Appendix A Glossary

A

Active travel
Active travel refers to modes of travel that involve a level of activity. The term is often used interchangeably with walking and cycling, but active travel can also include trips made by wheelchair, mobility scooters, adapted cycles, e-cycles, scooters, as well as cycle sharing schemes.

Agricultural runoff
The portion of rainfall that runs over agricultural land and then into streams as surface water rather than being absorbed into ground water or evaporating.

APP
Town centre Action Plan Policies

APIS
Adaptation Pathways in Somerset

Attenuation
In this document refers to the ability to temporarily store water for a period of time, to then release slowly back into the natural drainage system or watercourse.

B

Baseline
A fixed point of reference that is used for comparison purposes.

Bedforms
The form of the riverbed that develops as the result of bed material being transported and deposited. Examples include ripples and dunes on the bed of a river. Palaeo-Bedforms are often preserved in sedimentary rocks.

Biodiversity
The variety of living species on Earth, including plants, animals, bacteria, and fungi.

Blue infrastructure
Relates to urban water infrastructure, including ponds, lakes, streams rivers and storm water provision.

BNG
Biodiversity Net Gain

Breach
A breach of a flood embankment or natural riverbank occurs when water flows over or through the existing edge of the channel. This can be an intentional breach or unintentionally due to a flood event.

Brownfield
Urban sites for potential building development that have had previous development on them.

Bridleway
A type of Public Right of Way where the public have a right of access on foot, horseback or bicycle.

C

Catchment
A geographic area of land from which all surface water from rain, melting snow or ice flows into a particular as a river, stream, or lake. This area is defined by the topography of the land, with higher elevations forming the boundaries that direct the flow of water towards a common waterbody.

Channel realignment
The realignment of the river channel to redirect water flow.

CNCR
Climate Resilience Action Plan

Combined sewer overflow
Combined sewer overflows (CSOs) are overflow valves that reduce the risk of sewage backing up during heavy during storms and heavy rainfall. Combined sewers transport wastewater and stormwater to treatment plants, but intense or prolonged rainfall can overload them. CSOs divert excess flow direct to the rivers, enabling wastewater recycling plants to continue to operate and preventing upstream flooding of properties.

COWs
Critical Ordinary Watercourses

CrOW
Countryside and Rights of Way

CRT
Canal and Rivers Trust

CSO
Combined Sewer Overflow

Culvert(ed)
An enclosed artificial channel or pipe that is used to carry a watercourse beneath a road, building or structure.

D

Decarbonisation
Removal or reduction of carbon dioxide (CO2) output into the atmosphere.

DEFRA
Department for Environment, Food & Rural Affairs

Dewatering
The removal of water from a location.

Downstream
In the direction in which a stream or river flows.

Dredging
The excavation of unwanted sediment material from a water environment.

Dynamic equilibrium
Rivers are constantly changing over time to reach a balance with the processes that determine their form. As the flows of energy and materials passing through the river change over time, so too does the river towards this equilibrium.

E

EA
Environment Agency

Easy access trail
Easy access trail design principles give everyone the opportunity to use a countryside path route. They have easy terrain and no physical barriers, like stiles, making them suitable for pushchairs, wheelchairs and other mobility aids.

Ecosystem
A geographic area where plants, animals, and other organisms, as well as weather and landscape, work together to form a bubble of life.

EIA
Environmental Impact Assessment

ELMs
Environmental Land Management

Embankments
A bank of earth or stone that is used to hold back water to reduce the risk of flooding to an area of lower lying land. These can be used along waterways and the coastline.

ENCA
Enabling a Natural Capital Approach

Erosion
The physical break-up and transportation of materials from one place to another through natural processes. In river systems lateral erosion erodes the banks of the river (typically on the outside of a bend in the river), whilst simultaneously depositing sediment on the inside of the bend, thus changing its route without significantly changing its width. Where lateral movement is not possible through constraints of urbanisation, channels become over widened, deep and straight. Vertical erosion involves the wearing away and deepening of the riverbed.

Eutrophication
Excessive richness of nutrients in a lake or other body of water, frequently due to run-off from the land, which causes a dense growth of plant life.

F

FCERM
Flood and Coastal Erosion Risk Management

Flood alleviation
The detention and/or diversion of water during flood events for the purpose of reducing discharge or downstream flooding.

Flood risk activity
Used in this document in relation to the Environment Agency terminology meaning any activity within 8 metres of any flood defence structure or culvert on a main river, or 16 metres on a tidal river. If such an activity is not covered by a Flood Risk Activity Exemption registration it will require a permit, issued by the Environment Agency.

Flood risk activity exemption
Some flood risk activities are exempt from needing a permit and you can carry out the work if you register an exemption. Exemptions are registered with the Environment Agency.

Floodplain
An area of low-lying ground adjacent to a river, formed mainly of river deposits and subject to flooding.

Flood mitigation
Action(s) taken to reduce or eliminate long-term risk to life and property from a flood event.

Flood resilience
Minimising damage during times of flooding to enable quicker recovery after a flood event has occurred.

Fluvial flooding
Fluvial flooding occurs when rivers and streams overtop their banks and water flows out onto the adjacent low-lying areas (the natural floodplains).

Footpath
A path for people to walk along, and a commonly used term that may or may not refer to a path with legal Public Right of Way status.

FRMA
Flood Risk Management Authority

FWAG
Farming and Wildlife Advisory Group

G

Geomorphology
The shape of landforms and physical features.

GI
Green Infrastructure

Green infrastructure
A strategically planned network of natural and semi-natural areas with other environmental features, designed and managed to deliver a wide range of ecosystem services, while also enhancing biodiversity.

H

Hydropower
The use of falling or fast-running water to produce electricity or to power machines.

I

IDB
Internal Drainage Board

Infiltration
Infiltration is the process by which water on the ground surface enters the soil.

Irrigation
The practice of supplying land with water so that crops and plants will grow

L

Left and Right banks
When facing downstream the left bank of a river is on the left side and the right bank is on the right side.

LLFA
Lead Local Flood Authority

LNP
Local Nature Partnership

LPA
Local Planning Authority

M

Main River
Usually larger rivers and streams, designated as such, and shown on the Main River Map, falling under the jurisdiction of the Environment Agency. The Environment Agency has powers to carry out maintenance, improvements or construction work on main rivers to manage flood risk. Other rivers and streams are called ‘Ordinary Watercourses’.

MMP
Management and Maintenance Plan

Mobility hub
A mobility hub is a recognisable place with an offer of different and connected transport modes supplemented with enhanced facilities and information features to both attract and benefit the traveller.

Morphology
The shapes of river channels and how they change in shape and direction over time.

Multi-Use Routes
Multi-use routes, trails or networks are about the ability to be used by a range of active travel modes, for instance walking, as well as cycling and horseback. Routes might link up a network of existing Public Rights of Way or might integrate with paths without Public Right of Way status.

N

Nature Recovery
Improving the landscape's resilience to climate change, providing natural solutions to reduce carbon and manage flood risk, and sustaining vital ecosystems such as improved soil, clean water and clean air.

NCN
National Cycle Network

NCR
National Cycle Routes

NFM
Natural Flood Management

Non-main River
All watercourses that are not under the power of the Environment Agency.

NRS
Network Recovery Strategy

Nutrient neutrality
Nutrient neutrality is the outcome achieved when a particular land use or a specific development, within catchment areas of vulnerable watercourses, does not result in an increase in phosphate and nitrate levels in those watercourses beyond current levels.

O

Ordinary watercourse
A watercourse that is not part of a main river and includes rivers, streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows. These are under the permissive powers of the Lead Local Flood Authority.

P

Permissive powers

It remains the decision of the authority as to whether it carries out enforcement action or not. Permissive powers ensure that appropriate maintenance is carried out by riparian landowners on rivers and ordinary watercourses. These powers can be exercised if it is deemed that a lack of maintenance or an alteration to a watercourse pose a flood risk. Exercising of permissive enforcement powers will only take place when necessary and as a last resort when all other opportunities to resolve the issue have been explored.

PRoW
Public Right of Way

Public Rights of Way
A route over land which the public has a legal right to use at any time. Local councils have a responsibility to maintain and protect public rights of ways.

Public Byway
A type of Public Right of Way where the public have a right of way on foot, horseback, bicycle or vehicle. This includes horse-drawn carriage, motorcycle or other motor vehicle.

Public Footpath
A type of Public Right of Way where the public have a right of way on foot only. Prams, pushchairs, wheelchairs and invalid carriages are allowed along public footpaths. However not all paths may be suitable for the various types of access, particularly in the countryside.

R

Realigned
Change to the existing route to a different position.

Restricted Byway
A type of Public Right of Way where the public have a right of way on foot, horseback, bicycle or horse-drawn carriage.

Rhyne
A running waterway that links a ditch or stream to a river. A rhyne is more specifically used to turn areas of wetland close to sea level into useful pasture or agricultural land. Water levels are carefully controlled to allow the land to become wetter at times of the year when this will improve grass growth. Rhyne systems are managed and operated by the Somerset Drainage Board Consortium.

Riffles
An area of stream characterized by shallow depths with fast, turbulent water over rocks.

Riparian
Relating to or situated on the banks of a river.

River Channel
The main route, usually incised into the landscape, in which a body of water flows downstream. The channel shape and cross section changes along the course of a river varying in width and depth of the channel. Typically, the channel gets wider and increases in capacity in a downstream direction.

Riverbank
The land alongside the edge of a river.

RMAs
Risk Management Authorities

S

S106
Section 106

SAB
Sustainable Drainage System Approval Board

Sequestered carbon
The capturing, removal and storage of carbon dioxide (CO2) from the earth's atmosphere.

SPZ
Source Protection Zones

SRA
Somerset Rivers Authority

Subsurface water
Includes all water located in the pore spaces of soil and rocks.

Surface water
Surface water is any water that collects on the surface of the earth. This includes streams, lakes, rivers, reservoirs and wetlands. The vast majority of surface water is produced by rainfall.

Sustainable development
Sustainable development is development that meets the needs of the present, without compromising the ability of future generations to meet their own needs.

Sustainable Drainage Systems (SuDS)
A range of techniques for holistically managing surface water runoff onsite that aim to mimic more natural drainage processes.

T

TASCC
Taunton Adventurous Sports and Canoe Club

TPO
Tree Protection Order

Tributaries
A river or stream flowing into a larger river or lake. A tributary does not flow directly into a sea or ocean.

U

Upstream
In the opposite direction to that which a stream or river flows.

W

Watercourse
A natural or artificial channel through which water flows.

Water source heat pump
A water source heat pump system extracts heat energy from a water source such as a lake, river or even the sea and uses it to provide hot water and heating to a property.

WEIF
Water Environment Investment Fund

Wetlands
A wetland is a distinct ecosystem that is either covered by water or saturated with water permanently or seasonally.

Wet woodland
Wet woods occur on soils that are often or seasonally wet, either because of flooding, or because of the land form and soil type. Found along streams and rivers; on floodplains and at the edges of lakes; in peaty hollows; and at the margins of fens, bogs and mires.

Winterborne
A stream flowing only after heavy rainfall, especially in winter.

Appendix B
Management and Maintenance Plan

<Link to be inserted to external file>

Appendix C
Surface Water Management Approach

Calm ENGINEERING

Sustainable Drainage Systems (SuDS) Guidance

Sustainable Drainage Systems (SuDS) offer an approach to drainage that mitigates the impact of new development on flood risk and builds our resilience to flooding. It also provides opportunities to remove pollutants from urban run-off at source, and combines water management with green space, with benefits for amenity, recreation and wildlife.

Local planning policy and decisions on major developments – 10 dwellings or more, or equivalent non-residential or mixed development – are expected to make sure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate. The current national policy requirement, that all new developments in areas at risk of flooding should give priority to the use of sustainable drainage systems, will continue to apply. With the enactment of Schedule 3 of the Flood and Water Management Act this will be true for ALL new developments including Non-Major Developments (Less than 10 dwellings).

The LLFAs have their own guidance on sustainable drainage and these must be considered in any development proposal put forward by developers. The LLFAs, Internal Drainage Boards and Highway Authorities may have specific requirements with regards to design criteria for discharge rates, attenuation requirements, routes of discharge etc. It is the responsibility of developers to incorporate these requirements within any scheme presented to planning and/or to Wessex Water for Adoption.

