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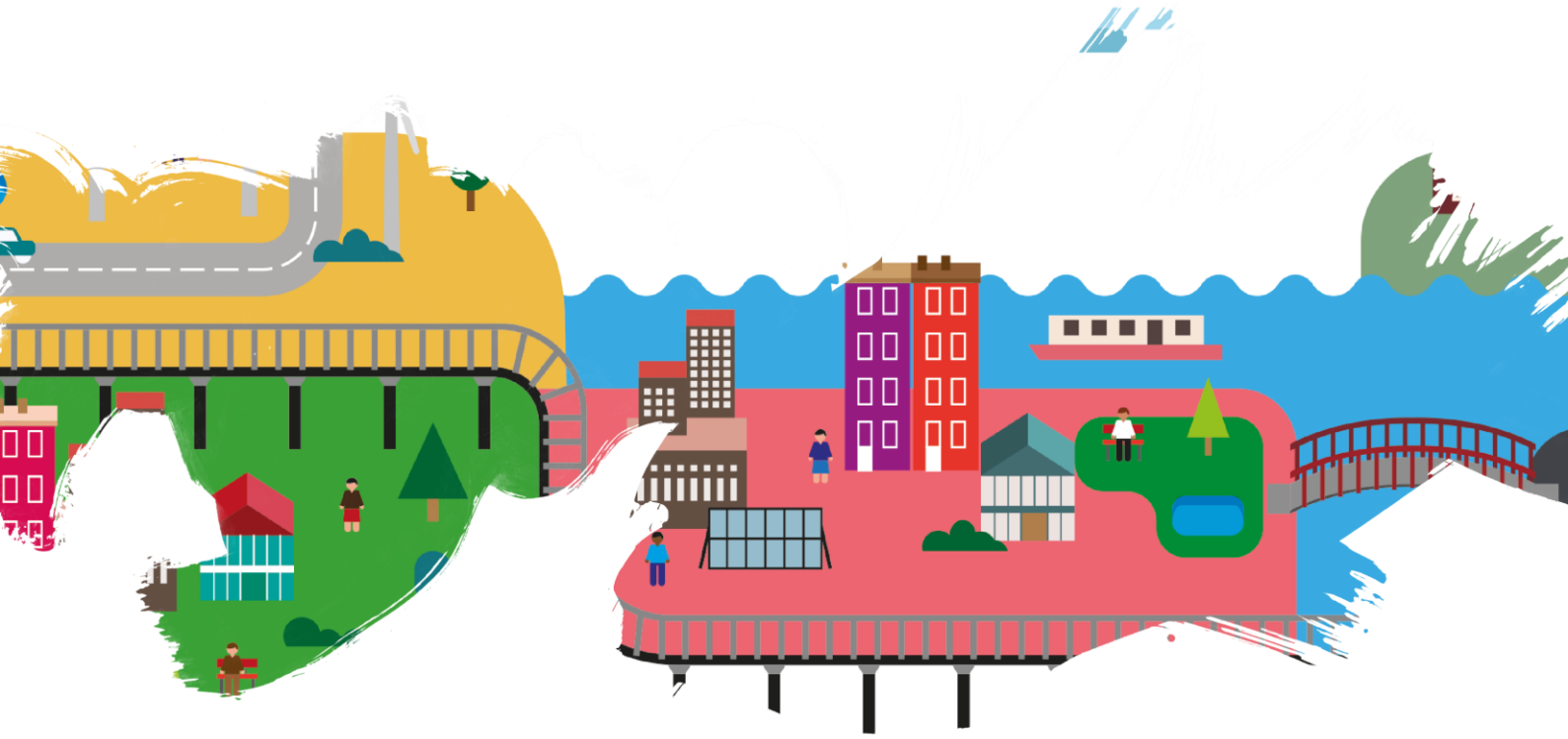


WATER MANAGEMENT
Perspectives from Europe

INTERNATIONAL URBAN COOPERATION PROGRAMME
LATIN AMERICA AND THE CARIBBEAN

INTERNATIONAL URBAN COOPERATION
European Union

WATER MANAGEMENT

Perspectives from Europe

The EU has developed an extensive portfolio of water initiatives, water strategies, legislation and guidance, research findings and other information. [1]

EU Water Blueprint for Water Security

The water framework directive has been updated and focused on new water resource challenges by the EU Water Blueprint 2012. The EU describes the Water Blueprint as follows: "The achievement of EU water policy goals is threatened by a number of old and emerging challenges, including water pollution, water abstraction for agriculture and energy production, land use and the impacts of climate change." 2 The EU's policy response to these challenges is the 2012 Blueprint to safeguard Europe's water resources. The overall objective of the Blueprint is to improve EU water policy to ensure good quality water, in adequate quantities, for all authorized uses. The Blueprint encourages a move towards what we call 'prevention and preparedness'. It will ensure a sustainable balance between water demand and supply, taking into account the needs of both people and the natural ecosystems they depend on. The Blueprint's policy recommendations are based on the results of the following ongoing assessments.

