Local Environment Agency Plans (LEAPS)

The future

The 900 years of the Don's history covered by this document has seen remarkable events enacted. It would be difficult to exaggerate the rivers contribution to the prosperity of the valleys inhabitants or even to Britain's economy as a whole. However, their achievements lacked one element which denied them permanency. In their abuse of the river and its associated environs our ancestors gave little thought to the sustainability of this precious resource. The result was a grossly degraded river which later generations of the valley have had to endure for almost a century and a half.

As we head into a new millennium we have the opportunity to reverse the mistakes of the past and pass on to our children an environment which can be sustained and enjoyed by all whilst still helping to serve the demands of a modern society.

The formation of the Environment Agency for England and Wales on 1 April 1996 helped to create one of the worlds most powerful environmental regulators. It merged the former National Rivers Authority with Her Majesty's Inspectorate of Pollution and the Waste Regulation Authorities helping to provide an integrated approach to environmental protection and enhancement. This integrated approach along with an increased level of public participation will help the Agency and the community contribute to the worldwide environmental goal of sustainable development.

PART 3 – THE FUTURE LOCAL ENVIRONMENT AGENCY PLANS (LEAPS)

THE ENVIRONMENT AGENCY'S VISION IS:

A better environment in England and Wales for present and future generations.

THE AGENCY WILL:

- Protect and improve the environment as a whole by effective regulation, by its own actions and by working with and influencing others;
- operate openly and consult widely;

ITS AIMS ARE:

- To achieve significant and continuous improvement in the quality of air, land and water, actively encouraging the conservation of natural resources, flora and fauna;
- To maximise the benefits of integrated pollution control and integrated river basinmanagement;
- To provide effective defence and timely warning systems for people and property at risk of flooding from rivers and the sea;
- To achieve significant reductions in waste through minimisation, re-use and recycling and to improve standards of disposal;
- To manage water resources and achieve a proper balance between the needs of the environment and water users;
- To secure, with others, the remediation of contaminated land;
- To improve and develop salmon and freshwater fisheries;
- To conserve and enhance inland and coastal waters and promote their use for recreation;
- To maintain and improve non-marine navigation;
- To develop a better informed public through open debate, the provision of soundly based information and rigorous research;
- To set priorities and propose solutions which do not impose excessive costs on society.
- To achieve significant and continuous improvements in the quality of air, land and water.

The Agency takes a much wider view of environmental regulation than was possible for its predecessors, while remaining an independent, impartial, and firm regulator in their best traditions.

LOCAL ENVIRONMENT AGENCY PLANS

In the Department of the Environment's Statutory Guidance under Section 4 of the Environment Act 1995 reference is made as to how the Agency should contribute towards the objective of attaining sustainable development. Local Environment Agency Plans will be used as integrated planning tools to take an holistic approach to protection and enhancement of the environment and encourage work in partnership with the public, local authorities, organisations and public bodies.

LEAPs will also play a key role in

- the efficient and effective delivery of services through integrated activity and priority business planning
- promoting openness and accountability
- providing a focus for liaison and partnerships with other key stakeholders
- educating the local public on environment management issues.

The Agency will seek active input into Local Environment Agency Planning from individuals and organisations concerned with the environment, and would wish to see the document used to influence and/or assist in the planning processes of others whose decisions may impact on the management of the environment.

Local Environment Agency Plans (LEAPs) are the successors to Catchment Management Plans produced by the National Rivers Authority

THE CONSULTATION REPORT

The South Yorkshire & North Derbyshire Local Environment Agency Plan will form one of several plans to be produced by the North East Region of the Environment Agency.

The publication of a consultation report due in June 1997 marks the start of a 3 month period of formal consultation enabling external organisations and the general public to work with us in planning the future of the environment of the River Don catchment area.

It describes the area, reviews the state of the local environment and identifies the uses and issues which need to be addressed and the proposals for action to address them.

The purpose of the consultation phase is to:

- establish the current state of the local environment;
- obtain views on the issues facing the environment;
- begin the process of identifying and implementing an Action Plan.

THE ACTION PLAN

The Local Environment Agency Action Plan will include:

- a final vision for the River Don catchment;
- a policy framework based on identified issues for the management of the environment over a five year period;
- costed action plans to address identified issues.

These elements will only be prepared once the period of consultation on this document has been completed and full consideration has been given to the responses received.

The Agency will monitor the implementation of the plan through regular consultationboth internally and with committed parties. Although these plans are non-statutory their aim is to provide a framework for the integrated management of the local environment between ourselves and other bodies.

THE ANNUAL REVIEW

The Agency will be jointly responsible, with other identified organisations and individuals, for implementing the Action Plan. Progress will be monitored and normally reported annually, by means of a review document which will be publicly available.

The review document will comprise of the following information:

- a detailed comparison of actual progress against planned progress;
- identification of additional actions necessary to maintain progress in the light of changes in the area;
- consideration of the need to update the LEAP.