Early pre-application engagement will be necessary to ensure that drainage is considered at the earliest opportunity in the design layout. This will maximise the opportunity for a more integrated multi-functional approach to SuDS. Historically, drainage proposals have been vague at the outset of the planning approvals process and (largely due to pressures and complexities of site layout) are often not defined by developers until too late in the process. The consequence is that the use of SuDS is often not possible due to the fixing of site details for other reasons – layout of houses, roads etc.

SuDS mimic nature and typically manage rainfall close to where it falls. SuDS can be designed to transport (convey) surface water, slow runoff down (attenuate) before it enters watercourses, provide areas to store water in natural contours and allow water to soak (infiltrate) into the ground or evaporate from surface water and / or from vegetation (known as evapotranspiration).

The SuDS philosophy is to replicate, as closely as possible, the natural drainage from a site before development. SuDS is designed within the opportunities and constraints of a site to deliver the most benefits for water quantity, quality, amenity and biodiversity.

SuDS are not just traditional soakaways, ponds or wetlands, but are a suite of components working in different ways.

The susdrain website provides an overview of the wide variety of SuDS components for review. When selecting SuDS components, the site opportunities and constraints need to be fully considered, it is the schemes that provide a combination of approaches that provide the best results and this is what Somerset Council will be looking for in any future development proposals. In so doing, it is then possible to ensure that the scheme is truly multi-functional and delivers the highest return for the developer and for the community, providing improved resilience and maximising efficiencies for maintenance and operation of the system.

West of England Sustainable Drainage Developer Guide

In 2015 Somerset County Council collaborated with Bristol City, Bath and North East Somerset, North Somerset and South Gloucestershire Councils to develop a SuDS guidance document (Bath & NE Somerset Council, Bristol City Council, North Somerset Council, Somerset County Council and South Gloucestershire Council, 2015).

The guide signposts to existing policy and guidance to support the delivery of a sustainable approach to the drainage of new development in the sub-region. From 6 April 2015, it was expected that local planning policy and decisions on Major Developments (10 dwellings or more; or equivalent non-residential or mixed development) to ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate.

It is understood that Somerset County Council were anticipated to provide details of the character of the County and specific technical and procedural requirements to support this guide. This is in development, however, has not yet been published (see Section 5.2 of this report).

Sustainable Drainage Guide

Somerset County Council, with funding from Somerset Rivers Authority, have developed up-to-date guidance for the delivery of sustainable drainage (SuDS) in Somerset (Somerset Rivers Authority and Somerset County Council, 2022).

The implementation of Schedule 3 to the Flood and Water Management Act 2010 will formalise the use of SuDS on ALL new developments going forward. Schedule 3 provides a framework for the approval and adoption of drainage systems, a sustainable drainage system approving body within unitary and county councils, and national standards on the design, construction, operation, and maintenance of sustainable drainage systems for the lifetime of the development. It also makes the right to connect surface water runoff to public sewers conditional upon the drainage system being approved before any construction work can start.

Government is currently giving consideration to how Schedule 3 will be implemented, subject to final decisions on scope, threshold and process, while also being mindful of the cumulative impact of new regulatory burdens on the development sector. This will include a public consultation, which will collect views on the impact assessment, national standards and statutory instruments. The timetable for its implementation is yet to be defined but the principles for good SuDS design should still be upheld and implemented for all new developments coming forward within Taunton in accordance with the published Somerset SuDS Guide.

Somerset Council may consider the Wessex Water Adoption approach as a starting point ahead of the SAB implementation programme coming forward.

Sustainable Drainage Systems

Urbanisation of a catchment reduces the permeability of the land, replacing free draining ground with impermeable surfaces, such as roofs, roads, parking and other hard landscaping. Development often removes the natural vegetation that intercepts, slows and returns rainfall to the air, reduces the amount of water that can infiltrate into the ground, and this can significantly increase the rate at which water runs off the surface, as shown in Figure 1.

Sustainable drainage systems (SuDS) offer a more natural approach to managing surface water runoff in and around properties and developments than traditional drainage systems. They are designed to temporarily store water during storm events, reduce peak flows and reduce surface water runoff, by mimicking the natural cycle of water management by retaining water where it lands.

The overarching principle of SuDS design is that surface water runoff should be managed for maximum benefit. The benefits that can be delivered using SuDS fit broadly into four categories: water quantity, water quality, amenity and biodiversity. These are also referred to as the four pillars of SuDS design as shown in Figure 2

SuDS can also provide additional benefits:

- A reduction in pressure on local infrastructure e.g. surface water sewers /foul networks
- Encourage positive views of 'living with water'
- Provide a form of water filtration and attenuation whilst providing attractive spaces
- Lower construction costs
- Opportunity to be used as an educational tool e.g. SuDS to be included within school designs
- Increased amenity values which can increase property values and aesthetic appeal
- Potential to incorporate SuDS as areas of recreational use
- Easy management regimes
- Replenish groundwater / the water table through infiltration
- Provide an opportunity to improve biodiversity within a site

There are opportunities to incorporate SuDS into all development, regardless of site size or previous land use. No two sites are the same so each site should be assessed and evaluated on a case-by-case basis when designing a drainage strategy. Site conditions (topography, geology, presence of surface water bodies, etc.) will inform the drainage scheme.

SuDS Management Train

SuDS systems should be designed holistically and interlock by use of a combination of conveyance and storage systems. The following hierarchy of management techniques as shown in Figure 3 should be considered:

- Prevention - the use of good site design and housekeeping measures to prevent runoff and pollution
- Source control - control of runoff at or very near its source (e.g. the use of permeable/infiltrating drainage or green roofs)
- Site control - management of runoff from specific site sections (e.g. routing water from roofs and car parks to infiltration or using swales to transport water through the site allowing infiltration and evaporation)

Regional control - management of runoff from the entire site or several sites, typically in a storage arrangement such as a detention basins or wetland.

For small developments, particular attention must be given to prevention and source controls, as site or regional controls such as detention ponds may not be practical. The reduction and the treatment of runoff at source will provide the required treatment levels.

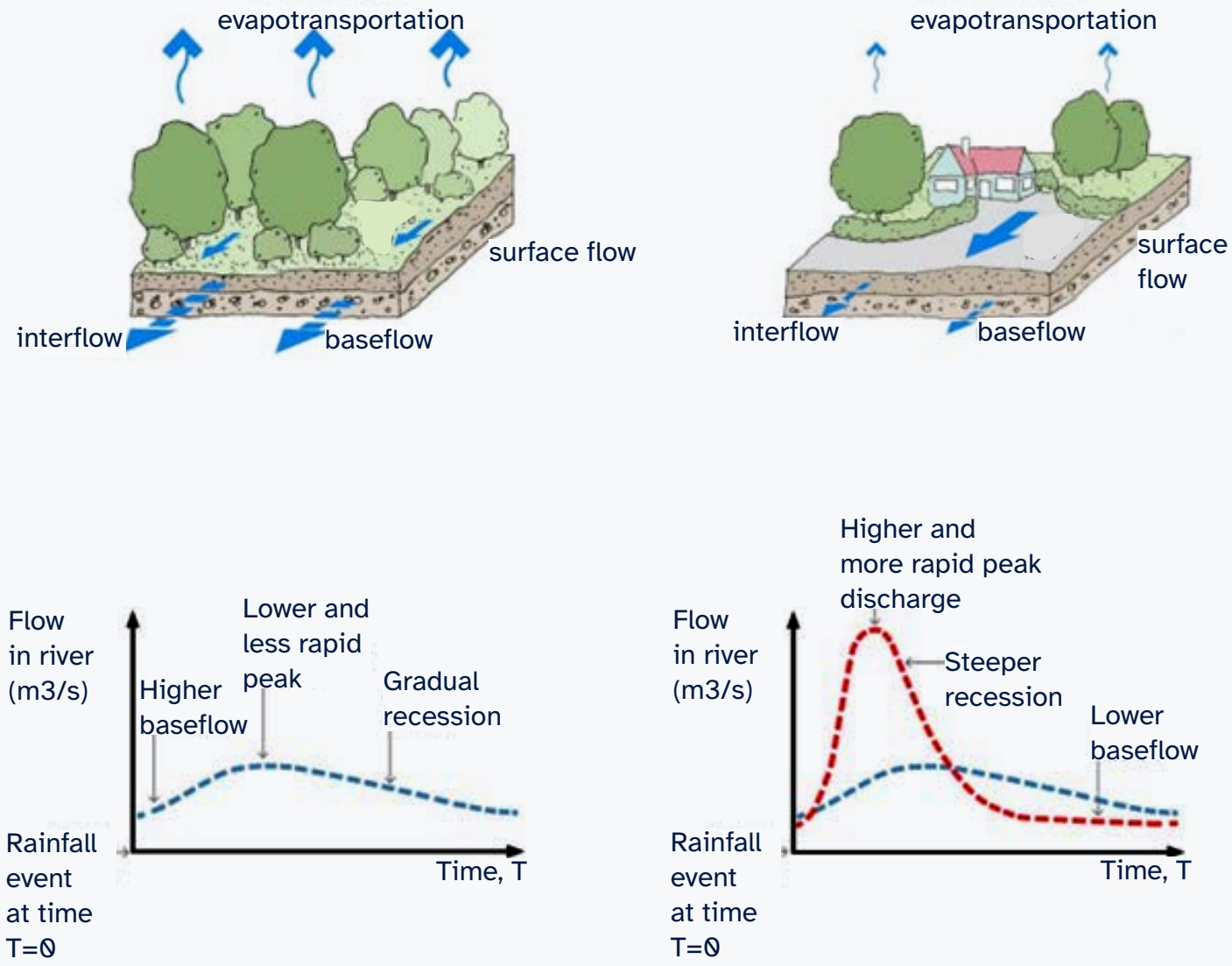


Figure 1: Impacts of Urbanisation on a Catchment (Susdrain)

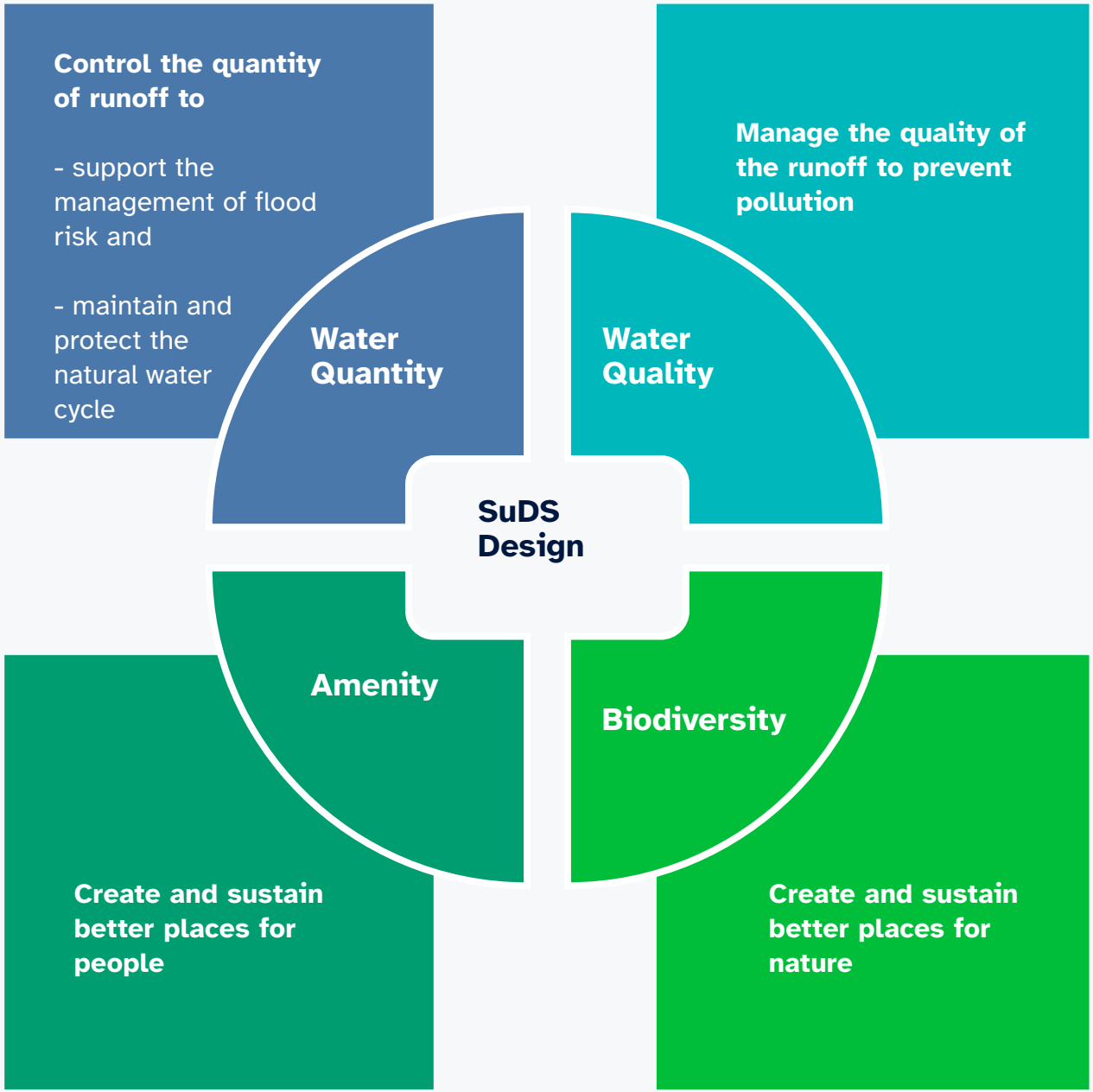


Figure 2: The 4 Pillars of SuDS design (C753:2.1)

Design foresight is required to build SuDS into the developable space. A drainage network incorporating SuDS should initially manage runoff close to its source. This increases the potential treatment of water and minimises the size of downstream storage.