- Analysis of the WFD's **river basin management plans**: giving information on how Member States have improved their water management.
- Review of the **2007 policy on water scarcity and drought**:
    - including water efficiency measures.
    - The evolution of water resources:
- Water's **vulnerability to climate change** and man-made pressures such as urbanization and land use.
- Outcome of the **fitness check of EU freshwater policy**:
    - A gap analysis to identify any uncovered areas and assess the adequacy of the current framework.

The results of these reviews, together with other EU studies, provide knowledge to help better implementation of the EU water policy.

[1] The following sites provide links to much of the EU guidance from DG Environment and other key reference sites in the Commission.

- http://ec.europa.eu/environment/water/index_en.htm
- http://eur-lex.europa.eu/search.html?qid=1433820926086&OBSOLETE_LEGISUM=false&type=named&SUM_2_CODED=2006&SUM_1_CODED=20&name=summary-eu-legislation:environment
- http://www.euwi.net/files/MSF14_final_report.pdf

Other information is available from EU Member States and a wide range of organisations including governmental institutes, research organisations, NGOs and commercial sources. Much of the information provided in this position paper is sourced from this information source. All has been referenced and the sources provided which will allow access to the original documents.

[2] European Union, 2012, Blueprint for water security. http://ec.europa.eu/environment/water/pdf/blueprint_leaflet.pdf

River Basin Management Approaches

Integrated river basin management (IRBM) is at the intellectual heart of the EU and Chinese approaches to water management, however, the maturity of approach and extent of application differ. The illustration in Figure 10 shows a generic river basin. This takes into account the high quality water catchment at the upper reaches of the basin. This is usually suitable for public supply with minimum treatment and tends to be captured in reservoirs for security of supply. As the rivers flow through the basin, human activity, towns and industry impact on river flows and water quality. Major towns and cities tend to be in the lower reaches of the river system and without protection become unusable and may cause flooding and environmental degradation. Management measures must be taken across the river basin to optimize water resources and increase water security. Isolated measures to improve water security cannot be successful without taking account of what happens upstream and downstream. Integrated river basin management adopts a holistic approach to protecting the whole body of water, its source, tributaries, its main rivers, lakes, and groundwater, through a coordinated strategy involving all the interested parties in decision-making. The river basin approach is acknowledged in Europe as the best way to manage water.

EU Water Framework Directive

The EU water directives underpin much of the water resource protection regulation activity across Europe. Member States can choose how they implement this provided the minimum requirements are met. Permitting is one of the core tools used to ensure compliance with EU and domestic standards. The European Union took a ground-breaking step when it adopted the Water Framework Directive (WFD)3. It introduced a new legislative approach to managing and protecting water, based not on national or political boundaries, but on natural geographical and hydrological formations: river basins. These are known as River Basin Districts. IRBM needs clear coordination and collaboration between administrative authorities and stakeholders within the river basin.

The main aim of EU water policy is to ensure that throughout the EU a sufficient quantity of good quality water is available for people's needs and for the environment. Since the 1970s, through a variety of measures, the EU has worked hard to create an effective and coherent water policy. The Water Framework Directive (WFD) established a legal basis to protect and restore clean water across Europe and ensure its long-term, sustainable use. The general objective of the WFD is to get all water — for example, lakes, rivers, streams and groundwater aquifers — into a healthy state.