APPENDICES INDEX I - VIII

APPENDIX I

Time Line of Events Which Helped to Shape the Future of the Don Valley

1100	Bedgrave Mill constructed on the River Rother. Today the mill forms part of the visitor centre at Rother Valley Country Park.
1112	William de Lovelot built a wooden castle at Sheffield.
1215-57	In the register of Archbishop Gray of York, references to iron mining at Silkstone and Tankersley.
1328	Weir at Brightside known to be in existence, serving a corn mill owned by Thomas de Furnival.
1531	Bodies called the commissions of sewers are set up by act of Parliament to regulate drainage and basic pollution control.
1578	Attercliffe Mill, a corn mill known to be in existence, this took water from a weir (Burton's weir) just downstream of Norfolk Bridge in Sheffield.
1581	Lady's Bridge Weir, Sheffield known to be in existence. Attercliffe and Nether Forges constructed, probably the earliest water powered Iron and Steel Works.
1626	Cornelius Vermuyden started draining the Hatfield Chase and diverting the course of the lower River Don.
1644	English civil war – Sheffield Castle besieged and conquered by Parliamentary army, including John Bright of Carbrook Hall and Kelham Homer, the Town's Armourer.
1648	Sheffield Castle demolished.
1703	John Yarnold began providing a water supply to Doncaster using a primitive pump known as the Water Engine. This took water from the River Cheswold. See Appendix ii(c)
1709	Abraham Darby first used coke for iron smelting in Coalbrookedale, Shropshire.This form of smelting was later adopted in the Don Valley.
1722	William Palmer carried out a survey of structures on the River Don to identify the difficulties likely to be encountered making the Don navigable.
1725	Act passed to make the Masters, wardens of the company of cutlers as undertakers of the River Dun Navigation from Holmes Stile to Tinsley.
1726	Act of Parliament passed which enabled work to commence on making the Don a navigation.
1729	Tidal locks constructed at Sandal just below Doncaster, probably the most significant event in the gradual demise of the salmon population.
1732	Amendment Act passed to divide interests of the two corporations; the Doncaster Navigation and the Master Cutlers. The Company of Proprietors of the Navigation of the River Dun was formed.
1740's	The development of crucible steel by Benjamin Huntsman proved to be an extremely important industrial breakthrough resulting in the transformation of Sheffield from a cluster of small metal working hamlets to the largest producer of steel in Europe by the late nineteenth century. See Appendix iv(a)
1742	Thomas Bolsover, a cutler accidentally invented silver plate (Sheffield Plate). While trying to repair a knife made out of copper and silver he unintentionally fused the two metals. This gave him the lucrative idea of making cheap copper items look expensive by coating them with a thin layer of silver. See Appendix iv(b)
1746	Masborough Ironworks, Rotherham founded by Samuel Walker and his brothers. In 1800 Walker's was probably the biggest ironworks in the country, supplying virtually all the huge cannons employed by the British Forces in the Napoleonic wars.
1773	The silversmith's industry of Sheffield acquired its own assay office. See Appendix iv(b)
1785	Benjamin Blonk & Co. opened the first steam powered grinding shop which gave the name to Blonk Street Bridge, Sheffield.
1787	John Read moved his Silver refining business from Green Lane, Sheffield to Royds Mill Farm. He is named as one of the lease holders of Royds Mill works in the Brightside rate books of 1834. This business was the forerunner of today's THESSCO works.
1796	Walker Bros. build the 'Milton Ironworks' at Elsecar because of an excellent supply of local iron ore.

1802	Stainforth Keadby Canal opened.
1810	Dove and Dearne Canal opened.
1815	Act of Parliament granted to extend the navigation from Tinsley to the centre of Sheffield. The canal opened in 1819 and for the first time it became possible to navigate from Sheffield to the North Sea on the Sheffield and South Yorkshire Navigation.
1820	Dore House Colliery opens adjacent to Orgreave Hall. This commenced a 170 year history of coal based industries in this area.
1825	First organised supply of water to Chesterfield. The water which was taken from Holme Brook was provided by the Chesterfield Waterworks and Gaslight Company. See Appendix ii(d)
1827	First piped supply of water to Rotherham, provided by a private company. Supply came under the Rotherham and Kimberworth Board of Health in 1853. See Appendix ii(b)
1830	Sheffield Water Company formed, it was privately owned and continued to provide supplies to Sheffield until 1887. George & Robert Stephenson use 'The Rocket' steam locomotive to open the first passenger railway from Manchester to Liverpool.
1836	The first major impoundment reservoir in the Don Valley is created at Redmires above Sheffield.See Appendix ii(a)
1839	A Superintendent was appointed to take charge of land drainage functions in the Dun Drainage Area.
1840	The first through railway opened (Sheffield/Rotherham/London).
1840	Aetna Works of Spear & Jackson established, makers of saws and tools. One of the first large companies to move to the East end of Sheffield.
1849	Firth Iron Wharf built on the Sheffield Canal at Tinsley. Swedish iron bars were delivered here from Hull. By several Acts of Parliament the navigation of the Dun became vested in the South Yorkshire Railway and the River Dun Company.
1856	Henry Bessemer discovered the Bessemer process of steel making. This produced an inferior quality steel to the crucible method but vastly increased production. This inferior steel was ideal for railway products ie. rails etc.
1857	John Brown opens the Atlas Steel works, over 25 acres in size.
1858	Robert Hadfield born, served a brief apprenticeship at Jonas & Colver before joining his father's new business as a metallurgist, and was only 24 when he discovered manganese steel. See Appendix iv(c)
1864	Collapse of Dale Dyke Dam. 250 people drowned.
1867	Vickers established their River Don works. The works grew rapidly, having 300 melting holes by the 1870's. Major armour plate and artillery production followed in the 1880's, and with the acquisition of the Maxim Gun Company in 1887 the company became a truly national concern.
1868	Barnsley Corporation started construction of their first water supply reservoir at Ingbirchworth.See Appendix ii(e) FJS Foljambe Esq, a local MP attempted to get an injunction against the Councils of Rotherham and Sheffield for allowing sewage to contaminate the River Don.
1873	Act passed leading to appointment of 12 Drainage Commissioners. A scheme for drainage improvement for the Doncaster Area was passed.
1881	Population of Sheffield reaches 300,000 serious pollution from inadequate sewage treatment facilities.
1883	160 million tonnes of coal in mined in Britain
1886	First reference to sewage treatment in Sheffield at Blackburn Meadows using the lime precipitation process. At the time they were opened, the works were considered a model and were visited by interested parties 'from all parts of the Kingdom'. Cost £44,730.
1889	Act passed to provide for the water rights of the Doncaster Corporation Mills in respect of the River Cheswold.
1910	As a result of pressure from the 'Local Government Board' and the 'West Riding Rivers Board', the old plant at B. Meadows was re-modelled and extensive 'bacteria beds' were provided. The estimated cost was either £360,000 or £480,000 depending whether or not the sewage needed to be passed once or twice through the beds.

