

MANAGEMENT OF ENGLISH RIVERS PRINCIPALLY OVER THE LAST 160 YEARS

THE TIMELINE FROM POLLUTION CONTROL TO NURTURING NATURAL RESOURCES AND ECOSYSTEMS

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SUMMARY

S1 This think piece is produced by the Worshipful Company of Water Conservators, the City of London Livery Company, focussed on the long-term health of our water resources and the broader environment. Our members include senior professionals from water, environmental and related industries and regulators, along with others who share our passion for water and the environment. Our experience and knowledge ranges from the complexities of environmental sciences, through the application of engineering to deliver the goals identified by those sciences, and the subsequent management of the assets created. The Company's purpose is *Promoting a diverse and sustainable environment*. To avoid confusion between the use of the term Company and water companies, the acronym WCWC is used

Why has the Worshipful Company produced this paper?

S2 During 2022 water management in England became a matter of debate in the media and in politics, but as part of routine business, Defra has been issuing several consultation documents on matters related to water management and the WCWC has responded (these responses may be found on its website). It is now engaged in producing a series of think pieces on the future of water conservation.

S3 One theme has been the management of river quality and this will be the subject of a think piece on the streamlining of legislation. Further consideration will be given to groundwater quality another think piece has been about water resources and uses of river water primarily from a quantitative aspect), and to marine water quality. In preparing its responses to consultations and in producing its think-pieces, the WCWC is very much aware that, sometimes, particularly in the lay media, the origins of current practices are obscured by the progress of time and it has been necessary to refresh the facts about historic core events. There are books and papers, but the WCWC determined that a simple summary would be of value as a working reference. This think-piece provides a time line of development, particularly over the last 160 years. It will be kept up date to date as much as possible.

S4 This timeline shows that over 160 years the need for professional management of rivers has evolved from being controlling point source impact through to whole river management through to catchment management and river corridors into fully integrated basin and catchment management which embraced management of land insofar that it impacted water resources. It brought together flood and drought adaptation and mitigation and ensured that rivers were seen as part of the hydrological cycle with interconnection with groundwater, estuarial and coastal waters. But there is scope for still further evolution to deliver more impact management and less focus on output management. ie less 'end of pipe', and there is an uncertain future as legislation comes forward for review.

S5 Society needs to refresh its memories of the contributions of the tools which still lie at the heart of current practices, such as the management principles, in no hierarchical order, of ... minimum river flows, the combination of rivers and groundwaters as the crux of water resources, the integration of flood and regular river management, emergency sewer and overflows, river use classification, ecological

and chemical status, statistical assessment of compliance and so on .This timeline charts out the evolution of those tools.

THE TIMELINE

The paradox of our love of rivers

1 Mankind has had a turbulent relationship with rivers since the dawn of civilisation. Rivers have been loved and abused and have been at the heart of our lives, being the catalysts for many early human settlements, cultures and even religions baptism in the River Jordan, immersion in the River Ganges .. for example. But in spite of this, mankind has abused the value of water ...water washes away dirt .. it has been thought to wash away sins and once used, its management was driven by the out of sight out of mind mentality.

2 From the purity of the relationships at the dawn of civilisation, we allowed our rivers to become polluted, whilst, paradoxically, still accepting the mystical role of water. Once the stink of the River Thames was resolved in the 19th Century, the polluted river was tolerated; in 1967 the Kinks famous song ‘Waterloo Sunset’ started with ‘Dirty old river, must you keep rolling, Flowing into the night?’ But society has awoken to that paradoxical dichotomy and the love of rivers now dominates the abuse and that is driving the current focus.

3 The issues which the WCWC is about to unfold have parallels in other countries, but in spite of the frustrations with our progress towards fulfilling our aspirations for the future, the UK has made good progress, not only during our membership of the EU. Many of the requirements of the EU are based on the experiences of the UK, albeit that it is argued that it has leapfrogged over what is done now. It will be essential that the vision of the European vision is maintained in moving post Brexit environmental legislation forward.