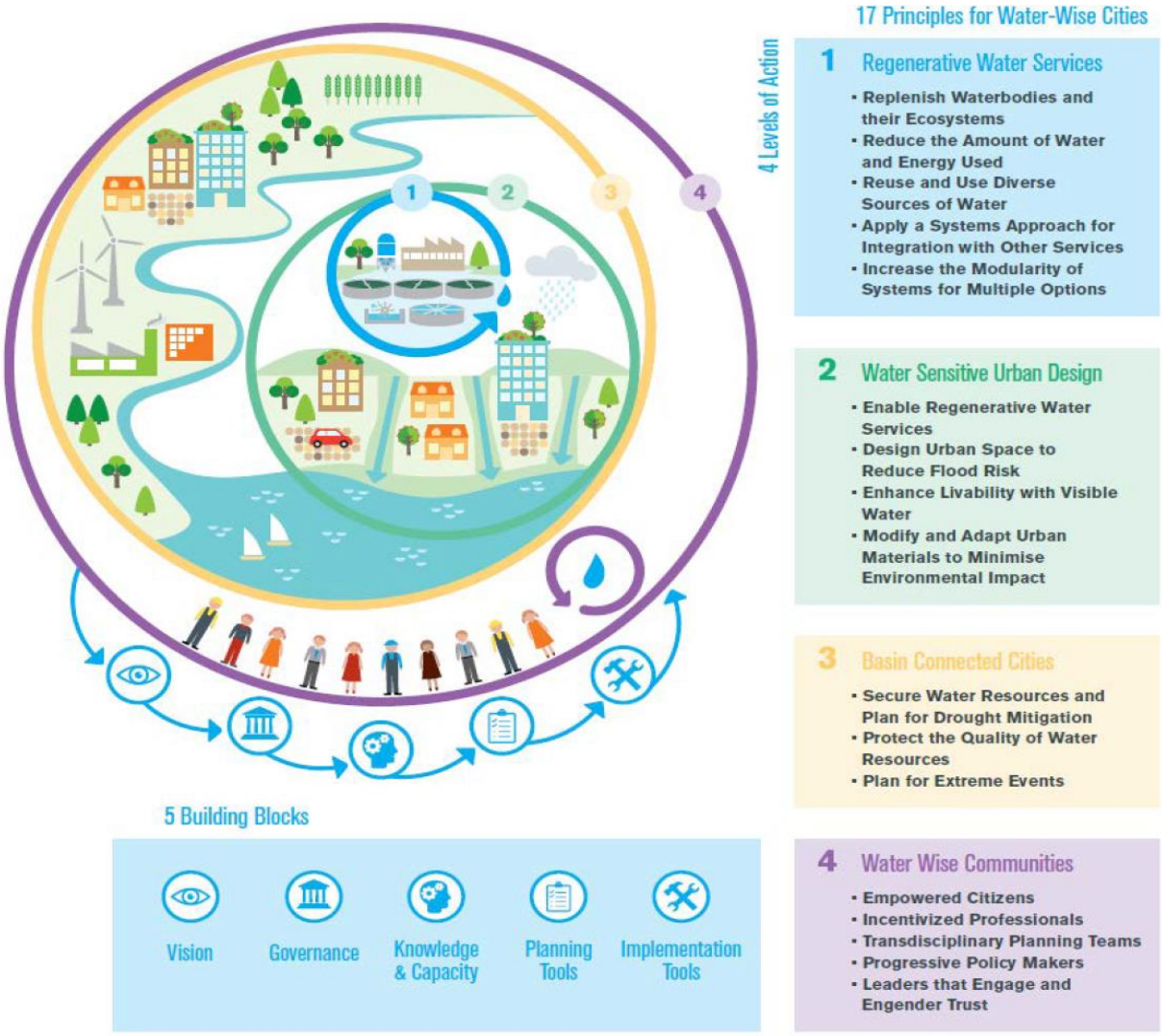
River Basin Management and Links to Spatial Planning

Maintaining water security requires a long-term vision and should be integrally linked to spatial planning for urban and regional development in both developing as developed areas. Water resource management is a fundamental element of development planning and should be designed into infrastructure projects at an early stage, taking into account the social and economic development opportunities improved water resources can bring. Modelling can test future development scenarios and identify options that could optimize decisions.

[3] EU Water Framework Directive CIRCA http://ec.europa.eu/environment/water/water-framework/iep/index_en.htm

Ultimately the availability of water will be limiting and the water planners and regulators may have to say no to further water exploitation in water scarce areas. In the UK the Environment Agency has final say, subject to appeal to Ministers. This is usually via the refusal to grant a permit or by imposing environmentally protective conditions in permits that may render the industry un-economic. Industry then has to decide whether a new installation is viable or not.