1913	Harry Brearley became an expert metallurgist and it was while he was working for Firth's Research Department in 1913 that he discovered a type of steel extremely resistant to corrosion. This 'Stainless Steel' was to revolutionise the cutlery trade in particular. See Appendix iv(d)
1914	The start of the First World War which was to continue until 1918
1918	Doncaster Corporation successfully sink a borehole which provides adequate quantities of water to serve the towns needs. See Appendix ii(c)
1920	Sheffield's first Labour Council opened the Corporation Abattoir. Prior to this date the town's slaughterhouses were situated on Castlegate adjacent to the river and discharged their untreated effluent direct to the Don.
1928	The partial amalgamation of Vickers, Vickers Armstrong, Cammel Laird led to the title 'English Steel Corporation'.
1929	Doncaster Area Drainage Act – Obligations of mineowners.
1930	Land Drainage Act
1931	River Ouse Yorkshire Catchment Board inaugurated with responsibilities for land drainage.
1932	Chemicals are first used to kill insects on farm crops.
1937	Importation of water from the Derbyshire Derwent to supply Sheffield.
1939	The Start of the Second World War which was to continue until 1945
1948	River Boards Act. The navigation comes under the control of Docks and Inland Waterways Executive, later to become the British Waterways Board. Yorkshire Ouse River Board formed taking over the tasks of the West Ridings Rivers Board and the Catchment Board.
1952	Formation of 'Yorkshire Ouse River Board' – Pollution Prevention and Fisheries Functions added. Great Smog (air pollution) of London kills upto 4000 people.
1956	First flow measurement facilities purpose built on the Don system at Hadfields Weir Sheffield. See Appendix ii(h)
1961	Land Drainage Act.
1963	Water Resources Act.
1964	First piped supplies to Don Valley from Elvington on the River Derwent in North Yorkshire. See Appendix ii(f)
1965	Responsibilities for land drainage, water resources, water pollution control and fisheries passed to Yorkshire River Authority who had previously been known as Yorkshire Ouse & Hull River Authority.
1973	Water Act
1974	Yorkshire Water Authority is inaugurated and incorporates the Yorkshire River Authority. For the first time a holistic approach to water management is possible. The new authority have responsibility for sewage treatment, water supply, land drainage, pollution control, resource management and fisheries. See Appendix ii(a)
1976	Land Drainage Act consolidates previous drainage legislation. Severe summer drought in Britain. Water supplies to many homes and industries are restricted to a few hours a day.
1981	Wildlife & Countryside Act – to protect and conserve our areas of natural beauty.
1989	Water Act instigates the Privatisation of Yorkshire Water and establishment of National Rivers Authority.
1991	Land Drainage Act & Water Resources Act consolidation Acts for duties, powers ect., of all drainage bodies and local authorities in respect of all watercourses
1994	Land Drainage Act – imposed environmental responsibilities upon internal drainage boards and local authorities.
1995	Environment Act. Drought conditions in Yorkshire require massive movements of water by road tankers to top up reservoirs.
1996	Formation of Environment Agency.

APPENDIX II

THE HISTORY OF DRINKING WATER SUPPLIES TO THE MAJOR CONURBATIONS OF THE DON VALLEY

A) SHEFFIELD

The organised supply of water to the Sheffield area began in the early 15th Century, when men with a sense of civic responsibility began to build up local spring sources with troughs and convenient outlet pipes. These men clearly had in addition, some sense of personal pride which may be implied from records which indicate that the works constructed tended to vie with each other in the splendour of their designs. By far the most adventurous of its day was a pool in Balm Green, Sheffield created in 1434 by a gentleman called Barker. This site in the heart of the city is still known as Barkers Pool to this day.

This pool, fed by wells and springs, sufficed for a considerable length of time but was eventually overtaken by developments in the area which polluted its sources and rendered it unsuitable for use other than flushing open channels in the street and extinguishing fires. Between the 15th and early 19th Centuries, many sources of a similar type were constructed advancing up the valleys to keep clear of the continuing development of the towns in the area.

During the early 18th Century, attempts were made to secure a more reliable supply by creating small reservoirs. The first of these sites was probably at Whitehouse Dams and was situated adjacent to what is now Langsett Road. The first of 5 dams was completed in about 1737 and served to provide water which was sold by the bucket or barrelful. The first piped supply began from these sources in about 1741, when pipes made of hollowed out oak trees of between 9 and 12 inches in diameter were laid, connecting the dams with receptacles in the town. From here the water was transferred into casks which were fixed on wheelbarrows and then taken about town by men whose business it was to sell it to householders.

Throughout the remainder of the 18th Century and well into the 19th, the development of similar facilities continued with the size of the dams or reservoirs gradually increasing in size. In 1827 the 'Sheffield Mercury' records that a cast iron pump was fixed at the bottom of Sheffield Moor. This was a great improvement to that part of the town, as they had previously had to procure their supply from an open well which was often subject to contamination. The reservoir or tank connected to this pump held 10,000 gallons of water and for the first time afforded a reliable supply during the summer months. By 1830 the population of Sheffield had reached 90,000 and the demand for clean water was well outstripping easily available supplies. Many of the traditional sources were by this time polluted either by the effluent of old or developing industries or by the waste of its servants and urgent attention had to be given to securing supplies for the future. This was achieved when the first large impounding reservoir was built at Redmires and successively as demand increased, by the many other reservoirs listed in Part 1, Chapter 1a.

The original body responsible for the development of Sheffield's water supply was the privately owned Sheffield Water Company. They were formed by Act of Parliament in 1830 and continued to manage supplies to the city until 1887.

Following the disaster caused by the collapse of the reservoir at Dale Dyke, the company had obtained parliamentary powers to levy a 25% increase in its water rates to cover it for the losses incurred during the resulting flood. This expired in 1887 and the Company applied to Parliament to make the levy permanent and to further increase its charges.

In response to the Company's application, the Corporation of Sheffield gave notice that it was applying for a bill for compulsory acquisition of the undertaking. The two bills were keenly fought before a committee of the House of Lords, but finally Parliament found in favour of the Corporation. The amount paid by the Corporation for the company's assets was £2, 092,014 which was a considerable amount considering that in 1831 the

company had acquired all rights for only £41,800. The Corporation of Sheffield continued to manage water supplies to the city until 1974 when the responsibility became that of the Yorkshire Water Authority.

B) ROTHERHAM

Prior to 1827 the town of Rotherham relied on wells, springs and on the unpolluted waters of the Rivers Don and Rother for its water supply. Several of the wells used are recorded in parish documents dating back to 1549 with the sites at Wellgate, Domine and St Annes amongst the most important.