SuDS Features

There are a wide range of SuDS that can be included in the design of a scheme each having different approaches to managing flows, volumes, water quality and providing amenity and biodiversity benefits. The application of SuDS is not limited to one technique per site and often a successful SuDS solution will utilise several techniques in combination.

It is expected that all SuDS features proposed to be implemented as part of any new development will be designed in accordance with the SuDS Manual (CIRIA C753) and the Site handbook for the construction of SuDS (CIRIA C698).

Details including construction and maintenance requirements can also be found in these documents, more information can be also found on the Susdrain website.

Above ground vegetated SuDS features should be prioritised ahead of below ground pipes and tanks. If it is not possible to design a solution using vegetated SuDS features then this is considered an exception. A detailed justification statement must be included within the sustainable drainage strategy for an alternative proposal which still delivers benefits, for example use of permeable paving, or combination of smaller vegetated SuDS with some underground storage.

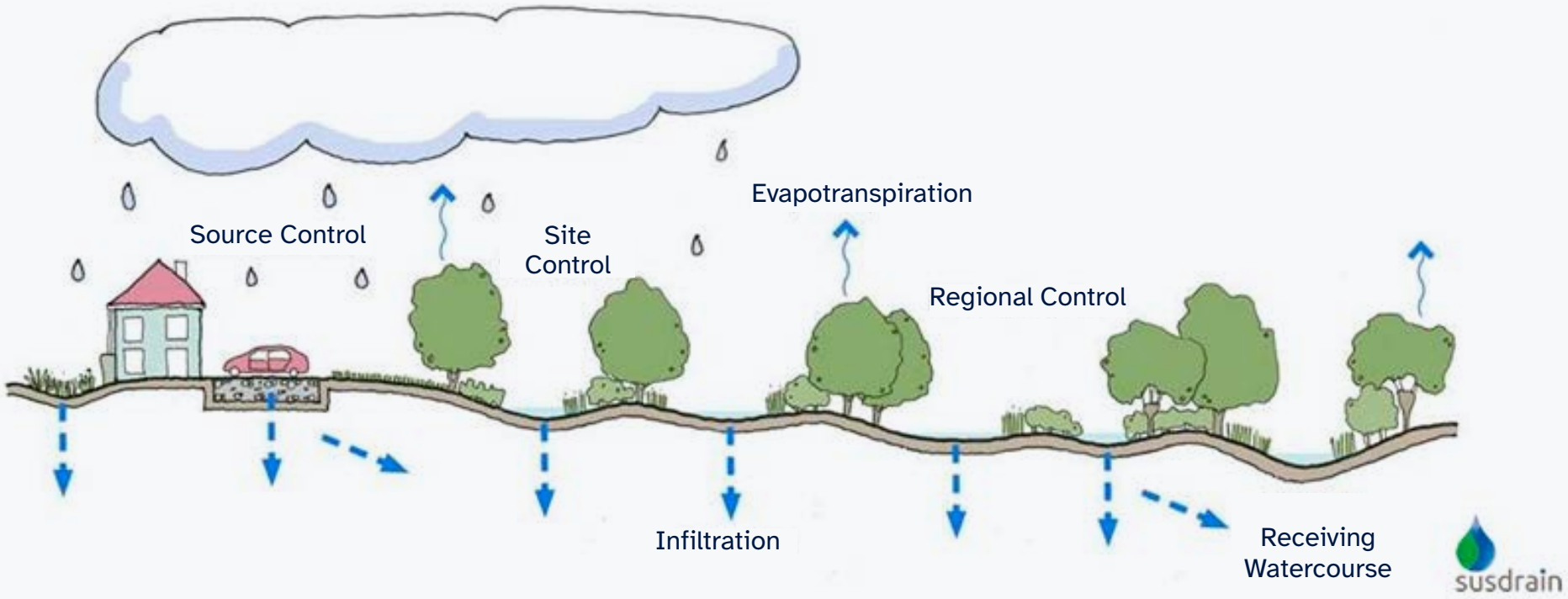


Figure 3: SuDS Management Train (Susdrain)

Source Control

The inclusion of source control in SuDS schemes is one of the more important principles of SuDS design and source control components should be upstream of any pond, wetland or other SuDS component. Source control can help provide interception storage which can handle and treat some of the more frequent but smaller, polluting events.

Most source control components will be located within the private properties or highway areas. Their purpose is to manage rainfall close to where it falls, not allowing it to become a problem elsewhere. They look to maximise permeability within a site to promote attenuation, treatment and infiltration reducing the need for offsite conveyance.

Rainwater Harvesting

Rainwater harvesting is the collection and re-use of rainwater for non-potable uses, there are two types of rainwater harvesting systems.

An active rainwater harvesting system (ARWH) can be used to manage surface water runoff and can be used for non-potable uses. Active rainwater harvesting systems will include a small overflow for extreme events.

Passive systems are reliant on the householder manually operating them, such as water butts. A passive system will not directly manage surface water runoff but promotes sustainable water reuse.

What are the benefits of rainwater harvesting?

Maintenance schedule	Required Action	Typical frequency
Regular maintenance	Inspection of the tank for debris and sediment build up, inlets/outlets/withdrawal devices, overflow areas, pumps, filters	Annually and following poor performance
	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and any other debris	Annually and following poor performance
Occasional maintenance	Cleaning and/or replacement of any filters	Three monthly or as required
Remedial actions	Repair of overflow erosion damage or damage to tank	As required
	Pump repairs	As required

Table 1: Operation and maintenance requirements for RWH systems

The main three benefits are:

- lower water bills
- a reduced environmental impact
- helping to cut the risk of localised flooding

Rainwater can replace up to 50% of domestic mains water usage and up to 63% in a commercial property, lowering annual bills by the same amount. By using rainwater to flush toilets, clean clothes and water the garden you'll also cut your CO2 emissions. It takes 1.3kwh of electricity to pump a cubic metre of water to your property – the less you need, the lower the carbon cost of your water supply.

How does it reduce the risk of flooding?

Rainwater harvesting systems help reduce flooding by holding back storm water and slowly releasing it into either drains or soak away over time. This helps prevent sewer systems and water courses from becoming over-stressed and flood risk is reduced.

What can I do with the water?

Everything except drink or consume it. The main things are filling toilets, washing cars, watering the garden and general irrigation usage. It can be used for washing machines and dishwashers however if for use in a dishwasher you may need to filter and purify the water before it can be used for this purpose.

Can rainwater be collected from any roof surface?

Most roof surfaces are perfectly ok to collect from. The most ideal are slate or other smooth non-absorbent materials, and most types of tiles are suitable. Flat roofs will give a reduced collection rate due to puddling and higher evaporation losses. Green roofs are designed to be absorbent so will give a much-reduced yield, and the water will invariably be discoloured so has limited use.

How clean is the water?

If the water is collected from a good surface, a good quality filter is used, and the water is stored in a cool dark place, ideally underground, then the water is extremely clean and should not have any colouration or smell. Under correctly maintained conditions it is difficult for any bacterial action to occur.

What maintenance is required?

Proper operation and maintenance of rainwater harvesting systems helps to protect water quality. Maintenance requirements are largely dependent on the runoff source and the runoff use and thus treatment processes provided. This will range from weekly input through to rare intervention. Routine inspection of the filter system at quarterly annual intervals is advised, even if they do not appear to need specific intervention. There are wide differences in the extent of maintenance required for different systems, and manufacturers guidelines should always be followed.

Table 1 provides guidance on the type of operational and maintenance requirements that may be appropriate.

For further information and explanations please see Section D (11) of the CIRIA SuDS Manual 2015 (C753) and Susdrain.

Green Roofs

Green roofs are areas of living vegetation, installed on the top of buildings for a range of different benefits including, visual benefits, increased ecological value, enhanced building performance. Green roofs are designed to intercept and retain precipitation, reducing the volume of runoff and attenuating peak flows.

Types of green roofs

Extensive green roofs cover the entire roof with hardy, slow growing, drought tolerant, low maintenance plants (e.g. mosses, herbs, grasses) often enhanced with wildflowers.

Benefits include; lightweight, suitable for roofs with a slope up to 1 in 3, often suitable for retrofits, little management of vegetation, little/no need for irrigation and specialised drainage systems.

Intensive green roofs (or roof gardens) are designed to sustain more complex landscaped environments that can provide high amenity or biodiversity benefits; easily accessible.

Benefits include; more favourable conditions for plants, good contribution to the thermal performance of buildings, attractive, accessible – can be used for recreation, good surface water retention capacity.

For further information and explanations please see Section D (12) of the CIRIA SuDS Manual 2015 (C753) and Susdrain.

Permeable Surfaces

Permeable surfacing provides a pavement suitable for pedestrian and/or vehicular traffic, whilst allowing rainwater to infiltrate through the surface and into the underlying structural layers. Water is temporarily stored beneath the overlying surface before infiltrating into the ground.

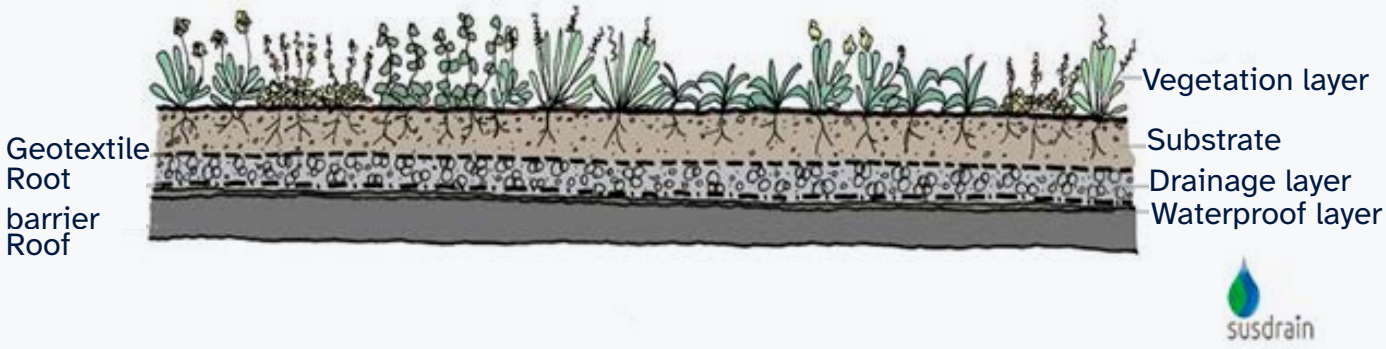


Figure 4: Green Roof (Susdrain)

Permeable paving can be constructed with various materials including (but not limited to) block paving, resin bound gravel and porous asphalt.