Figure 1: The Principles of Water Wise Cities Framework – four levels of Action and five Building Blocks for urban stakeholders to deliver Sustainable Water in their Cities



The Principles for Water Wise Cities outlines a framework to assist urban leaders and water professionals to develop and implement their vision for sustainable urban water and resilient planning and design in their cities. The ultimate goal of the Principles is to encourage collaborative action, underpinned by a shared vision, so that local governments, urban professionals and individuals actively engage in addressing and finding solutions on urban water management challenges.

Source: Andrews, L. 2016. The IWA's Principles for Water Wise Cities: Developing a Shared Water Vision. 20 June 2016. *International Water Association*. http://www.iwa-network.org/the-iwas-principles-for-water-wise-cities-developing-a-shared-water-vision/

Water Allocation and Supply Demand Balance

Water is a scarce resource and must be closely governed to ensure optimal and equitable allocation. This is usually done by government ministries, or their agents on behalf of society, using water laws and regulations. The EU sets minimum water standards across the EU in order to optimize water resources. This is governed by the EU Water Framework Directive4 (EUWFD) focusing on a river basin management approach.

The demand for water from cities, and households, continues to increase. Modern standards and lifestyles demand more water for washing, showering and cleaning. Understanding how this water is used is critical if demand is to be reduced. Mechanisms to influence water use will be discussed, including water efficient housing and appliances, and economic instruments such as water pricing. In addition, heating water in households is one of the largest energy demands, so reducing hot water use significantly reduces energy consumption. Water supply is limited by environmental factors, geography, geology and climate. These limit water availability and although new resources may be found these are scarce and expensive. Water availability is generally on a downward trend. Resources must be balanced by controls and incentives to manage within the resource – so called demand management. Water strategies for cities need to take account of this in forward looking long-term water plans.

The contribution of water and eco-city design to the supply demand balance should be considered and evaluated as part of the project justification and benefits assessment. In optimum applications of these concepts water savings and could get as high as a 30% reduction. However this is rarely quantified or assessed and impacts may be much less. However, research is needed to optimize impact and reduce pressure on scarce water resources.

Standards – Drinking Water Quality

The WHO publishes Guidelines for Drinking Water Quality5 that are followed in Europe. The EU sets similar such standards through the EU Drinking Water Directive, The Drinking Water Directive (Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption) concerns the quality of water intended for human consumption6. Equivalent or tighter standards are applied through Member State laws and regulations. The EU Drinking Water Aims are: High quality, safe and sufficient drinking water is essential for our daily life, for drinking and food preparation. We also use it for many other purposes, such as washing, cleaning, hygiene or watering our plants. The European Union has a history of over 30 years of drinking water policy. This policy ensures that water intended for

[4] http://ec.europa.eu/environment/water/water-framework/index_en.html
[5] World Health Authority, 2011, Guidelines for Drinking Water Quality –Fourth Edition http://www.who.int/water_sanitation_health/dwq/gdwq3rev/en/
[6] *The Drinking Water Directive (Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption) concerns the quality of water intended for human consumption* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1998:330:0032:0054:EN:PDF

human consumption can be consumed safely on a life-long basis, and this represents a high level of health protection. The main pillars of the policy are to:

- Ensure that drinking water quality is controlled through standards based on the latest scientific evidence;
- Secure an efficient and effective monitoring, assessment and enforcement of drinking water quality;
- Provide the consumers with adequate, timely and appropriately information;
- Contribute to the broader EU water and health policy. 7

Best Practice - Water Safety Plans
Water Safety Plans are increasingly a key element of reducing risks to drinking Water in Europe. They have been derived from the World Health Organization (WHO)'s 2005 document, Water Safety Plans Managing drinking-water quality from catchment to consumer .8 A Water Safety Plan (WSP) is the most effective way of ensuring that a water supply is safe for human consumption and that it meets the health based standards and other regulatory requirements. It is based on a comprehensive risk assessment and risk management approach to all the steps in a water supply chain from catchment to consumer.

The primary objectives of a water safety plan in protecting human health and ensuring good water supply practice are the minimization of contamination of source waters, the reduction or removal of contamination through appropriate treatment processes and the prevention of contamination in the distribution network and the domestic distribution system. These objectives are applicable to all water supply chains, irrespective of their size or complexity.