The waters of Wellgate spring were the most popular amongst the population and in 1791 an aqueduct was created which fed its waters to several spouts across the town from which people could obtain supplies. This continued until 1827 when a private company was formed who undertook to provide a piped supply to the town. Again it was the waters of Wellgate spring which were used, and from the well the water was pumped up to 2 service reservoirs at Quarry Hill and The Crofts, and subsequently through metal mains to the consumers.

In 1853 the supply of water came under the public control of the Rotherham & Kimberworth Board of Health. This body was responsible for erecting pumping engines connected to retaining tanks at College Fields and also constructed service reservoirs at Boston Castle and Kimberworth. These works, which came into operation in 1855, were still using water from Wellgate spring and this practice was to continue until the well became polluted by the growth of population and by increased agricultural activity in the area. It was finally abandoned in 1894. An example of the pollution problems are described below:

REPORT OF WILLIAM LEE ESQ INTO THE SANITARY CONDITIONS IN ROTHERHAM IN 1850

Conditions and Recommendations

1. There is much preventable disease and mortality in the townships of Rotherham and Kimberworth, that epidemics are very frequent and low typhoid fever almost constantly present in certain localities
2. That with the exception of the reparation of the public highways in the townships of Rotherham all the local arrangements having reference to the health of the inhabitants are exceedingly defective
3. That there are many narrow courts and alleyways in the town admitting little ventilation and that privy conveniences are constructed with open cesspools and pits to contain the night soil; they are frequently placed on the sides of the hills so as to be above the level of the other houses with the result that the offensive matter percolates through the walls of the dwellings below.

It is recommended that the health of the town would be much improved by a constant supply of pure water and by a system of drainage, the abolition of all privies and the substitution of soil pan apparatus with water laid on to convey the soil away from the town.

By the early 1860's it had become clear to the Board of Health that its springs supply could not be relied upon to adequately provide for the town's needs, and it therefore sought Parliamentary Powers to create an impounding reservoir. In 1874 Ulley Reservoir was completed harnessing the flows of Ulley and Morthern Brooks and this supply, together with a small impoundment on Dalton Beck, was initially adequate to meet needs. For a further 20 years, Rotherham's water requirements were satisfied, but by 1896 demand was showing signs once again of outstripping supply.

To meet the impending shortfall the Board entered into an agreement with the Corporation of Sheffield and Doncaster to construct the reservoir at Langsett, from which Rotherham were to be entitled to a daily supply of 1.6 million gallons. This supply came on stream in 1905, delivered by pipeline to the Boston Castle supply reservoir. It came just in time as, in 1906, the Dalton Brook became polluted by discharges from Silverwood Colliery and, along with several of the traditional spring sources which had also become unusable, it was abandoned.

Despite having secured its immediate needs the Corporation, who by this time had assumed responsibility for water supply, were not complacent and when an opportunity arose to obtain a further supply from Derwent Reservoir via Sheffield's Rivelin Valley Reservoir the Corporation took it. Their foresight secured the needs of the town for almost half a century, and it was not until 1960 that extra supplies were required. These, like the needs of Barnsley and Sheffield, were to be met by the Yorkshire Derwent Water Transfer Scheme, which is described later.

C) DONCASTER

Supplies of water to the settlements of the lower valley had traditionally been obtained from the rivers or from small wells. The first reference to water supply in the accounts of the Doncaster Corporation occurred in 1598 for the maintenance of wells and again in 1704 when they were fined £1.10s.0d for not removing dead cats and vermin from a well.

The first organised water supply to the town was provided by John Yarnold in 1703. Yarnold operated a primitive form of pump known as the water engine, which extracted water from the River Cheswold and passed it through pipes of wood and lead up to the town. In 1775 the Corporation purchased these works for the sum of £2,300 (a very considerable sum in those days) and continued to maintain them until 1916.

By the end of the 19th Century, Doncaster had become an influential railway town, being an important junction on the main route between London and the North of England. The population of the town had risen accordingly, with the development of a major locomotive manufacturing works and coal mining in the surrounding villages. By 1900 the town was beginning to suffer annual problems of insufficient supply which caused great concern. The river water was, by this time, too polluted to be used as drinking supply, and attempts to tap into known reserves in the Bunter Sandstone below the town had failed in 1862 when the borehole which was sunk unfortunately penetrated the magnesium limestone layer. The water obtained being of very poor quality.

In desperation the Corporation turned to impounded sources and built the reservoir at Thrybergh. This facility assisted in providing supplies, but its reliability was always threatened by mining activity around and beneath its catchment. Nevertheless, it allowed the town to prosper and with an additional 4,500 cubic metres per day purchased from Sheffield Corporation via its Langsett Reservoir, the supply requirements of the town were initially satisfied.

In 1918, 50 years after the first unproductive borehole was sunk, the Corporation of Doncaster decided to try again. This time they were very successful, managing to hit the sandstone and obtaining an excellent supply.

Meanwhile the rural areas surrounding the town still relied on local wells and small boreholes. After years of extreme difficulty and water shortage between 1905 and 1923, the Doncaster & Tickhill Joint Water Board, later to become the Don Valley Water Board, was formed and several very successful boreholes were sunk which, at last, provided these rural areas with a reliable supply.

D) CHESTERFIELD

The first organised supply of water to Chesterfield was provided by a company known as the Chesterfield Waterworks and Gaslight Company which was formed in 1825.

The supply obtained by this company was from the Holme Brook, which was dammed by a masonry weir built some 2 miles upstream of the town. From this point, the water was piped by gravity down to a supply tank or reservoir situated near what is now West Street in Chesterfield, and was then distributed by piped supply.

This supply received no treatment and its condition often raised criticism from the townspeople.It was once described thus: 'The condition of the water is such that the poor sometimes use it as soup.'

Despite its condition, no water borne epidemics were ever reported from this supply and it continued to satisfy demand until 1855 when a second company was formed and plans were prepared for an impounding supply. This was achieved by damming the Holme Brook to form Lineacre Lower Reservoir with a capacity of

31 million gallons. Within 10 years this supply was proving inadequate and Lineacre Upper Reservoir was added providing a further 126 mill/gals of water to serve the town's needs.