Types of permeable surfacing

- Permeable pavements - made from impervious material, void space created
- Porous pavements - infiltrate water across their entire surface material

There are three different types of paving which allow for the use of this component throughout a wide range of sites and site conditions:

- Type A – Also known as full infiltration, this allows all rainfall to pass into the sub-base, before infiltrating into the soil. There is normally no discharge from the permeable paving system to a watercourse or sewer; however, there may be an emergency overflow
- Type B – Also known as partial infiltration is where a proportion of the surface water runoff that exceeds the infiltration capacity of the subsoils is conveyed to a receiving drainage system
- Type C – This does not provide any infiltration and is used primarily as an attenuation storage following filtration through the sub-base. The system is generally wrapped in an impermeable, flexible membrane before being discharging to the outfall

For further information and explanations please see Section D (20) of the CIRIA SuDS Manual 2015 (C753) and Susdrain.

Soakaways

Soakaways are an infiltration component consisting of excavations filled with a void-forming material that allows for the temporary storage of water before it soaks into the ground. Soakaways often constructed with geocellular units, pre-wrapped in geotextile.

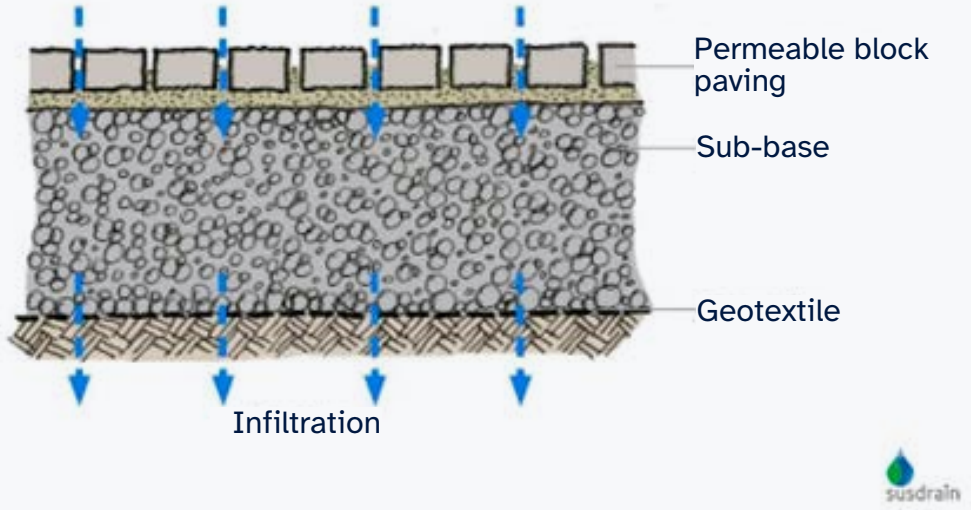


Figure 5: Permeable Paving Type A/B (Susdrain)

For further information and explanations please see Section D (13) of the CIRIA SuDS Manual 2015 (C753) and Susdrain.

Rain Gardens

Bio-retention systems (including rain gardens) are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution using engineered soils and vegetation.

Typically rain gardens are small systems, less engineered than full bio-retention components. These systems are generally used to manage and treat runoff from more frequent (smaller) rainfall events. Rain gardens should generally not have impermeable liners unless there is a specific need to prevent water from infiltrating.

For further information and explanations please see Section D (18) of the CIRIA SuDS Manual 2015 (C753) and Susdrain.

Channels and Rills

Channels and rills are open surface water channels with hard edges. They are simply channels that water flows along whereby they can have a variety of cross sections to suit the urban landscape, including the use of planting to provide both enhanced visual appeal and water treatment.

Treatment channels collect water, slow it down and provide storage for silt and oil that is captured. The outlets are designed to act as a mini oil separator; hence the channels can be very effective at treating pollution.

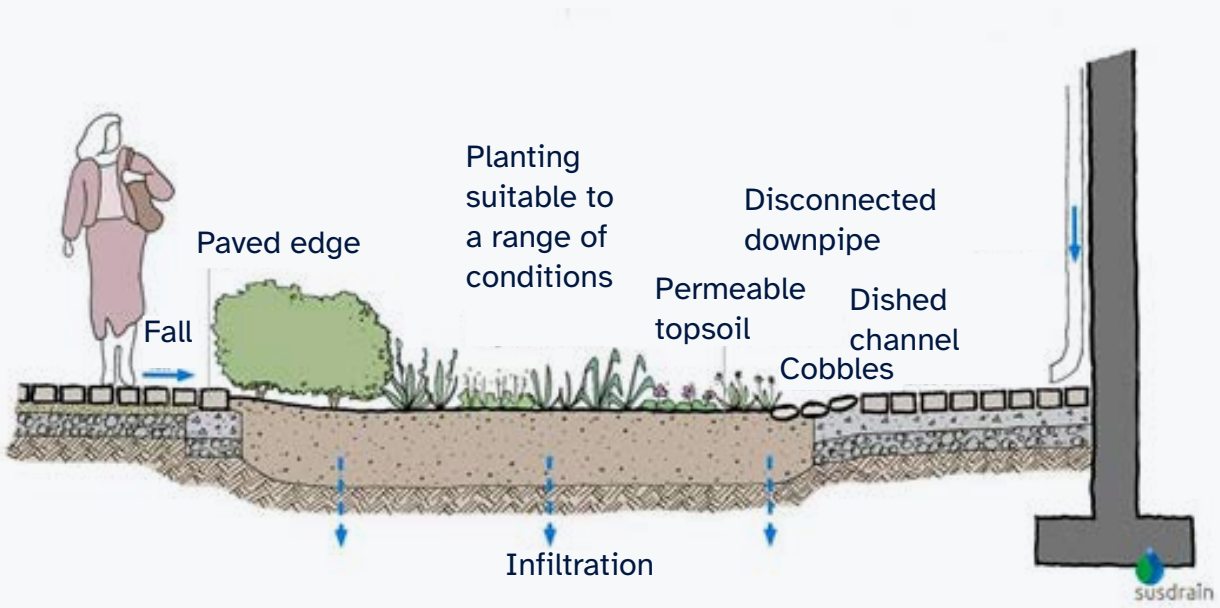


Figure 6: Raingarden (Susdrain)

Swales

Swales are shallow, flat bottomed, vegetated open channels designed to convey, treat and often attenuate surface water runoff. Standard swale channels are broad and shallow, covered in vegetation (usually grass) to slow the water and provide a range of other benefits.

Types of Swales

- Conveyance and attenuation swales – an effective way of collecting and conveying runoff from the drained area to another stage of the SuDS management train. They can be designed for treatment and/or attenuation (CIRIA, 2015)
- Dry swale (or enhanced swale) – a vegetated conveyance channel, designed to include a filter bed or prepared soils that overlays an underdrain system which provides additional treatment and conveyance capacity. Can be lined in areas of high groundwater (CIRIA, 2015).
- Wet swale – equivalent to the conveyance swale, but designed to deliver wet and/or marshy conditions in the base (CIRIA, 2015).

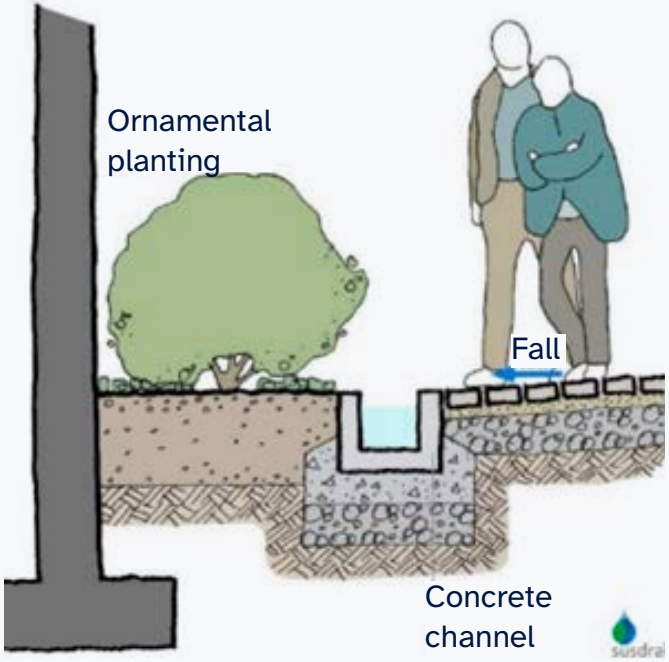


Figure 7: Rills and Treatment Channels (Susdrain)

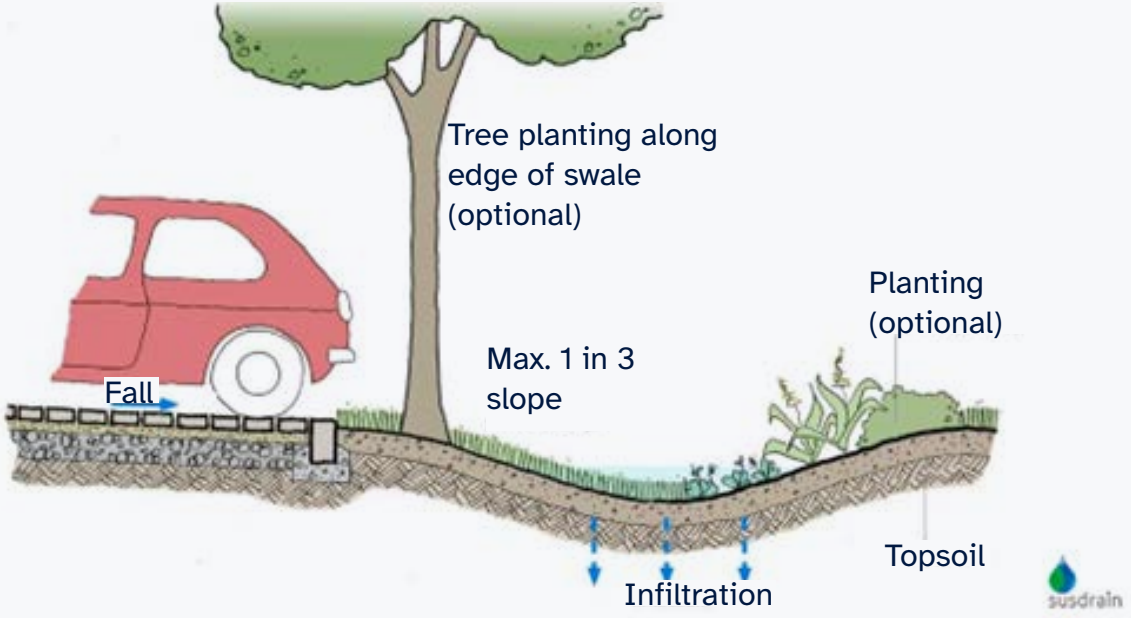


Figure 8: Swale (Susdrain)

For further information and explanations please see Section D (17) of the CIRIA SuDS Manual 2015 (C753) and Susdrain.

Filter Strips

Filter strips are gently sloping, vegetated strips of land that provide opportunities for slow conveyance and infiltration (where appropriate). They are designed to accept runoff as overland sheet flow from upstream development and often lie between a hard-surfaced area and a receiving stream, surface water collection, treatment or disposal system.

The main purpose of the filter strip is to remove any silt in the water so that it does not clog up downstream components. They treat runoff by vegetative filtering, and promote settlement of particulate pollutants and infiltration.

Filter trenches provide a similar function to filter strips. They are shallow excavations filled with rubble or stone that create temporary subsurface storage for infiltration or filtration of runoff. These trenches can also be used to filter and convey storm water to downstream SuDS components. Ideally filter trenches should receive lateral inflow from an adjacent impermeable surface, but point source inflows are also acceptable.

Trees

Trees can help to protect and enhance the urban environment in several important ways. Within a development, trees can be planted amongst a range of infiltration SuDS components to improve their performance, alternatively they can be used as standalone features such as, tree pits/ planters or structural soils.