A WSP should ideally be developed for each water supply chain. For very small supplies this may be quite challenging and it would be acceptable to use a generic or model WSP for small water supply chains that are similar in nature with guidance on application to individual systems. Such generic or model WSPs could be based around a specified packaged technology. However, for all other water supply chains a WSP should be developed specifically for each system. Clearly WSPs can vary in complexity depending on the water supply chain. A WSP is essentially a framework of hazard identification, risk assessment, risk management including the control measures, monitoring and incident and emergency plans and the associated documentation for each stage in the water supply chain. The water supplier is the key player in a WSP but other stakeholders have significant roles.

Outlook - Improvement of EU Drinking Water Legislation

The EU Commission9 has performed a public consultation on the quality of drinking water in the EU in order to assess the need for improvements on EU drinking water legislation. The consultation is one of the actions announced in the response of the Commission to the European Citizens' Initiative 'Right2Water'(Communication (2014)177 final).

[7] EU Drinking Water Web Page http://ec.europa.eu/environment/water/water-drink/index_en.html
[8] WHO, 2005, Water Safety Plans Managing drinking-water quality from catchment to consumer , WHO/SDE/WSH/05.06 http://www.who.int/water_sanitation_health/dwq/wsp170805.pdf
[9] EU Current Activity – Drinking Water http://ec.europa.eu/environment/water/water-drink/review_en.html

Revision of technical annexes: The Commission worked in close consultation with Member States, experts and stakeholders on a revised text for Annexes II and III. The amendments will give in the future an opportunity to monitor drinking water parameters at more appropriate frequencies. The new Annex II provides an option to perform the drinking water monitoring in around 100,000 water supply zones in Europe in a more flexible way, provided a risk assessment is performed ensuring full protection of public health.

It follows the principle of 'hazard analysis and critical control point' (HACCP) used already in food legislation, and the water safety plan approach laid down in the WHO Guidelines for Drinking Water Quality. These amendments will allow a better and more problem-oriented monitoring of small water supplies. The new monitoring and control system allows to reduce unnecessary analyses and to concentrate on those controls that matter.

WASTE WATER TREATMENT

Sector Context and Policy Analysis

Wastewater treatment is sometimes referred to as the 'dirty water' side of the water management business. It includes the collection of wastewater from households and industry into sewerage networks, the management of the networks and the treatment of the dirty water at sewage treatment works, before discharging the treated effluent back into the environment. Surface water from urban development is sometimes combined with the dirty water in 'combined sewerage systems'. This may have engineering, cost and treatment advantages, according to circumstance. However, with the growth of cities and increases in impermeable areas, combined sewerage systems can cause problems with overflows of contaminated water into watercourses – so called combines sewer overflows (CSOs).

Increasingly surface water and dirty water systems are being separated and new developments will often be designed with separate systems. Increasingly dirty and clean water systems, and flood alleviation measures are being planned and developed in an integrated way. This is because we are increasingly aware that all interact, especially in extreme situations.

Approaches such as sponge-city, eco-city and Sustainable Urban Drainage Systems (SUDS) offer options to work with city planners to arrive at optimal and more sustainable solutions. However, in most cases, especially when applied to existing cities, these are in addition to conventional drainage infrastructure.

There will always be a need to ensure public-health with the proper collection and treatment of sewage though large base remover sewage treatment plants; environmental sanitation and development of sewerage networks.

As piped water becomes available in households, there is a consequential need to dispose of the waste water. Also, in the developed world, the majority of households have water closet based toilet systems, utilizing water to wash away human excreta. This brings significant public health benefits, by physically separating the handling and removal of contaminated faces from other household activities. As cities develop, more and more households have inside toilets.

This removal of human waste is known as environmental sanitation and encompasses disposal and treatment of waste waters. This requires an integrated management approach at neighbourhood or city level. At the household level there is of course also the safe management of human excreta, which includes the provision of toilet facilities, in combination with education and behavior change promoting

hygienic practices (e.g., hand washing) to reduce fecal–oral diseases. The waste water is known as sewage and the collection systems are sewers, or sewerage networks.

The collection of this sewage in urban situations is usually via centralised sewerage networks. Initially this sewage is removed from households and discharged into nearby watercourses, creating significant public health risk, especially if this is near a drinking water abstraction points. Other environmental pollution and damage occurs, especially if there is little dilution.

As cities develop, the next step is usually to add a municipal sewage treatment works on the end of the sewage network to treat the sewage before discharge. This treatment can be progressively improved to reduce the public health risks and environmental impact.