In 1895 the Chesterfield Waterworks and Gaslight Company relinquished its water supply responsibilities into the public ownership of the local Board of Health, who subsequently prepared plans to add yet another reservoir to their Lineacre group.

Lineacre Middle Reservoir was completed in 1904 and provided a further 90 million gallons of supply. With the addition of this third impoundment, the Holme Brook catchment was fully exploited and attention turned to securing additional water from borehole supplies. These were sunk at Whispering Well and Hunger Hill and with these extra reserves the towns needs were, in the short term, secured.

In 1920 the functions of gas and water were separated, water being taken over by Chesterfield Corporation. By this time, it is reported that over 50% of households in the town had water closets and 15% were enjoying the luxury of piped supply to baths. Demand continued to grow and in 1933 the Corporation, which by this time had formed the Chesterfield and Bolsover Water Board, sunk a further borehole at Whaley Hill.

Further amalgamations occurred in 1957 and 1963 and finally resulted in the formation of the North Derbyshire Water Board, with responsibility for supplying the needs of over 314,000 people covering an area of 450 square miles.

E) BARNSLEY

At the start of the 19th Century, the population of Barnsley was still reliant on its traditional well and spring sources and on the River Dearne for its drinking water supply. This continued to be the case until 1837 when the responsibility for providing supplies was taken over by the Barnsley Waterworks Company, who constructed a small reservoir at Smithies to the north of the town. Water for the reservoir was obtained from the adjacent River Dearne, and in turn, it was pumped from Smithies down to a service reservoir at Bailey Hill in the town. Water from this source initially received no treatment, and this continued to be the case until a new service reservoir was constructed with a filtration plant at Jordan Hill.

By 1852 the population of the town had grown to 15,000, yet despite this increase, approximately 40% of the houses were already receiving a piped supply, a much higher proportion than most other local towns. In 1858 the supply of water became a public responsibility under the control of the local Board of Health. They quickly recognised that the waters of the Dearne were becoming too polluted to be used for human consumption and began to search for other forms of supply.

Impoundment was the obvious answer and the Corporation commenced work on a new reservoir at Ingbirchworth which commenced operation in 1868. This supply sufficed to serve the needs of the town for a further 30 years, but by 1890 the Barnsley Corporation, who by that time had assumed responsibility for water, had begun to recognise the need for further reliable sources. This they obtained by the building of Midhopes Reservoir which was completed in 1903.

With adequate supplies now available, the Corporation extended its supply area providing water for many of the surrounding villages. They managed to meet demand until 1920, but again recognised that a further reservoir would be needed if future supplies were to be safeguarded. In 1923 Scout Dyke Reservoir was completed and this enabled the corporation to prosper, assured that its water needs were satisfied. For a further quarter of a century this remained the case, but by 1947 demand was once again beginning to outstrip supply.

This time the Corporation turned to the reserves in the coal measures below the town and sunk a series of boreholes between 1947 and 1962 which served to supplement their reservoir stocks. By 1962 the Corporation of Barnsley had assumed responsibility for supplying an area extending from Dunford Bridge in the west, South Elmsall in the east, Wintersett in the north and Wortley to the south, and even with these extra supplies, they were finding it difficult to meet increasing demand.

By the early 1960's it had become evident that the natural supplies available within the Don Valley were no longer able to meet the rapid increase in public demand. To meet this shortfall a new source of supply had to be developed and this is described in the next section.

F) HOW THE IMPENDING WATER SHORTAGE IN THE DON VALLEY WAS ADDRESSED

After the Second World War when all local sources had been utilised, the rate of increase in demand for potable water indicated that a new source would have to be found by the mid 1960's. A decision was taken at that time, that the most suitable source would be the River Derwent just before it became tidal, at a point some 11.3 km from York. Works were proposed to treat the water concerned at a new water treatment plant at Elvington, near Sutton on Derwent and to pump it through nearly 64.4 km of pipeline to Sheffield and Rotherham, making supplies available en route to Leeds and Barnsley. This scheme, which came into operation in 1964, was by 1974 supplying approximately 18.5 million gallons of water per day, an amount equal to that supplied by all the impounding reservoirs in Southern Yorkshire.

The earliest supplies from impounding reservoirs had been put into service without any treatment whatsoever and depended entirely for their purity on prevention of pollution at source. Later lime was added to prevent pick up of lead from supply pipes and subsequently simple forms of filtration were added. However, the supply from these sources was generally of reliable quality, and apart from the addition of chlorine to sterilise supplies, (a precaution added shortly before the Second World War) the process remained fundamentally the same in 1965.

In comparison, the supply from the Derwent required substantial treatment. This river, which rises on Fylingdales Moor about 12.9 km north west of Scarborough, flows down through the Vale of York to its confluence with the River Ouse at Barmby. En route it picks up the effluents from the towns of Pickering, Malton and Norton. Whilst the Derwent was classified as a Class 1 (clean river) it was, compared with the sources previously developed, highly polluted and required treatment of an entirely different standard. In addition, safeguards had to be built in so that in the event of failure of any critical part, alarms would sound and suspect water would be prevented from entering the distribution system.

Further complications were also presented by the fact that there was also an extremely variable character to the Derwent's water. This required an automatic installation to monitor these changing characteristics and to adjust the dosing accordingly. This was achieved by a plant which in comparison to those serving the Dons reservoir supplies, was extremely complex and required skilled operatives to man it.

The development of the River Derwent Water Transfer scheme added a new dimension to the Don's problems. The river was now receiving an additional 12 mgd later to increase to 18.5 mgd of water per day by way of the household and industrial use that the Elvington Supply was being put to. The majority of this water entered the river by way of sewage treatment works discharges, which placed a further huge burden on the rivers ability to dilute the vast amount of effluents it was receiving by 1974.

G) HISTORY OF RAINFALL RECORDING

In the 19th Century all the known reliable recording stations in this country were listed by G J Symons in 'Symons British Rainfall', the first edition of which appeared in 1860. He continued the task of listing the stations and their statistics until 1900, when ill health forced him to give up the job and pass it on to 2 able successors. At this time the number of stations listed was 3,500 compared with 424 in Symons original list of 1860. The number increased to about 5,300 by 1930 and by 1965 stood at 6,500.