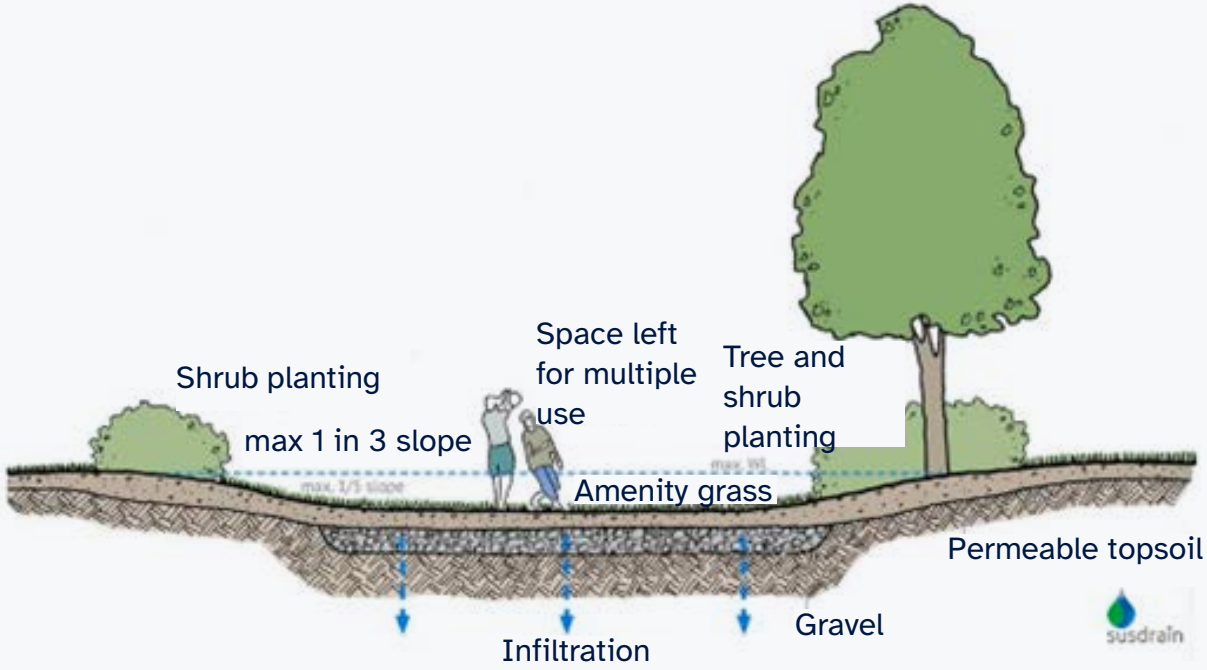


Figure 9: Infiltration Basin (Susdrain)

For further information and explanations please see Section D (19) of the CIRIA SuDS Manual 2015 (C753) and Susdrain.

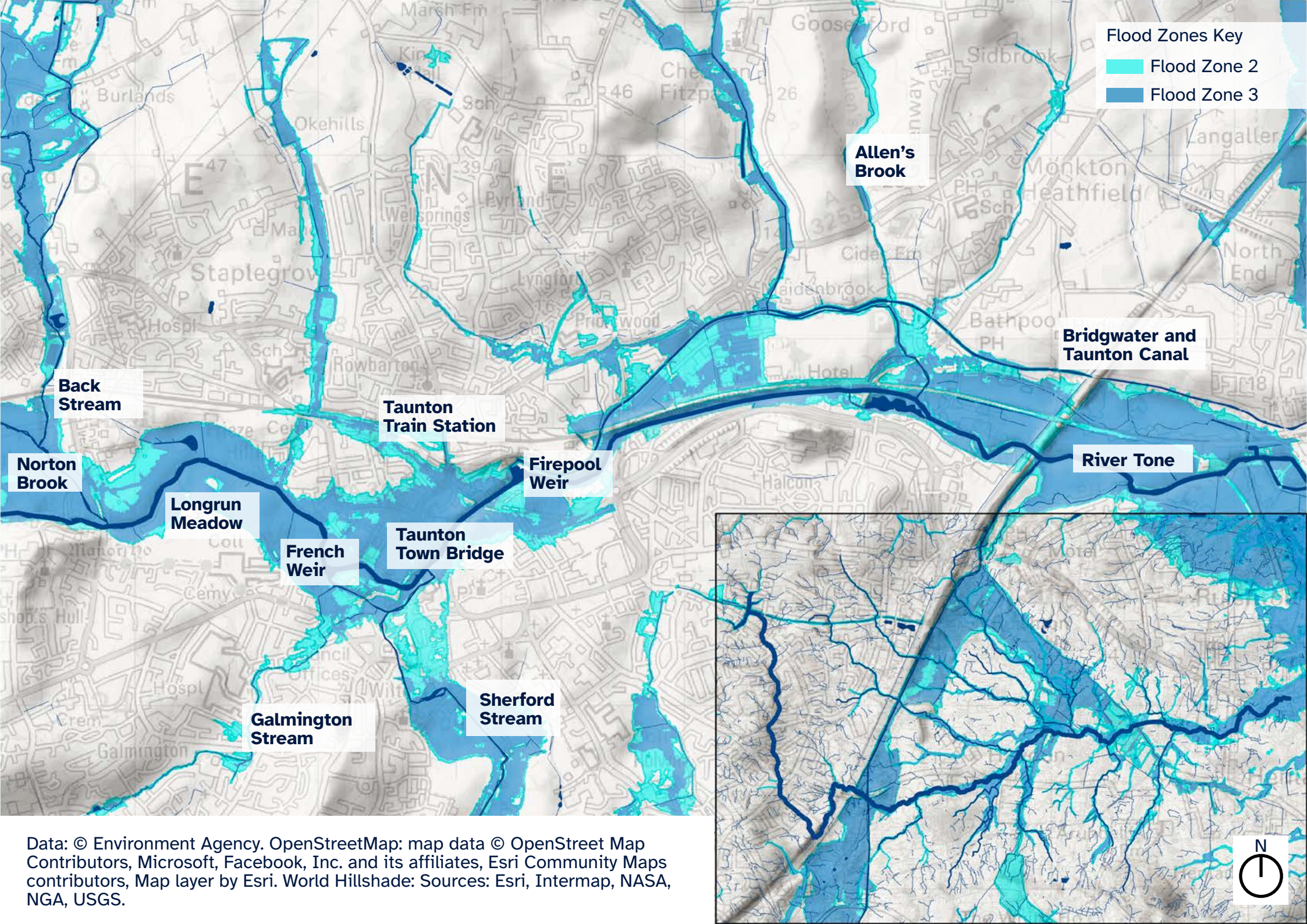
Basins, Ponds and Wetlands

Basins are landscaped depressions, usually dry except during and immediately following storm events. These components can be designed as ‘online’ or ‘off-line’.

Ponds and wetlands are features with a permanent pool of water that provide both attenuation and treatment for surface water runoff. ‘Wetland’ is used to describe a body of water with larger proportions of the surface covered by aquatic planting. Both can support emergent and submerged aquatic vegetation, aiding in the treatment process.

Appendix D
TWSG Strategies / Floodzones

Calm ENGINEERING



Data: © Environment Agency. OpenStreetMap: map data © OpenStreet Map Contributors, Microsoft, Facebook, Inc. and its affiliates, Esri Community Maps contributors, Map layer by Esri. World Hillshade: Sources: Esri, Intermap, NASA, NGA, USGS.

Appendix E
TWSG Strategies / Mobility Hubs

City Science and CoMoUk Guidance

Mobility Vision – Guiding Principles

- Mobility interventions will be guided by net zero carbon considerations
- Mobility services will be safe, sustainable, convenient and widely accessible
- Active travel will remain the preferred option for short journeys.
- Mobility hubs will be developed as a way of improving access to key services
- Users will be at the heart of the mobility strategy ensuring designs are inclusive and tailored to the needs of future residents, employees, and visitors
- Infrastructure proposals will be future-proofed to allow for changes in mobility options and trends, where appropriate.

Strategic Context

The policy landscape is changing, policy makers and decision makers at all tiers of government are placing a greater emphasis on the need to decarbonise transport and how the uptake of public transport and active travel modes can deliver substantial social, environmental and economic benefits.

To deliver meaningful change and to meet legally binding net zero targets, there is a recognised need to make public transport, walking, wheeling and cycling the natural first choice for all who can take it.

For new development, this revolves around the process of embedding sustainable travel behaviours from the onset through user-centric design, avoiding a ‘car culture’ from arising.

- “Transport is the UK’s largest polluting sector, producing nearly 20% of its total emissions. The majority of emissions come from road transport vehicles (91%), in which cars and taxis are the largest contributors (61%).”
- “The majority (68%) of UK trips undertaken are under 5 miles, with 19% of trips being less than 1 mile in length. These short trips are amenable to walking and cycling for most people and are particularly relevant areas of focus for improving air quality and noise as they contribute disproportionately to emissions.”
- “91 million days are lost each year due to mental health problems. An increase in physical activity has been proven to be associated with benefits to mental health. Physical activity can reduce the risk of depression, dementia and Alzheimer’s and costs the NHS up to £1 billion each year.”
- “20-minutes of exercise each day cuts the risk of depression by up to a third, boosts worker productivity and reduces the time spent seeking medical care through individuals leading active and healthy lifestyles.”
- “High-quality active travel infrastructure increases the likelihood of people choosing to walk, wheel or cycle within existing and new neighbourhoods and encourages local businesses to thrive. People who travel to the high street by active modes can spend up to 40% more than those who drive.”

Mobility Hubs

“A mobility hub is a recognisable place with an offer of different and connected transport modes supplemented with enhanced facilities and information features to both attract and benefit the traveller.” (Como-UK)

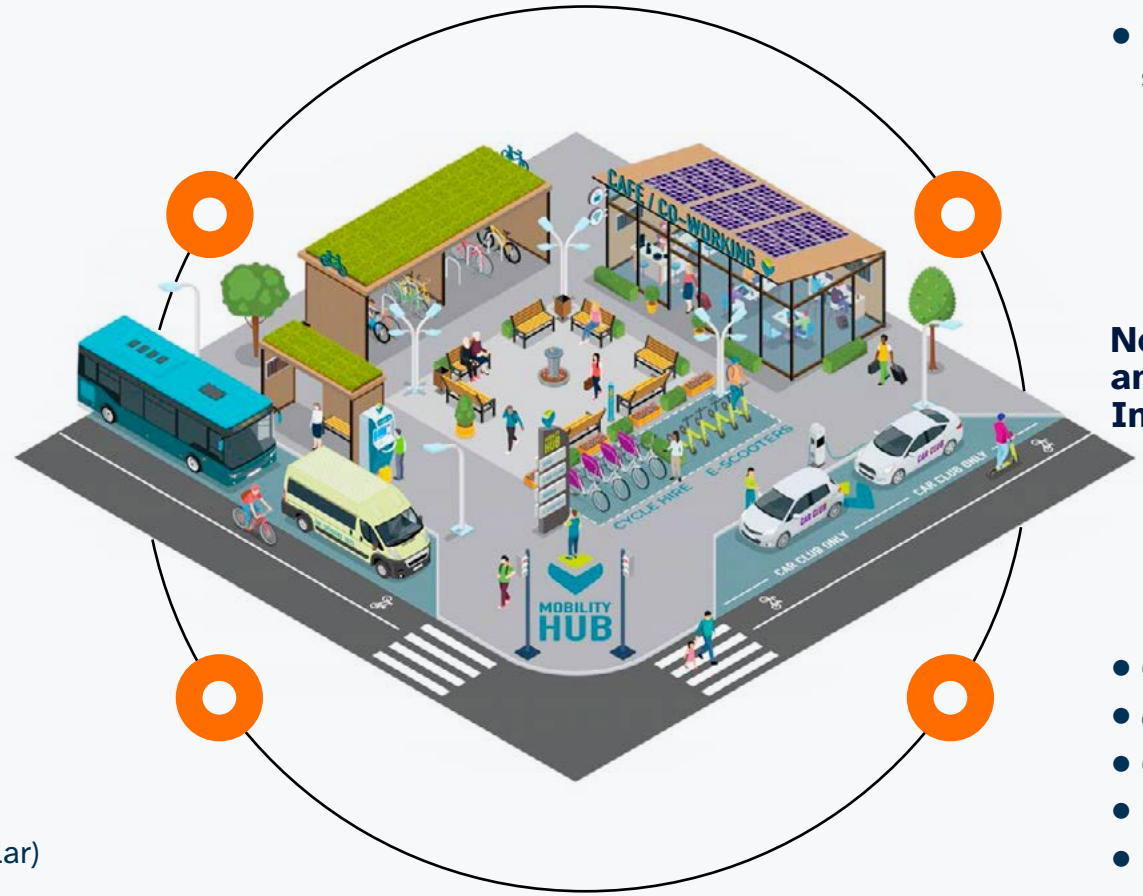
Hubs are not ‘one size fits all’, and tailor-made solutions need to be created for each location, considering type of components, scale and levels of service.