Centralized versus decentralized systems

Many cities have become oriented towards ¨high-tech¨ solutions of centralized collection and treatment systems. Water supply on the one hand, and waste water collection (sewerage system) and treatment are two sides of the same coin. Urban areas which lack the necessary infrastructure to collect, treat, and dispose of wastewater face numerous human and environmental health problems. Environmental sanitation is necessary for proper management of urban environments and to improve and protect human health as well as the natural environment.

The majority of cities focus on centralised water supply and sewage collection networks. These are an essential part of city infrastructure and these major water supply and waste removal systems are the backbone of public health provision. These centralised systems are usually developed and operated by municipalities, but in some countries these are privatized and operated by commercial organizations, with water charges being raised by the water companies to fund the provision. The trend is still to agglomerate water and sewage networks in order to optimize operation and reduce water charges. This is still the preferred model and commercial and competitive methods show this to be the case.

However, new research and thinking is challenging this and in some cases, especially for new suburbs and developments, decentralised models are being tried and can show efficiency, especially in eco-city contexts.

The reality is likely to be in mixed centralised and decentralised options, each complementing water sensitive city designs. However, for big cities the core infrastructure will remain for the foreseeable future and will be essential to maintain public health – the essential underlying consideration.

Inadequate collection of waste water

If sewerage networks are undersized or badly maintained then blockages and overflows occur. At worst this can cause sewer flooding and the backing up of sewage into households.

Inadequate collection of waste water has a very strong impact on the natural environment. More so, the discharge of untreated effluent and industrial waste has strongly detrimental effects on the biology of watercourses and their ecosystem. Contaminated freshwater sources, degraded aquatic environment, and eutrophication through excessive nutrient discharge are all outcomes of poor wastewater and surface water management. Coupled with these challenges, inadequate drainage and preparedness for heavy rain events often means that wet season and instances of high rainfall are compounded by poor or absent solid waste management and exacerbate the challenges that cities face in managing water

resources, as it impacted by through localized flooding, contamination of water resources (through effluent combined fresh water).

The EU-funded SWITCH project has recommended a strategic and broad scenario for dealing with waste water through decentralised approaches, assuming that these practices will lead to substantial gains in water resources:

EU Urban Wastewater Treatment Directive

The EU Council Directive 91/271/EEC concerning urban waste-water treatment, was adopted on 21 May 1991. Its objective is to protect the environment from the adverse effects of urban waste water discharges and discharges from certain industrial sectors. Member states increasingly set emission standards that are tighter than these minimum standards. These are usually set to meet 'river needs' or the increased requirements of the Water Framework Directive. These standards are set using discharge permits which closely specify numeric requirements for performance. The numbers are determined by mathematical modelling of receiving water objectives. Models such as SIMCAT are used to determine cost effective options within river catchments. The publication 'Regulation for Water Quality'10, provides an extensive overview of these permitting and modelling processes.

Outlook - The EU Future Environment Targets

Overall the EU sets future targets in line with the evidence from the EEA and according to the EU's 7th Environmental Action Programme (see below) 5. Increasingly this follows an integrated approach, looking to optimise between Air, Land, Water and Waste, whilst preserving scarce natural resources.

Outlook - Energy capture from sewage networks and treatment plants

Digested sludge has been used to produce methane to power treatment works for many years. The processes are being progressively improved and optimized, in terms of the quality of the methane produced and the efficiency of the engines used to burn the methane.

Sewage, water treatment and water pumping are energy intensive process so any methods to optimize this are important. These include, pump design, real time control systems and heat and energy recovery systems. The concept of carbon neutral STW is being developed, although none have yet reached this status. Significant development is continuing and this will be a major driver for future work, in terms of carbon reduction and cost saving.

Outlook – Diffuse Pollution Control

One of the major challenges for environmental regulation is in addressing the sources and causes of diffuse pollution. Conventional engineering and permitting-based regulation works well for point sources of pollution, but has been ineffective at addressing diffuse sources such as pollutant runoff from agricultural practice, forestry, and urban hard surfaces. It is clear that behaviour change is needed on the part of the people and organisations responsible for generating the diffuse pollution, often in complete ignorance of the impact their activity creates.