The oldest records from stations in Yorkshire are from gauges installed in 1800 at Counter Hill, near Addingham and Thorne Fell, near Burnsall, both in Wharfedale. On the Don system, the first records were collected from a gauge at Goole Docks installed in 1863 and this site remains part of the Agency's recording network.

In 1932, following the establishment of the River Ouse (Yorkshire) Catchment Board and the River Hull Catchment Board, networks of stations were set up reporting directly to those Authorities. 'British Rainfall' was studied for the most suitable existing stations from which to request copy records month by month and

several new stations were installed. Because the Don was one of the first rivers the River Ouse Catchment Board intended to carry out works on, it was in this valley and that of the River Derwent that the first of these facilities were developed.

In 1948 further gauges were established on the Don and Rother catchments to act as an early flood warning system and information from these facilities was instrumental in the development of measures to control and alleviate flooding over the following decade and beyond.

The statutory requirement to record rainfall was continued under the Water Resources Act of 1963. This merged the Yorkshire Ouse Catchment Board and the River Hull Catchment Board into the Yorkshire River Authority. Under Section 15 of the 1963 Act, river authorities were obliged to prepare a 'hydrometric scheme' with proposals for the systematic measurement of rainfall, evaporation and river flows, and to submit this to the Water Resources Board. With the merger of the two Catchment Boards, the need to rationalise the rainfall recording networks became necessary, and a number of the more closely spaced gauges were terminated and new ones opened in areas where cover had previously been sparse.

By 1974, when the responsibility for rainfall measurement became that of the Yorkshire Water Authority, there were 22 recording stations on the Don system (including its tributaries). The highest of these stations was at Redmires above Sheffield at an altitude of 338 metres above sea level, the lowest was at the aforementioned Goole Docks at just 5 metres. The full list of sites on the Don in 1974 is included in The List of Rainfall Gauging Station in 1974.During the period of monitoring to 1974, the highest annual rainfall figure recorded in the Don, Rother and Dearne Valleys was at Dale Dyke Reservoir gauging station in 1905, when 1,341 millimetres of rain fell. The lowest figure recorded was at Thorne in 1951 with just 709 millimetres.

H) HISTORY OF FLOW MEASUREMENT

The earliest facilities for recording flow measurement in Yorkshire were installed on the River Nidd at Hunsingore in 1934. These early gauging stations were generally reliable for the purpose of giving satisfactory measurements of the average and high flows required for the land drainage and flood defence requirements for which they were built. They were not, however, accurate enough to provide the more detailed information required for water resources investigations. This information was essential for the satisfactory management of the resource in terms of assessing the existing and potential impacts of abstraction from the river by industry, agriculture and for domestic supply.

In addition, the Rivers Prevention of Pollution Acts of 1951 & 1961 gave powers to the River Boards to impose consent conditions on effluent discharges to rivers. In determining these conditions, it was essential to understand the characteristics of the river in question, and particularly to have records of the 'dry weather flow'. This factor was critical, as it formed the basis upon which the rivers ability to dilute the effluent was calculated.

The earliest flow measurement facilities on the Don system were at Hadfields Weir in Sheffield, built in 1956. For the first few years of its existence this facility provided only water level information, but in 1960 was upgraded to record river flow.

Further flow gauges were added, mainly during the period 1959-1965, to the Don at Doncaster and to several of the tributaries including the Rother and Dearne and for the first time it became possible for River Board Engineers and Scientists to begin to build a picture of the actual effects of rainfall, abstraction and pollution dilution on the Don.

I) ADDITIONAL INFORMATION

LIST OF FLOW GAUAGING STATIONS ON THE DON SYSTEM IN 1974 (NON TIDAL)

RIVER	LOCATION	NGR	RECORDS FROM
DEARNE	ADWICK	SE477 020	01.11.63
DOE LEA	STAVELEY	SK443 746	01.07.70
DON	DONCASTER	SE569 040	01.10.60
DON	SHEFFIELD	SK390 910	01.10.65
ROTHER	WHITTINGTON	SK394 744	01.10.63
ROTHER	WOODHOUSE MILL	SK432 857	01.10.61

LIST OF RAINFALL GAUGING STATIONS IN 1974

STATION NAME	NGR OF STATION	ANNUAL AVERAGE RAINFALL (mm)	START OF RECORD
Upper Don			
Ingbirchworth Reservoir	SE 213 056	991	1932
Langsett Reservoir	SE 211 003	1059	1948
More Hall Reservoir	SK 289 957	856	1916
Dale Dyke Reservoir	SK 242 917	1100	1905
Redmires Reservoir	SK 262 857	1082	1898
Sheffield	SK 339 873	780	1883
Rother			
Upper Linacre Filters	SK 339 727	848	1932
Whaley Well	SK 509 718	653	1944
Bolsover	SK 463 710	744	1952
Coisley Hill	SK 414 843	714	1951
Woodhouse Mill	SK 432 857	–	1961
Lower Don			
Thrybergh Reservoir	SK 474 961	645	1875
Dearne			
Emley Moor	SE 223 130	–	1964
Bretton Hall	SE 283 129	–	1963
Cannon Hall	SE 273 084	739	1914
Worsbrough Dale	SE 363 035	673	1947
Wath Wood Reservoir	K 437 993	620	1932
Tidal Don			
Doncaster	SE 581 033	–	1971
Thorne	SE 675 145	576	1951
Ackworth	SE 441 160	597	1952
Goole Docks	SE 745 235	622	1863

APPENDIX III

HISTORY OF FLOODING IN THE DON CATCHMENT

The steep sided valleys and high rainfall in the upper reaches of the catchment and the very high tide levels which can be experienced in the Lower Don, mean that large areas are at risk from flooding. Consequently, there is a long history of extensive engineering improvements which have been carried out as a matter of necessity to sustain and protect life and property from the disastrous effects caused by extreme flooding conditions in the river catchment. As with most large river catchments, the Don catchment has a history of notable floods (see below).