4 In order to make the position paper come alive, the time line has drawn on visual memories of iconic rivers. For example, London and the River Thames, in which the state of the river is intertwined with the improvements made to public sanitation and the quality of drinking water in the city. And, where-ever appropriate, the points made by the WCWC are illustrated by reference to the River Thames. But parallel events took place in other rivers, such as the Mersey, Severn and Trent.

The origins of what we do now

Loss of innocence

- 1197: King Richard I sold the Conservancy of the River Thames to the Corporation of London (as commemorated annually by the presentation of a jug of Thames water by the WCWC to the Lord Mayor).
- 1215: Magna Carta: Thames mentioned as a significant salmon fishery.
- 1421: Dick Whittington’s Longhouse toilet for 128 people discharging direct into the Thames
- 1531 Statute of Sewers, passed by King Henry VIII in 1531 starts regulation of land drainage , and several further Acts over many years which built upon that foundation
- 1613: The New River Water Company provides clean water to London.

- 1596 John Harington built a flushing closet for Queen Elizabeth, his godmother, but it was complicated and did not catch on.
- 1797: 6,000 flush closets built by Joseph Bramah in London overwhelm the sewerage systems.
- 1808: Start of drinking water treatment with filtration in Paisley.
- 1815: Disposal of household waste to sewers legalised. The introduction of the water closet and urban growth meant cesspits were no longer able to cope. Sewers, designed originally for land drainage, now discharge sewage into rivers.
- 1833: Last salmon caught in the Thames.
- 1832 – 1853/4: Major cholera and typhoid outbreaks; 48,000 dead from cholera alone in 1848/49; start of proper sanitation and separation of that from drinking water services .. work of Chadwick and Snow (first paper 1849 following major cholera outbreak).
- 1846: The Nuisances Removal and Diseases Prevention Act, encourages connection of domestic sewage to sewers ... inspired by Chadwick.
- 1851: First public toilet (the “Monkey Closet”) at Great Exhibition.
- 1852: Metropolis Water Act. London water companies are forced to move their abstraction points above the tidal limit as part of water supply improvements.
- Mid 19th Century : Public and political outrage at pollution of rivers – the Great Thames Stink of 1858-9.

Lightbulb moments and emergence of public health engineering and science and the concept of pollution prevention

- 1861 Pasteur published first work on ‘germ theory’ which underpinned and catalysed work on water contamination .. continued publishing for several years.
- 1864-65 Bazalgette built the Northern Interceptor sewer downstream to Beckton and the Southern Interceptor to Crossness The investment continues to this day with the Supersewer. Only storage provided initially.
- 1865-74: Two Royal Commissions set out the objectives of reducing sewage and industrial effluent pollution.
- 1870 First charcoal filter for drinking water produced by Doulton.
- 1875: Public Health Act established Local Authorities as Sanitary Authorities.
- 1876: Rivers Prevention of Pollution Act set out what the Sanitary Authorities should do to avoid river pollution and later enabled the creation of River Boards and Joint Committees. Fisheries Boards given powers following catchment, rather than municipal boundaries.
- 1878: Over 640 people die when the Princess Alice sinks near London’s sewer outfalls triggers further demand for action.
- 1890: First major investments in sewage treatment; start of development of biological treatment of sewage with filters. Common mode of treatment, where provided, was using the microbial capacity of soil to clean the sewage. This is the origin of the term ‘sewage farm’ which still persists.
- 1891 Thomas Crapper designed the flushing toilet This was a crucial step insofar that it really heralded in the era of water flushing drainage systems from homes. There is still advocacy of waterless systems, but is there any practical alternative in the way our domestic infrastructure is conceived and constructed, particularly in built environments?