Any Mobility Hub is underpinned by a series of overarching objectives:

- **Inclusive Mobility** – Providing an attractive range of sustainable transport modes, encouraging individuals out of their private vehicles
- **Healthy Streets** – Facilitate safe, clean and high-quality places through improving the public realm, reducing severance, enhancing accessibility and provide wayfinding
- **Vibrant Neighbourhoods** – Provide gateways into local communities, providing the opportunity to offer new places to gather and the ability to access jobs, education and leisure opportunities

- Bus Routes/local re-routing etc.
- links to Taunton Town Centre and neighbouring settlements such as Minehead and Seaton

Mobility Components (Non-public Transport)



- Co-working space
- Retail / Leisure space
- Parcel lockers / Click and Collect points
- Play areas / Open green space / Play pitches

Non-Mobility and Public Ream Improvements

- Shared mobility services
- Car Clubs
- Docked/dockless shared e-scooter schemes
- Brompton Bike Hire (or similar)

Mobility Components (Non-public Transport)

- Cycle parking
- e-bike/scooter charging points
- Cycle mainenance
- Digital Wayfinding
- Real Time Information

Mobility Related Components

Mobility Hub Hierarchy

The spatial distribution of Taunton coupled with the River Tone bisecting it lends itself to a Mobility Hub Strategy that follows as 'hub and spoke' approach whereby any network adopts a hierarchy of mobility hubs that provide various transport and non-transport elements depending on their location.

This would include small-scale neighbourhood and secondary hubs in the town's peripheral areas within proximity to existing key transport corridors and key destinations as well as larger-scale central hubs within the urban core of Taunton, along its riverfront. Through these hubs providing a variety of sustainable transport offering such as public transport and active travel alongside potential to include mutually supporting community facilities, delivery will enable positive mode shift onto low-carbon modes whilst also contributing towards improved safety, environment and place.

It is envisaged that these hubs will be delivered either as part of the development of key site allocations within the current Local Plan such as at Tangier and Morrisons, or as part of the redevelopment of existing available land (such as University Centre Somerset). There is already a positive precedent being set for the implementation of mobility hubs as demonstrated through the identification of facilities within the masterplan for Firepool which is currently being built out which includes proposals for a mobility hub as part of the wider reopening of the bus station. These hubs would be further developed and refined as proposals for redevelopment of Taunton's Waterways as well as for its surrounding areas evolves.

Work undertaken on behalf of Somerset Council by WSP (Somerset and Devon Mobility Hub Strategy, 2023) considered a range of corridor, campus, interchange, community, rural and tourism hubs. The study identified Taunton Railway Station, the proposed Comeytrow and Trull New Garden Community within Taunton and the proposed Monkton Heathfield New Garden Community to the northeast of Taunton as potential locations for mobility hubs.

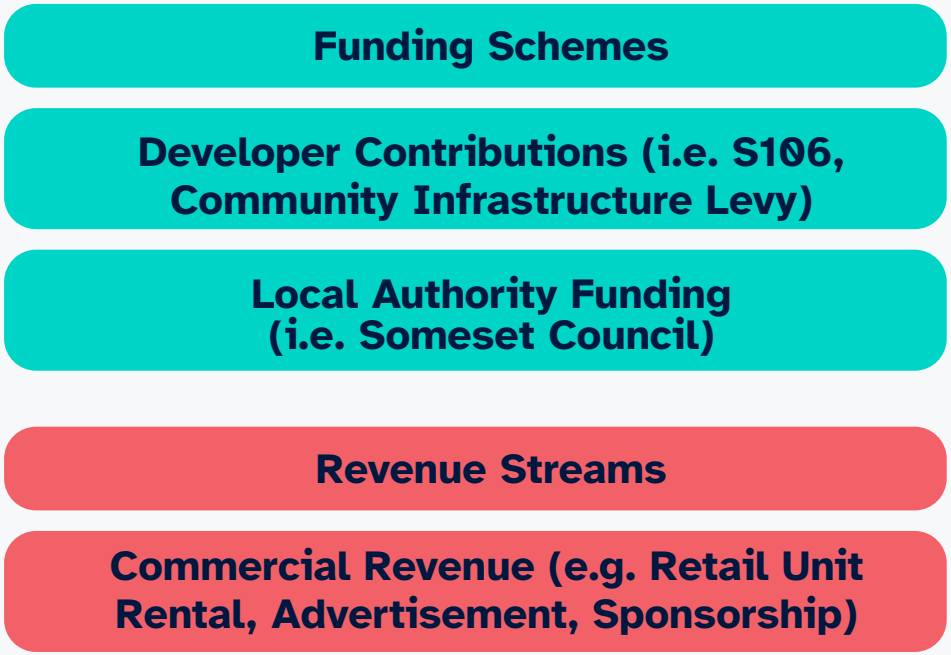
Mobility Hub Funding – Initial Considerations

Identification of funding for any Mobility Hub proposals is essential from the onset to ensure that there is a valid financial and commercial case for delivery, capitalising upon the opportunity for funding to be sourced either the public and private sector or both.

Whilst the cost for any proposals will depend upon their scale, size and overall offering, the ability to integrate existing services (e.g. bus routes) and make use of underutilised land where possible will assist keeping initial capital costs at a manageable scale. The pace of Mobility Hub delivery across the UK has intensified in recent years, with there now being a 'pool' of appropriate case studies to assist in planning and delivery.

A further key consideration as part of the affordability of any Mobility Hub Strategy is the consideration of the operational model, and who would be responsible for operating and maintaining any facilities and their associated offerings. Some hubs will be wholly or mostly owned by the public sector (Huntly's community owned Green Travel Hub); others will be wholly private sector owned (BP's Berlin Mobility Hub); others still will adopt a hybrid ownership model. Many will transition from one model to another over time – most commonly from public to private ownership. In terms of revenue generation, the answers will vary from site to site, so having some degree of flexibility is of paramount importance.

Lastly related to affordability is the procurement model that would be adopted and whether it would be led by the public or private sector or whether, in a similar theme to operational aspects, a hybrid approach would be implemented.



SLR Guidance - Mobility Hubs

Enabling placemaking and low carbon masterplanning Responding to the growth in demand for shared mobility

1.0 Background

The uptake of new mobility services over recent years has been significant, fuelled by new technologies making them easy to use, convenient and affordable. They provide an opportunity not just to fill gaps in the public transport network, but to also help local planning authorities work towards decarbonising the transport and planning sectors, improve air quality and public health.

Bike, eBike and eScooter share schemes, as well as car clubs and demand responsive transport are being rolled out in increasing locations helping people to reduce their car dependency. With research showing a fall in UK driving licence ownership amongst younger generations, such mobility options are becoming more essential to provide communities with the accessibility levels they need, affording economic, social and environmental co-benefits.

One of the external impacts of the COVID-19 pandemic has been an accelerated change in mobility behaviour, flexible and remote working, online shopping and greater local living. The rise of 15-minute neighbourhoods as a planning concept is a result of this growing desire to have more amenities within a short walk or cycle, making communities more vibrant and resilient. Mobility hubs are helping to enable this transition and form part of the overall Vision and Validate approach to transport planning.

This approach involves the planning industry thinking of transport infrastructure holistically, placing greater emphasis on sustainable movement, active travel networks, local business, health and wellbeing rather than simply enhancing highway capacity to accommodate future traffic demand.

Planning should also recognise that many journey purposes are today fulfilled “virtually” with 30% of retail shopping done online, and on average a quarter of people working from home at any one time. As set out in the DfT’s Decarbonisation Plan, Vision and Validate is taking the place of the now defunct Predict and Provide approach.

In tackling climate change as an industry, we must challenge the need for outdated infrastructure and support local planning authorities in delivering placemaking and sustainable mobility through the planning process. This is in harmony with the three overarching objectives of the NPPF which require demonstrable impacts in the fields of climate, health and economy.

2.0 Introduction

Mobility hubs locate shared and public transport modes together, enabling attractive and seamless journeys whilst reducing car dependency and carbon emissions.

Hubs may also offer amenities – concierge, co-working space, cafés and bike repair - making them the heart of the community and reducing the need to travel.

Hubs come in different shapes and sizes offering convenient and real alternatives which can be flexibly selected to serve the chosen community. They can be located in new or existing residential areas, business parks, town centres, shopping centres and rural or suburban areas.

For new strategic developments, mobility hubs should be carefully designed as part of the masterplanning process and set up as a network of interconnected small and large hubs.

One of the key factors for ensuring the success of shared mobility services and mobility hubs, is supporting behaviour change methods. These include real time journey planning information, integrated mobility as a service, bike and car share mobile phone applications, discounts, incentives, prizes, reward points and so on.

Another key factor is understanding the financing models for mobility hubs. Capital costs can be shared amongst several stakeholders through planning obligations, as well as the mobility operators. Revenue costs can be shared between multiple organisations but also supported by attracting a café, bike workshop or co-working to share the floorspace, mutually creating footfall and a vibrant community.

SLR offers a unique mobility hub design and delivery team which draws on its combined masterplanning, architecture and transport planning disciplines.

2.1 Mobility hub hierarchy

Strategic residential, mixed-use and commercial developments are best served by a connected network of mobility hubs to maximise accessibility and connectivity with the public transport network.

They should be connected via active travel corridors allowing easy access using shared bike, eBike, eScooter and cargo bikes. This enables car free lifestyles inside the development and provides access to the amenities within the 15 minute neighbourhood design. The primary hub also serves as a community centre with additional facilities, plus public transport and Digital Demand Responsive Transport (DDRT) for onward connecting trips.

SLR applies a three tier hierarchy in the planning and delivery of mobility hubs as follows. There is a large degree of flexibility of application, depending on the site. The component mobility services and supporting features grow cumulatively at each tier.

- Tertiary: basic mobility services, to enable connection with larger hubs and the wider community
- Secondary: includes tertiary components plus additional mobility modes and supporting features to serve a larger catchment
- Primary: includes tertiary and secondary components plus a wider range of mobility modes, public transport connections and supporting features making it a local centre. Onward travel to main destinations

Mobility hub hierarchy

Hub type	**Hub type**	**Hub type**
Tertiary	Secondary	Primary
Mobility Service	**Mobility Service**	**Mobility Service**
• Car club bars • Cycle share • Cycle parking • Bus stop (walking distance) • eScooter share	• EV car club bays • EV charging points • eBike share • DDRT vitual bus stop • Secure cycle parking	• Bike repair workshop • Concierge and travel advice • Cargo Bike • Brompton Bike hire • Public transport options
Supporting features	**Supporting features**	**Supporting features**
• Step free access • Branding • Street Lighting • Seating	• Bike pump • Water fountain - outdoor • Bike repair mini-station • Covered seating	• Step free access • Branding • WiFi • Parcel lockers plus last mile delivery (ground drone) • Realtime PT and wayfinding totem • Cafe and Co-working space

Tertiary Mobility Hub (SLR)

The tertiary mobility hub might offer cycle parking, cycle and eScooter sharing as well as car club cars. Ideally it should have a bus stop close by. Branding and street lighting are important to make users feel safe. It would be located in more peripheral locations to fill gaps in the public transport network.

Secondary Mobility Hub (SLR)

The secondary hubs are larger in scale as they accommodate greater footfall. Therefore they might offer secure cycle paking, EV car clubs, EV charging points, eBike share, DRT and a bus stop. They would also offer more supporting features such as shower, toilet, bike repair station, water fountain, seating and maybe even a café kiosk.