A GUIDE TO SERIOUS FLOODS ON THE DON SYSTEM PRE 1974

Date	River	Comments
1768	Sheaf	Part of Talbots Hospital washed away 5 residents drowned
Jan 1850	Lower Don	Flooding of Goole and surrounding land
11/3/1864	Loxley, Don	250 people drowned when Dale Dyke Dam bursts
4/5/1886	Don, Rother	Serious flooding in Doncaster, Rotherham
7/8/1922	Rother Valley	Serious property flooding
4/9/1931	Don, Rother	Extensive flooding of Rother and Don Valleys
24/5/1932	Don, Rother, Drone	Extensive flooding particularly in Doncaster/Bentley& Chesterfield
1/10/1941	Don	Highest recorded discharge of flood water through Doncaster
20/9/1946	Dearne	Large area of land flooded
19/3/1947	Don	Widespread flood of long duration. Doncaster levels similar to the October 1941 incident
July 1958	Rother, Sheaf	Highest recorded levels in these rivers
5/12/1960	Don	Areas upstream of Sheffield worst affected
10/12/1965	Don	Highest levels in Sheffield & Upper Don
13/4/1970	Dearne	Highest recorded levels in this system
July 1973	Rother tributaries, Sheaf	Intense storms causing severe flooding

Perhaps the most disastrous fluvial flood recorded in the catchment occurred on 11 March 1864, on the River Loxley in Sheffield. This flood was the result of a dam failure at Dale Dyke reservoir, near the village of Bradfield. The effects of the flood were felt as far as Attercliffe on the River Don and resulted in the loss of about 250 lives (still the most serious flood recorded in terms of loss of life in Britain).

On 14 May 1886, a notable flood occurred on the Rivers Don and Rother when information suggested the highest level was reached in Doncaster (see table above). The level reached during this event was estimated at 11.5 ft. A.O.D. (Liverpool Datum).

The most damaging flood on the Don system during the period 1974-1996 occurred on the River Sheaf on 21 December 1991. The flood happened due to the blockage of a debris screen. It caused flooding to Sheffield Railway Station and several commercial premises in the surrounding area.

APPENDIX IV

FOUR IMPORTANT INDUSTRIAL BREAKTHROUGHS IN THE IRON & STEEL INDUSTRY

A) CRUCIBLE STEEL

The development of crucible steel in the 1740s by Benjamin Huntsman proved to be extremely important, resulting in the transformation of Sheffield from a cluster of small metalworking hamlets to the largest producer of steel in Europe by the late 19th Century.

Huntsman, a Lincolnshire born clockmaker, moved to Handsworth from Doncaster in the early 1740s. By then he was already researching ways of refining poor quality blister steel in order to make better components for his watches and other instruments. He devised a method whereby blister steel was remelted in clay crucibles or pots in enclosed melting holes. The resulting refined steel had a much more even carbon content. It was the first cast steel, which made it well suited to the production of high quality agricultural and industrial edge tools.

However, because it was harder and superior to the blister steel, the cutlers and toolmakers in Sheffield at first refused to use Huntsman's invention, complaining that it was too difficult to work with. Unmoved, Benjamin simply exported his crucible steel. When it came back to Sheffield converted into vastly superior products, the local industrialists were forced to take notice.

A major advantage of the crucible steel making method was that it was ideally suited to working in small scale units. This encouraged the expansion of steel making from riverside mills and backyards to the large enterprises of the east end. Contrasting examples are the toolmaking operation at Abbeydale (which can still be seen at the industrial hamlet) employing five melting holes, and the main melting shops at Thomas Firth's which had over a hundred melting holes. The crucible method was also well suited to the production of specialist alloy steels, which were to figure prominently in Sheffield's industrial development. An example of a large crucible melting shop can still be seen at Sanderson Kayser's Darnall Works.

B) SHEFFIELD SILVER PLATE

While Benjamin Huntsman was busy inventing crucible steel, a cutler by the name of Thomas Bolsover was accidentally inventing silver plate. In 1742 while trying to repair a knife made of copper and silver, Thomas unintentionally fused the two metals. This gave him the lucrative idea of making cheap copper articles look expensive by coating them in a thin layer of silver. He started by silver plating simple articles like buttons and snuff boxes and then extended the idea to larger objects such as tea urns, tankards and candlesticks. On the back of Bolsover's invention the silversmiths industry in Sheffield grew to such a size that the town acquired its own assay office in 1773. Sheffield's assay mark before 1975 was a crown. Now it is a Tudor Rose, one of only four such marks remaining in the UK.

Thomas moved to Whiteley Wood Hall and set up a rolling mill and forge on the nearby Porter Brook. He died aged 84 in 1788 and was buried in St Pauls churchyard, now the Peace Gardens in the city centre.

By the mid 19th Century Bolsover's fused silver plating method was superseded by cheaper electroplating, to such an extent that articles plated by means of the old process are now extremely valuable.

C) SPECIAL STEELS

Sheffield's reputation as a premier producer of steel was built upon quality as much as quantity, and the development of special steels within the city was a key factor in enhancing that reputation.

Robert A Hadfield was born in Attercliffe Hill Top in 1858. Working for the small steel castings firm set up by his father, he was only 24 when he developed manganese steel, a steel which was tough, durable and non-magnetic. Hadfield went on to become an expert metallurgist, developer of alloy steels and builder of one of the largest steel making enterprises in the city, employing some 15,000 people in 1919. He was Master Cutler

in 1899, Knighted in 1908 and made Freeman of the City of Sheffield a year before his death in 1940. The firm he helped to create only outlived him by some 40 years.

D) STAINLESS STEELS

Harry Brearley was born near the Wicker in 1871. Like Robert Hadfield he became an expert metallurgist, and it was in 1913 while working in Firth's research laboratories that he discovered a type of steel extremely resistant to corrosion. This discovery of 'stainless' steel was to revolutionise the cutlery trade in particular, but at the time Brearley's employers were singularly unimpressed. They concluded that his discovery was neither of commercial value nor scientific interest. The rest is history.

APPENDIX V

ORGREAVE RECLAMATION SITE

The site of the Orgreave Coking & By Products Plant is typical of the industrial degradation created by coal mining and its associated industries.

Industrial activity commenced on the site in 1820 when the Dore House shaft was sunk adjacent to Orgreave Hall. This shaft and several others which were subsequently sunk were acquired by the Fence Colliery Company, later to become the Rother Vale Colliery Company and were operated as such until 1919. In 1919 the sites were acquired by the United Steel Companies who used the coal obtained to supply their new Orgreave Coking and By Products plant.