- 1893 Last case of indigenous cholera in the UK (no available data for London). This was a clear demonstration of the benefits of a satisfactory foul drainage system and robust water supplies.
- 1895 Emergence of professionalism in what eventually became Chartered Institution of Water and Environmental Management.
- 1898-1915: Royal Commission on Sewage Disposal linked treatment standards to river quality and established a classification system; introduced first concepts for storm overflows.
- Early 20th Century: New effluent treatment technologies emerge ; outstanding example being activated sludge processes for sewage; and emergence of chlorination for drinking water supplies .
- 1923: Salmon and Freshwater Fisheries Act. Empowered Fisheries Boards to take action against pollution affecting fish.
- 1927 Royal Commission on Land Drainage finds 100 catchments but 361 Catchment Boards
- 1930 Land Drainage Act establishes 47 Drainage Boards
- 1935: Last case of indigenous waterborne typhoid.
- 1936: Public Health Act limited local authority discharges.
- 1937: Public Health (Drainage of Trade Premises Act) gave Local Authorities powers to control trade effluents discharged to sewers, thus recognising the impact that these can have on sewage treatment and effluent quality.
- 1939-45: War years' home- grown food resulted in massive increase in use of synthetic fertilisers leading to some phosphate and nitrate pollution Intensive animal farming also resulted in organic pollution. And ploughing of grassland released nitrate into surface and ground waters. Permanent change to agriculture reflected in the 1970 Agriculture Act
- 1945: Water Act support the national water supply in England and Wales. It marked the beginning of a national water supply policy, required water suppliers to supply water to non-domestic customers for the first time, and introduced the concept of abstraction licencing.
- 1948: River Boards Act established 32 independent River Boards as regulators, replaced the 1876 River Boards. Merged with Fisheries Boards
- 1948-52: Common law case on riparian rights in River Lee sets famous precedent

The science and engineering of pollution prevention emerges into main stream management

- 1951: Rivers Pollution Prevention Act replaced the 1876 Act with much stronger powers. Consents required for new discharges.
- 1958: River classification system introduced by Ministry of Housing and Local Government based on chemical quality (73 % of rivers in England and Wales deemed unpolluted or recovered from pollution. A latter- day version, in 1990, reported 89% good or fair and 87% in 1995.

- 1950-60s: Improved river quality saw return of fish, recreational angling and other water sports, such as canoeing, leading to a rise of lobby groups, such as the National Federation of Anglers.
- 1961: Rivers (Prevention of Pollution) Act extended pollution powers of River Boards and in particular all exempt discharges needed Consent as from 1963.
- 1961: Public Health Act extends local authority powers on drains and sewers.
- 1960s: Emergence of formal biological monitoring systems of rivers to assess pollution building on the work in the Trent.
- 1960s: Emergence of algae problems arising from nitrate and phosphate pollution leading later to extra demands for effluent treatment, but legal restriction on phosphate in detergents did not come until 2015. Government guidance and controls on fertiliser use with respect to environment protection did not come until 1983.

Emergence of the principles of water resources management and wider controls

- 1960s WPRL Technical Report 10 sets out the massive dissolved oxygen sag in the Thames as a basis for investment in sewage treatment. Similar studies in other rivers eg. Trent from which a Biotic Index was created.
- 1960s Start of a big push on investment for full sewage treatment, e.g., in five centralised plants in London (eg Crossness 1964) investment continues even today.
- 1963: Water Resources Act created 32 River Authorities from river boards with wider powers to integrate all aspects of water resources and river management as from April 1965 . It established the principle of minimum flow in rivers at abstraction points to limit those abstractions
- 1965: After the Second World War the use of synthetic detergents caused massive foaming problems. A voluntary ban on non- biodegradable products was introduced in 1965. There is now a legal ban. This was a dramatic demonstration of how a consensus decision can solve an environmental problem over- night.
- 1970: Basis of modern principles defined for sewer design and treatment capacity regarding combined surface water and sewage flows – still forms fundamental basis for design with some evolution, but is under challenge in the 2022 criteria.
- 1970s Start of integrated monitoring: e.g. monitoring of the river by the GLC and PLA with the Natural History Museum and the Wildfowlers of Great Britain and Northern Ireland, for the return of fish, estuarine life and wildfowl to the estuary as a means of tracking improvements.
- 1973: Return of first salmon to River Thames.

