasky, S. and RM Adams (2000) Valuing urban wetlands. A property price approach. Land Economics. 6 (1). 100-113.
9. The Obesity Report (2005) National Taskforce on Obesity, Ireland
10. NRA (2006) A guide to landscape treatments for national road schemes in Ireland National Roads Authority
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Inland Fisheries Ireland is the statutory agency responsible for inland fisheries in Ireland. It operates under the aegis of the Department of the Environment, Climate and Communications. The principal function of Inland Fisheries Ireland is set out under Section 7 (2) of the Inland Fisheries Act of 2010. This is the protection, management and conservation of the inland fisheries resource. Our mission is to protect, manage and conserve Ireland's inland fisheries and sea angling resources and to maximise their sustainability and natural biodiversity for you and for future generations. We achieve this through working with the Community, Government, its agencies, and Business.



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