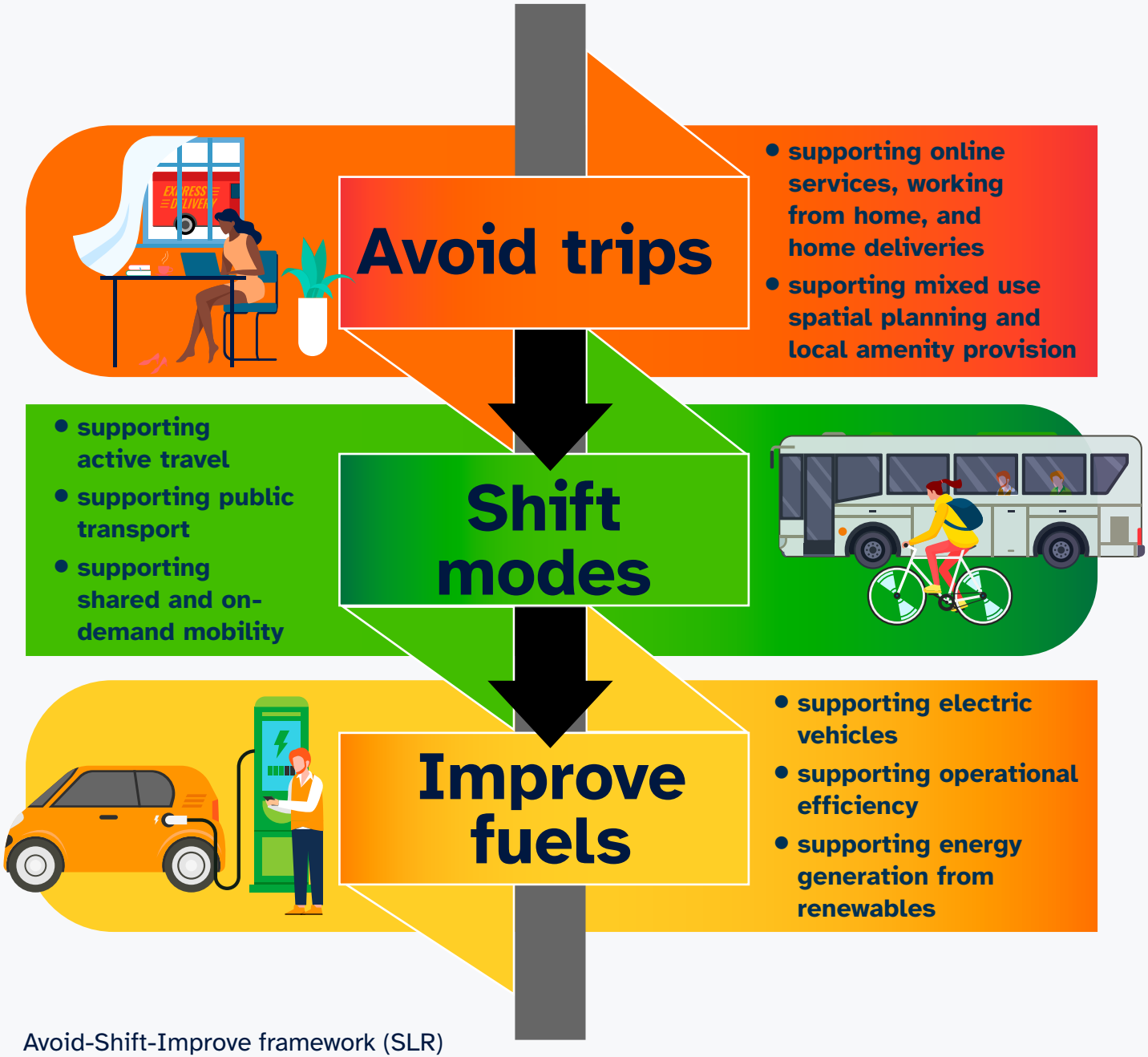
The primary hub would serve a larger catchment and offer the greatest quantity of mobility services. Most importantly though it would act as the community centre and hence offer a selection of additional amenities such as: café, bike repair workshop, concierge, parcel collection, real time travel information and co-working space.

Primary Mobility Hub (SLR)

2.2 Avoid-Shift-Improve framework

SLR applies the Avoid-Shift-Improve framework to its transport planning services, to maximise placemaking and sustainable mobility systems in new and extended developments. Avoid-Shift-Improve is a key component of vision-led planning where places are designed around the collective needs of people rather than prioritising private transport. This simultaneously realises co-benefits by minimising carbon emissions and maximising liveability, health and biodiversity. This hierarchy is as follows:

- AVOID Trips: Provision of local amenities to reduce the need to travel. Support online services to maximise 'virtual' mobility
- SHIFT Modes: Make provision for active, shared and public forms of transport
- IMPROVE Fuels: For any trips that must be made by car, ensure charging infrastructure is available for Zero Emission Vehicles



Avoid-Shift-Improve framework (SLR)

Mobility hubs are uniquely placed to enable all three levels of the Avoid-Shift-Improve framework. They are therefore an important part of many vision-led planning schemes. This is evidenced further in the following chapters.

2.3 Snap shot of current demand for shared mobility

There is a significant demand for shared mobility services in the UK as illustrated in the graph below showing the results of the 2023 Statista survey question: “Which of these services have you booked online (website or app) in the past 12 months?” Multiple answers were possible.

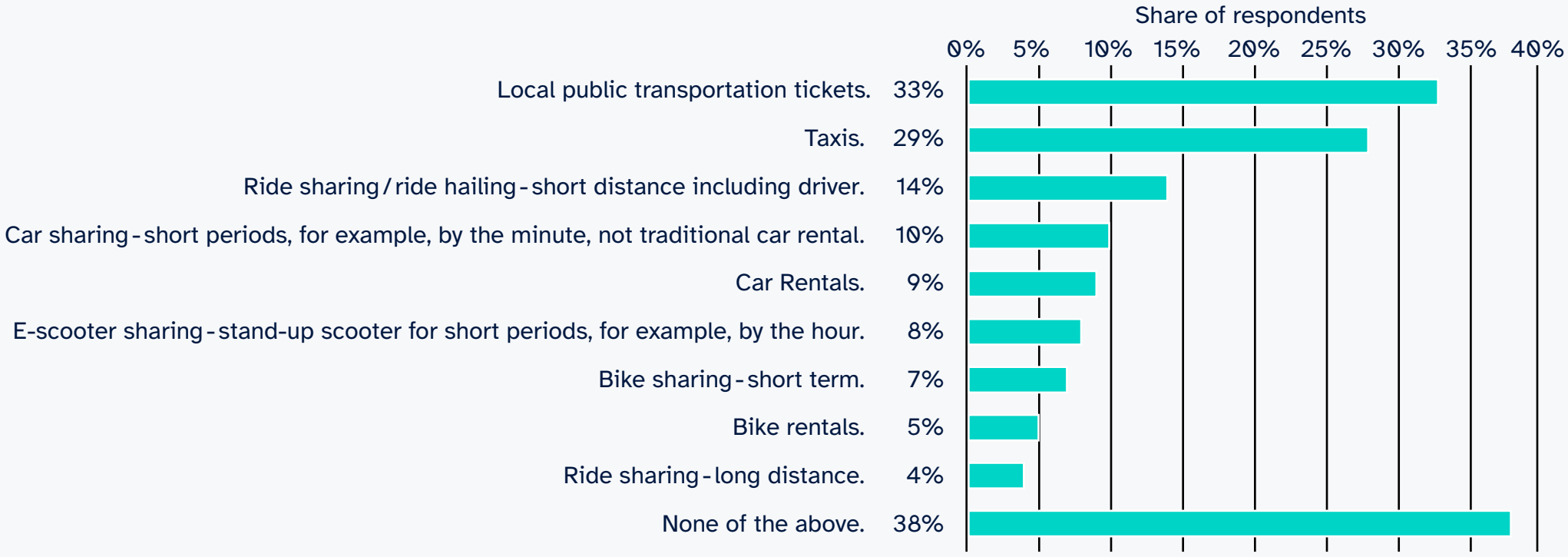


Figure 5: **Mobility service online bookings in the UK as of March 2023**
Source: Statista Consumer Insights; ID 997887. Notes: United Kingdom; April 2022 to March 2023; 18-64 years; 4028 respondents

The percentage of respondents who have used such modes within the last 12 months include ride sharing (e.g. Uber) 14%; car sharing (car club) 10%; eScooter 8%; and bike share 7%.

Whilst this is a survey based only on 4,000 respondents, it is indicative of the changing ways in which people travel today, compared to 15 years ago when these percentages would all have been close to 0%. It shows that these services need to be included in the design of new developments, especially to attract the generations who have grown up using such mobility as standard.

3.0 Mobility hubs: avoid trips

Changes to working and shopping habits, supported by technological advances, have seen significant increases in home working and online retail sales and deliveries. This has been reinforced due to the effects of COVID-19 on behaviour.

Mobility hubs offer great potential to respond to these growing trends.

3.1 Co-working space

In May 2021, a global Accenture survey found that "76% of 9,650 people said they want a "third place" to work that is outside of their homes and the traditional office".

Since then, working from alternative locations has boomed. IWG, which operates under brand names such as Regus and Spaces among others, reported an average 54% increase in visits to their workspaces between January to November 2022.

They also reported that demand for flexible workspaces away from busy city centres had increased by more than a third (36%) in 2022. Locations such as Bolton, Cardiff, Hemel Hempstead and Chelmsford are among the locations with the biggest rise in footfall, at increases of 190%, 190%, 140% and 112% respectively.

This supports the increasing trends seen towards more flexible working (JLL Workforce Preferences Barometer, 2022):

- 36% of employees work in third places on a weekly basis
- 55% hybrid work, meaning they work from at least two different locations; and
- 33% are interested in gaining access to coworking facilities or satellite offices closer to their home

Today, approximately 25% of people are working from home at any one time on average, compared to approximately 15% before COVID (SLR's Working from Home tool). Some industries are seeing much higher rates such as Information and Communications 53% and Financial Services 40% (ONS Business Insights and Conditions Survey 2023).

This illustrates the potential demand for such third place working in local communities which can be accommodated in the design of primary mobility hubs.

3.2 Parcel collection and delivery

Online retail in the UK has been gaining ground in the past decade. The value of online retail sales in the UK was estimated at £120bn in 2021, or 29% of the market share. Clothing and household goods are the most popular items. For 2025, the forecasted retail eCommerce sales is projected to reach 38% which implies even greater delivery vehicle miles travelled. There is therefore a growing need for local consolidation, parcel collection and last mile delivery services within communities.

Mobility hubs can be designed to include concierge services, parcel lockers and eCargo bike or ground drone deliveries such as those circulating in Milton Keynes operated by Starship.

4.0 Mobility hubs: shift modes

Mobility hubs offer shared bikes, ebikes, car club cars, cargo bikes and secure cycle parking to make such modes the natural first choice for many users. They therefore respond to the significant growth in demand for shared mobility services over the last ten years, and support national and local government targets to shift away from car use especially for trips of short distances.

4.1 Car club

Car clubs can significantly reduce the reliance placed on the private car, by providing access to a vehicle as and when it is required. This removes the need to have a vehicle idling in a driveway being unused for 96% of the time, and frees up street space for other amenities and biodiversity.

On average, one car club vehicle removes between 13 and 22 private cars from UK roads. The 2022 car club study by CoMoUK found that each car club vehicle replaces 22 private cars in the UK.

This is an increase on the previous 20 vehicles reported in 2021, and 18.5 vehicles reported in 2020. This is highly dependent on location, with one vehicle removing up to 24 private cars in London in 2021. This was also supported by Zipcar who quoted each of their vehicles removes 23.5 private cars. This is compared to approximately 8.5 private cars in Exeter (Co-Cars). One factor influencing these numbers is that members often sell (or don't replace) a private vehicle when they join the scheme. 22% of car club members said that they would have bought a car if they had not joined a car club. Alongside removing private vehicles from the roads, active car club members use cars up to two-thirds less often than private vehicle users.

In areas with high concentrations of car club cars such as London, and where there are parking and access restrictions, significant impacts can be seen on private vehicle ownership and use:

- 28% of car club members based in London have reduced the number of vehicles owned by their household since joining a car club, of which 53% report that the car club was the main factor; and
- 85,552 is the estimated total number of cars that have been removed from London roads by currently active car club members (source. CoMoUK London Car Club Report 2021).

In the 2021 car club report, CoMoUK estimated that a total of 116,811 cars had been removed from UK roads by active car club members (source: CoMoUK London Car Club Report 2021). This estimation was calculated from the number of active car club vehicles, the number of active members, and the number of vehicles that each car club car removed from the road. This was an increase from the 99,355 estimate from 2020.

Research by the Energy Savings Trust showed that reducing grey fleet use – private vehicles that staff use for work purposes – can result in up to 25% less car travel overall, as staff no longer gain workplace-related benefits from using their own cars (DfT 2015. A guide to managing grey fleet mileage. Energy Saving Trust).