Full development of water cycle management and the protection of water uses. The emergence of natural resources management

- 1973: UK joined European Community (later Union) and this introduced steady stream of Directives and Regulations and Common Agricultural Policy, which, increasingly, affected qualities of rivers and their uses.
- 1973: Water Act. Following on from the 1972 report ‘Out of sight Out of Mind’, concerns about the needs for coordination of all aspects of water cycle management

(and to bring sewage treatment works up to common good standards) created the 10 Regional Water Authorities in 1974 in England and Wales based on River Basins. DoE then HMIP had oversight of sewage effluent consents until formation of NRA in 1989. Coincided with reorganisation of local government.

- 1974: Control of Pollution Act included provision to extend the writ of water pollution control and enabled bodies and persons other than regulators to take action on pollution arising from failed to comply with legislation. This later resulted in the notion of statically based look up tables for sewage effluent compliance which were adopted later in the 1991 Urban Waste Water Treatment Directive. Also, later, saw descriptive consents for small sewage treatment works.
- 1975: Flood Studies Report provides basis for predicting flooding.
- 1976: Drought highlighted value of regional concepts.
- 1980s: Water Authorities Association, National Water Council cooperate with government in national committees developing agreed strategies; developed ideas of river quality objectives for stretches of rivers which reflected uses of water in the stretches, but comparative classification system was still needed. In 1990, 77% rivers in England were Good or Fair.
- 1981: Wildlife and Countryside Act had implications for wildlife stewardship in rivers. Included first regulation of import and movement of invasive species. At about this time the concept of river corridor management emerged.
- Early 1980s: first restrictions on the use of fertilisers in agriculture to limit pollution and remedial action to control and remove phosphates in water and sediments
- Mid 1980s: Hyperinflation restricted investment in water services and as a result river quality declined. This became one of the drivers for further investment along with meeting European commitments which led to privatisation in 1989.
- 1989: After previous attempts at privatisation. the need for increased investment in water services, and dissatisfaction with integrated regulation resulted in breakup of Water Authorities to form Water Companies, regulated economically by OFWAT in a 5- year cycle and by the National Rivers Authority. Water companies and the NRA lost the power of statutory objection to development, but the concept of infrastructure charges was introduced.
- 1990: Environment Protection Act paved the way for consent to discharge to be regulated by Environment Protection Regulations with the principles of integrated pollution control.
- 1991: Water Resources Act integrated legislation for water cycle management. Principle of Statutory Water Quality Objectives established.
- 1991: Water Industry Act set out more prescriptions on the duties of water companies which included impact on river quality and service to customers.
- 1991 Urban Waste Water Treatment Directive with the look up table for larger sewage effluents and demise of long sea outfalls for screened sewage and dispersal of sewage sludge at sea.
- 1992: NRA produced a new classification system reflecting chemical and biological quality and the establishment of the notion of statutory river quality objectives related to uses. By 1995 this was established as the River Ecosystem Scheme and for comparative purposes the General Quality Assessment Scheme with six chemical

classes, and biology, nutrient and aesthetics windows. By 2008, after which the new classification came in the good was 79% and fair 13%.

- 1995: Environment Act created integrated environmental regulation including river quality, by Environment Agency.
- 1999 Water Industry Act introduced a series of specific measures in several relating to the relationship of water companies and their customers.