While in the EU there has been great progress in reducing point source pollution over recent decades, non-point / diffuse pollution, especially of nitrate and phosphorous from agricultural land, has generally

[10]Foundation for Water Research, 2014, Regulation for Water Quality. http://www.fwr.org/WQreg/

remained stable or become worse. Awareness of this issue is often low with the majority of farmers not realising that they are major contributors to surface and groundwater pollution. There are often significant time lags between the application of fertiliser, pesticide or manures / sludge to land and its transport to rivers by surface or sub-surface routes. These will be dependent on weather, with site specific factors also affecting the pathways of pollutants to the receiving water.

EU Floods Directive

The core European policy position on flood risk is the EU Floods11 Directive provides a common approach to flood risk across the EU. It entered into force on 26 November 2007.

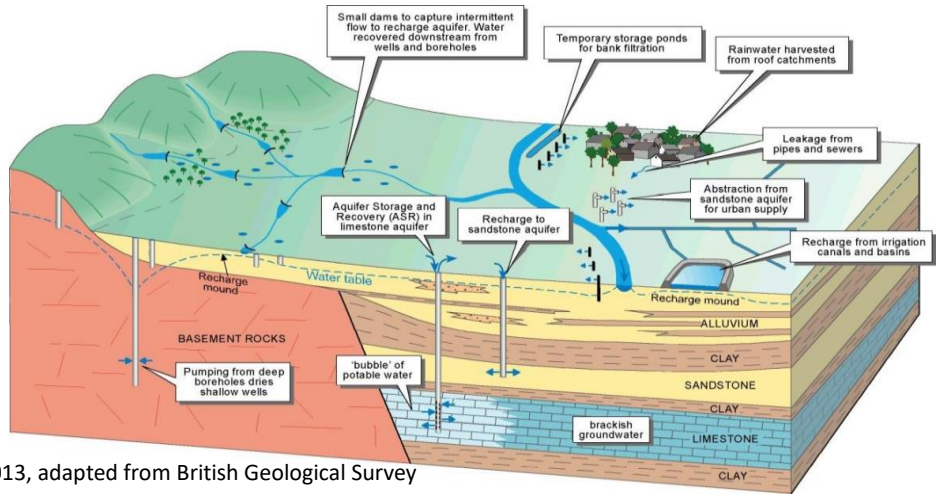
This Directive requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk. With this Directive also reinforces the rights of the public to access this information and to have a say in the planning process.

Aligned with the Floods Directive is the EU Flood Action Programme12. This preceded the Floods Directive and was important in shaping the approaches.

Integrated flood management, drainage and sewerage planning

The capacity of a city to cope with rainfall, drain effectively, and maximize opportunities for storm-water collection and reuse is essential for the long-term sustainability of cities. Drainage and flood water management is multifaceted and closely linked to adequate infrastructure. Inadequate drainage and flood control is most pronounced in urban areas that own rivers, and are located on or near floodplains or low-lying areas.

Options for Artificial recharge and recovery of groundwater in context of sponge cities - Active Groundwater Recharge



Source: Atkins 2013, adapted from British Geological Survey

[11] EU, 2007, Directive 2007/60/EC on the assessment and management of flood risks http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32007L0060

[12] EU, 2004, **Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions - Flood risk management - Flood prevention, protection and mitigation** http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52004DC0472

Increasingly flood and drainage systems are being considered as integrated systems. In high rainfall, foul sewers, surface water drains and rivers all become impacted and flood water can back up sewer systems and infiltrate back through flood defences into homes and industries.

RENUNCIA

La ilustración de los estudios de caso de IUC-LAC solo fue posible mediante el uso de una amplia gama de materiales publicados, la mayoría de ellos disponibles en línea. Muchas de las ilustraciones (fotografías y gráficos) se originan en fuentes de Internet, y se reproducen aquí con citaciones y referencias adecuadas. El uso de estos materiales es únicamente con el propósito de compartir conocimientos, sin ningún uso o intención comercial.

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IUC-LAC PROGRAMME

The International Urban Cooperation Programme - Latin America and the Caribbean (IUC-LAC) connect cities in different regions of the world to get in touch and share solutions to common problems. This initiative is part of a long-term strategy of the European Union to promote sustainable urban development in collaboration with both the public and private sectors and with civil groups and citizens. Through participation in the IUC-LAC, Latin American municipalities exchange knowledge with their counterparts in Europe, thus building a greener and more prosperous future.

IUC-LAC activities promote the achievement of political objectives and important international agreements on urban development and climate change, such as the EU Urban Agenda, the UN Sustainable Development Goals and the Paris Agreement.

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* All the aforementioned information is based on internet and published source mentioned in footnotes.