4.2 Digital Demand-Responsive Transport (DDRT)

DDRT is a modern, user-orientated form of public transport, with flexible routing, pick-up, and drop-off locations, with timetabling matched to passenger needs. To keep the service flexible and responsive, users are often directed to a local bus stop, or, in less connected areas, virtual bus stops can be formed, where passengers are directed to a convenient street for pick-up. DDRT has the potential to provide services as and when required without the need to provide a service throughout the day at times when demand may be less. This can lead to a more efficient and effective economic model for providing mobility.

In New Lubbesthorpe, a new housing development in Leicester, within 2 months of an Arriva Click DDRT service launching, there were more than 12,000 accounts, with more than 2,500 weekly journey requests (Source: Arriva Click). It served residents of the new community as well as those in adjacent areas to gather a critical mass of users. It was used for commuting, leisure, and education purposes. The service is now being taken forward by Vectare, using technology provider Padam Mobility.

A survey undertaken for another of Arriva Click's operations in Liverpool (February 2019) showed the modes previously used before shifting to DDRT (Source: Arriva Click):

- 45% local buses
- 21% taxis
- 18% car driver
- 6% walked
- 5% travelled by train
- 2% car passengers and
- 2% cycled

These shifts away from private vehicles are supported by other DDRT services across the UK. Tees Flex, operating through the Tees Valley, provides a service of roughly 1,500 journeys per week to a user base of nearly 10,000, indicating wide adoption by the local community. Their data shows that 62% of passengers reported using their private cars less frequently.

fflecsi, operating throughout Wales, also reported that 73% (Stats provided by Via) of their users had been able to reduce their private car usage due to the DRT service provision.

Arriva Click research showed that their DDRT services saw up to 40% of passengers moving out of cars and up to 56% using the service to avoid having to find a parking space at their destination.

These statistics support the effect that DDRT can have in local communities to reduce reliance on single-occupancy vehicles and thus forms an important component in serving tertiary, secondary and primary mobility hub locations.

4.3 Bike sharing

CoMoUK conducts annual surveys into bike sharing. These are compiled in conjunction with accredited UK bike share operators, who provide CoMoUK with statistics on membership numbers, bike fleets and other indicators to highlight the latest trends in the sector. These are combined with the results of questionnaires distributed to members of these UK bike share schemes.

The statistics for 2022 survey respondents show the demand for bike sharing for commuting journeys (source: CoMoUK 2022 bike sharing statistics).

- 35% used bike share for commuting at least once a week
- 16% used bike share for commuting at least three times a week
- 62% of respondents used bike sharing at least once a month for their commute

There is also a demand for other journey purposes:

- 24% of users use bike sharing at least once a week for purposes such as accessing shops, doctors and entertainment. A further 33% do so at least once a month
- 66% of users have been cycling more frequently in general, since joining a bike share scheme

In terms of the resulting modal shift, had bike share not been available, users would have otherwise made their most common trip as follows:

- 37% car (as driver, passenger, or by taxi or hire vehicle)
- 15% bus
- 9% train
- 7% underground, light rail or tram
- 4% public transport options like park and ride or employer shuttles
- 15% walk
- 10% their own bike
- 2% e-scooter

The 2021 bike share survey also reported that:

- 34% of respondents using e-bikes said that they were replacing car or taxi trips of more than 5 miles per week as opposed to 24% of non-e-bike users

Therefore there is substantial justification to include bike and ebike sharing services at primary, secondary and tertiary mobility hubs.

4.4 eScooters

e-scooters have become a common sight on streets across the UK and in many major cities and towns internationally. Whilst the UK government considers legislative updates to enable the legal use of e-scooters outside of public trials / hire arrangements, there has been considerable uptake in those areas where public hire schemes have been introduced.

Taunton and Minehead

An e-scooter trial scheme has been operational in Taunton since October 2020, with a similar scheme operational in Minehead. The scheme is operated by Zipp and, based on data up to May 2022, the scooters had:

- Provided 92,618 rides
- Covered 182,003 miles at an average trip length of 2.08 miles and an average duration of 15 minutes 37 seconds
- Travelled at an average speed of 7.98mph
- Accommodated 12,364 users and accumulated 24,114 hours of travel time

56% of the total distance travelled by the e-scooters was for trips where users stated that they would otherwise have used a car (as driver or passenger). This represents 101,922 miles saved and a CO2 reduction of 41.4 tonnes during the period October 2020 - May 2022. Looking at the number of trips, rather than distance, 15% of journeys replaced a private car trip.

It was reported in December 2022 that the trial had, at that time, provided 121,750 rides and e-scooters had travelled more than 228,500 miles. This coincided with the Department for Transport's National Evaluation of e-scooter Trials: Findings Report and Technical Report.

Comparator Schemes – UK and International

In 2022, the West of England Combined Authority published a review together with Voi outlining the findings and impacts following their 12-month e-scooter trial. The trial covered 2 areas: Bristol & South Gloucestershire and Bath.

In Bristol & South Gloucestershire, 36% of users reported that they would have used a car or taxi instead had an e-scooter not been available. Using this modal shift figure, Voi estimated that 874,000 car trips had been replaced by an e-scooter within the first 12 months of the trial.

In Bath, 29% of users reported that they would have used a car or taxi had an e-scooter not been available. Using this figure, Voi estimated that 86,000 car trips had therefore been replaced by an e-scooter during the first 12 months of this trial. However, 45% of users said that they would have walked, which is a negative modal shift. Bath is built on many steep hills, and this could be a reason why people chose to use this "easier" mode instead of walking.

Overall, they found that 44% of Voi journeys would otherwise have been walked, 6% cycled and 31% driven. Although some journeys had been shifted away from active modes, the number that had been pulled from private cars was still substantial and very positive.

The mode shift seen above had been replicated by a 2018 e-scooter trial in Portland, USA (2018 Bird e-scooter trial conducted by the Portland Bureau of Transportation (PBOT) with the results fully monitored during and after implementation. During the four-month trial, people took 700,000 trips, covering 800,000 miles, on 2,000 scooters.

- 34% of Portland riders and 48% of visitors took an e-scooter instead of driving a personal car or using Uber, Lyft, or taxi
- It was estimated that e-scooters replaced approximately 300,000 vehicle miles that would have been travelled in single occupancy vehicles and other shared vehicle trips – this corresponds to a similar emissions reduction as removing 27 average passenger vehicles from the road for a full year
- However, a third of people would otherwise have walked or cycled
- Portlanders reduced or considered reducing their car ownership due to e-scooters –6% of users reported trading in a car because of e-scooters and another 16%considered it
- E-scooters attracted new people to active transportation. 74% of local users reported having never ridden the e-scooters previously and 42% never cycling

In December 2021, a Swiss research paper (Reck, Daniel J.; Martin, Henry; Axhausen, Kay W. (2022). "Mode choice, substitution patterns and environmental impacts of shared and personal micro-mobility". It found that privately owned e-scooters tended to replace car journeys.

The inclusion of shared eScooters should therefore be considered within mobility hubs, once and if they are legalised beyond the current authorised pilots seen in UK cities.

5.0 Mobility hubs: switch fuels

For remaining trips where a shift away from the car is not possible, there is a need to improve vehicle energy and carbon efficiency.

Whilst the mobility hub would not seek to encourage private car travel, some journeys will require the use of a car, whether that be private or shared.

For these journeys, in order to reach Net Zero targets, the switch to EVs will be critical. Hence the provision of EV car club vehicles and EV charging points for private use (and for delivery and servicing LGVs) should be considered to meet growing demand.

At the end of 2016 just 0.4% of all new vehicles registered were Battery Electric Vehicles (BEV). By 2022 this had risen to 16.6% of new car registrations. A further 6.3% of all new cars registered were plug-in hybrid EVs (PHEV), making a total market share of 22.9% for new cars registered with a plug in 2022.

From the 2022 CoMoUK car club report, 14% of car club vehicles in the UK are now electric, with a further 20% being a form of hybrid. 42% of survey respondents had used a full electric car club vehicle, and 91% of those users stated they were very satisfied with driving the electric car club vehicles.

These numbers reflect a year-on-year increase in demand for electric vehicles and therefore justify the inclusion of charging points at selected mobility hubs, which also adheres to the UK Government's aim for 300,000 electric vehicle charging points to be available on the network by 2030 (source: UK Government). In addition, this gives access to EV charge points to those without off-street parking, and provides the opportunity to charge within the local neighbourhood. This is an important service provision, as not everyone has a driveway or the capability to charge a vehicle at home. This could provide a positive influencing factor to those otherwise unwilling to shift to EV.

This could also provide a further beneficial relationship between the EV charging facilities provided and the non-mobility features of larger mobility hubs. Whilst waiting for the battery to charge, users might make use of the café or co-working facilities.

Consideration could also be given to incorporating renewable electricity sources - such as solar PV – into the design of the hub rooves, supported by on site battery storage.

The provision of electric charging services at primary mobility hubs can also extend to electric DDRT (e.g. MK Connect, Milton Keynes) and e-bus services, which would further enhance the sustainability and carbon reduction in the surrounding area.

6.0 Cumulative uptake of shared modes

The potential uptake of shared mobility services can be exponentially increased by locating multiple modes in one location, along with traditional public transport options. This is an important rationale behind the mobility hub design.

Car club users tend to be more likely to use a variety of other sustainable modes.

In the CoMoUK 2021 survey, 61% of car club members reported having used public transport at least once a week, compared to a national average of only 19% (source: CoMoUK Car Club Report 2021). In London, 75% of car club members had used public transport.

Therefore by offering car clubs and bus services at a mobility hub, this should have an cumulative uptake of both modes.

Car club users are also much more likely to use a bicycle:

- 37% of car club users reported having used a bicycle once a week, compared to a national average of 20% (source: CoMoUK Car Club Report 2021)
- In 2020, 30% of car club members reported using a bicycle three times per week (source: CoMoUK Car Club Report 2020)
- 55% use a bike to get to work compared to 27% in the control group, non-car club users (source: Analysis of the impacts of car sharing in Bremen, Germany)
- 39% use a bike to shop compared to 23% in the control group, non-car club users (source: Analysis of the impacts of car sharing in Bremen, Germany)
- In London, 36% of car club members reported having used a bicycle at least once a week (source: CoMoUK Car Club Report 2021)

CoMoUK 2022 bike sharing statistics also show bike share users are more likely to take multimodal journeys:

- 54% of users use bike share at least once a month to access public transport.
- 64% of users combine bike share with other modes of transport, mainly with bus and rail.
- 23% stated that they combine their most common bike share trip with a bus
- 22% with a train
- 10% with underground, tram or light rail
- 4% reported combining their most common bike share trip with the use of an e-scooter
- 13% reported combining bike share trips with taxis
- 13% reported combining it with car driving, and
- 6% combined it with being a car passenger.

Therefore, a cumulative uptake in cycling can be expected by co-locating such shared services with public transport and car clubs.

Escooter riders also show a greater tendency for multi-modal journeys, with 34% (San Francisco Municipal Transportation Agency (SFMTA) e-scooter pilot mid-point evaluation, and 15% (2019 6-T Bureau de Recherche in Paris, Marseille, and Lyon user survey), reporting that their most recent trip was multi-modal to or from public transit. Lime scooter data also shows a consistent story to the research above with 30% of riders replacing a car trip and 27% connecting with public transport in urban areas (source: Forbes). This shows the importance of including e-scooters in all levels of mobility hub to bridge the gaps in the wider public transport network.

Technology can also reduce barriers to entry towards new or previously unused modes. By having access to all modes at a mobility hub through the same smart phone app, for example, this is likely to encourage users to try out the other modes available, such as e-bikes and scooters, even if they have never used them before.

This would be further supported by having concierge/support services at the hub that can directly support users.

In addition, primary mobility hubs can provide services such as concierge assistance, which can help encourage people to try out new modes, and overcome wariness or concerns which is likely to help initiate and maintain new travel behaviour.

Overall, therefore, there is much data which indicates that the co-location of all such services within mobility hubs is likely to have exponential uptake of the component modes and lead to long-term changes in behaviour. This can be maximised through mobile phone applications to increase convenience and act as a medium through which incentives can be offered.

Somerset Council
County Hall, Taunton TA1 4DY
0300 123 2224

www.somerset.gov.uk

LDĀDESIGN

Bristol
First Floor, Hanover House
Queen Charlotte Street
Bristol BS1 4EX
+44 (0) 117 203 36288

www.lda-design.co.uk

LDA Design Consulting Ltd
Registered No: 09312403
17 Minster Precincts, Peterborough PE1 1XX