Restoration of rivers to a nearly natural state and origins of current angst

- 2003: The Water Framework Directive (WFD) 2000, enacted in Water Environment (Water Framework Directive) (England and Wales) Regulations, establishes an integrated approach based on 6-year plans for river basins. This joins a suite of EU Directives; Urban Waste Water Treatment (1991), Nitrate (1991, creating nitrate vulnerable zones), Bathing Water Quality (1976, revised, 2003) and Environmental Quality Standards (2008) for priority substances, along with the CAP. Many other Directives and regulations also apply, e.g., for pesticides, detergents, etc. Under the WFD, management at sub-basin level (catchments) is described as for Water Bodies and introduces concepts of Ecological and Chemical Status as planning and reporting criteria. 100 Catchments formally defined in 2013
- 2008: Rising concern about sewer overflows resulted in Sustainable Urban Drainage Systems best practice for new build, but still not mandatory under 2020 Act.
- 2008: Water Framework Directive UK TAG report on standards
- 2009: New EA classification system changes the goal posts radically. Based principally on Good Ecological Status (from WFD), which is a nearly natural state and Good Chemical Status But the data need careful use. Good Ecological Status was 22% in 2009 and 23% in 2016.
- 2010: Water and Flood Management Act; after decades of extreme flood and drought events, management of these is harmonised with other aspects of river management (following on from the Floods Directive 2007) Schedule3 regarding the introduction of statutory SUDS standards still not implemented in England , but is in Wales in 2019 .
- 2013: Water Industry (Specified Infrastructure Projects) (English Undertakers) Regulations for large projects such as Thames Tideway
- 2014: Defra published UKTAG revised environmental standards for water bodies
- 2015: The Water Framework Directive (Standards and Classification) Directions (England and Wales) : Tightened standards.
- 2016: EA reported that Good Ecological Status, the overall objective for all rivers was now only 14 % in 2016. Good chemical status 97%. Serious pollution incidents had been cut, but total incidents were rising. Significantly, nitrate arose again as a hot issue.
- 2017: WFD regulations updated.

- 2018: EU Withdrawal Act. Statutory power to transfer law arising from EU to be transposed direct into English law .EU water quality regulations now direct in force in UK rather than via European legislation.
- 2019: New standards for ubiquitous toxic substances results in Good Chemical Status falling to zero still concerns on serious pollution incidents. Good Ecological Status still at 14%
- 2019: First Statutory Water Resources Plans.
- 2020: Water companies PR 19 have to finance specific investment on river quality. Water Industry Environmental Investment Programmes WINEP, which, for example includes large number of new phosphate consent limits
- 2020: Vast majority of storm overflows being monitored providing more and new data; national Storm Overflows Task force established by Defra and commissions Stantec to produce evidence report.
- 2021: Changes to the National Policy Planning Framework with implications for infrastructure overload and management.
- 2021: New river basin planning guidance issued by Defra.
- 2021: Environment Act with a particular focus on storm overflows and new powers for Secretary of State; there was public and political concern over apparent deterioration of rivers, and sewer overflows; key Stantec evidence report on storm overflows report to Defra.
- 2021: The Thames supported over 120 species of fish with dolphins, seals and whales and a wide diversity of other mammals and birds now occurring within its environs, but suffering from storm sewage overflows from overloaded sewers being supplemented now with the new Super Sewer.
- 2022 : The EAC completes its Inquiry into River Quality with a focus on storm overflows in January . This is in response to concerns, but in itself generates a very substantial interest by the media in the evidence given by a variety of bodies including the Environment Agency, Water Companies and NGOs such as the Rivers Trust.
- 2022: Drought raised profile of water resources and conservation still further; very significant rise in the demand for wild swimming in rivers catalysed by Covid19 .
- 2022: General rise of public and political interest in river uses quality with Defra consultations and actions under the Environment Act 2021 on ... storm overflows (2021 Stantec report to Defra Task Force underpins cost data), biodiversity, phosphates, abstraction (water demand, increase of inland bathing and demands for more wild swimming with specific designations. But nutrient neutrality causes delays in housing development and conflict between environment and 'levelling up objectives'. Significant focus by the public and regulators on water company performance.
- 2022 August Storm Overflows Reduction Plan
- 2022: EA calls for reform of classification systems.
- 2022 Sept. .: Retained EU Law (Revocation and Reform) Bill. The 2018 Act was never intended to sit on the statute book indefinitely. The intention is to end the special status of retained EU Law in the UK statute book on 31st December 2023. The Bill will abolish this special status by 31st December 2023 and will enable the Government, via Parliament to amend more easily, repeal and replace retained EU Law. The Bill will also include a sunset date by which all remaining retained EU Law will either be repealed, or assimilated into UK domestic law; this may be extended for

specified pieces of retained EU Law until 2026. This will provide an opportunity for regulatory streamlining, but has caused a great deal of debate already.

- 2022 Dec: Updated River Basin Plans.
- 2023 Jan Government announces Sch 3 of 2010 Water Act will be implemented
- 2023 April Launch of Plan for Clean and Plentiful Water