This operation continued until 1947 when the coal industry was nationalised and the mining operations were separated. The coal processing and chemicals interests remained with United Steel Companies under their subsidiary, the United Coke & Chemicals Company.

Under nationalisation the 2 main collieries of Orgreave and Treeton were linked and together used coal washing facilities at Orgreave Coal Preparation Plant. By 1992 when the collieries were closed the spoil heap created by 170 years of mining activity had amassed to a total of more than 12 million cubic metres of material.

In addition to coal spoil, part of the area was used for the disposal of steel works slag, which was imported from a number of sites. This material was deposited into 2 depressions which had been created by the opencast exploitation of shallow coal reserves in 1946 and 1948.

The spoil heaps at Orgreave had a history of overheating caused by the slow burning of discarded coal within the tip and for many years ammonical liquors, a by product of the coal tar distillation process were pumped on to the stacks. This had the benefits of partly neutralising the liquor and of helping to cool the burning of the coal deposits. Unfortunately some of the liquor was able to percolate through the material eventually seeping into the River Rother, a problem experienced at several similar sites throughout the Don system.

The industrial activities which were carried out in and around this site over 170 years led to both physical degradation of the area and in places serious land contamination. Following the closure of the Orgreave Coke & By Products plant in 1990 opportunities for restoration of the area were investigated and in 1995 planning permission was sought by British Coal Opencast.

The scheme which received approval involves reclamation of approximately 256 hectares of land and will be achieved principally by the creation of an opencast void from which available coal will be removed. When extraction is complete an impervious cell will be created at the base of the void into which all contaminated material will be sealed. The void will then be infilled and the whole site landscaped.

The restoration strategy which is to be implemented in agreement with Rotherham Metropolitan Borough Council will pay particular attention to the recreation of the valley form of the River Rother and will involve the planting of significant areas of new woodland. Some diverting of the river channel will be necessary but the design of the new course will incorporate features which will benefit the ecological recovery of the river, in particular its recovering fish populations.

APPENDIX VI

THE DECLINE OF THE OTTER IN THE RIVER DON CATCHMENT

The changes in otter populations, perhaps more than those of any other animal, typify the decline of many of the rivers of England and Wales. Its position in the food chain and its sensitivity to man's activities mean that the degradation of the aquatic environment has had devastating consequences for this shy and secretive creature.

Records of otters in the catchment have been collated by Colin Howes from Doncaster Museum and this case study is based directly on his research.

Until the middle part of the 18th Century otters were certainly present throughout the Don catchment as well as much of the surrounding area. Contact with man was apparently frequent and the records certainly show that fish rearing ponds and ornamental lakes were visited. William Guest, an angler from Bentley recalled that during the 1790's he 'frequently met with otters in the Don'. The island in the Don at Sprotborough was locally known as Otter Island. Many of the early reports of otters come from the records of churchwardens and parish constables who were able to pay bounties for the control of vermin. A number of parishes paid one shilling for otters (bowsons) as compared with 2d for a weasel (weevil) or 4d for a polecat (foulmart). In the parish of Arksey the annual otter cull up until the late 1790's was around one per year up to the maximum of five.

Hunting for sport also occurred. Two notable otter hunters were Messrs Whittaker 1710-1794 and Lee 1755-1814 both of Auckley. Both were renowned for their skills in tracking the animals and Whittaker was allegedly a master in the use of the otter spear and delighted in recounting his otter hunting exploits.

Whittaker evidently played an important role in the destruction of otters which fished the ornamental lakes and ponds in the Doncaster area and Hatfield in his 'Historical Notices of Doncaster' recounts that 'Every hall and mansion of consequence in the neighbourhood received him... the more he protected the stew pond, the more cordial were his receptions'.

In the Dearne and Dove valleys, particularly in the Worsbrough, Rockley and Stainborough areas where, during the early 1700's, otters had abounded a marked fall in population was inferred in 1853 by the poet-naturalist, Thomas Lister who wrote in his 'Tributary Ode to Stainborough'

> 'The brown diving Otter no longer is gliding, Beneath the fring'd banks of the cool valley rill
> Nor bitten is calling, nor curlew is hiding, Nor badger is housed in the cleft of the hill.'

And referring to the Tankersley area, Wilkinson in his history of Worsbrough 1872 comments, 'It certainly possesses not permanent abode here, having become a great stranger'

Otters were also quite common in the valley of the River Rother in the 18th Century as indicated by parish records at Whiston Church. Between 1722 and 1729 bounties were paid on 5 otter heads by church wardens, all it would appear to a hunter by the name of David Snowden.

The last recorded evidence of an otter in the valley of the Rother was a specimen shot by T Livesley Jnr on 14 December 1895 near Hartington Colliery.

Away from the main urban and industrial centres and in areas relatively free from water pollution, small relict populations still survived in the early 20th Century. In 1910 Denny noted in the 'Proceedings of the Sheffield Naturalists Club' that otters were present in unpolluted waters above Sheffield and Corbett knew of them persisting in the lower Don area

Despite the decline of the species, otter hunting continued to be carried out up to the late 1940's. Annual late summer visits were made by the Buckinghamshire pack which based itself at Bawtry. These sorties were generally successful indicated by the killing of 3 otters in 1946 from Serlby Lake, which used to lie adjacent to the River Ryton, near Bawtry.

As far as the Don system is concerned it would appear that otters have been absent from the river and its tributaries for most of the 20th Century. No further records are available in support of their continued existence following the information provided by Denny and Corbett. As the river continues to improve, and lost habitats are restored, the fish populations which this most charming creature relies upon will redevelop perhaps attracting the otter back to its original haunts.

As this document went to publication in March 1997 confirmation was received that an otter was once again resident in the Don catchment.

APPENDIX VII

STURGEON IN THE RIVER DON

Records of this species occurring in the Don has been researched by Colin Howes, Environmental Records Officer for Doncaster Museum and the following information is produced from his document 'The History and Distribution of Fish in the Doncaster District'.

Up until the turn of the Century, Sturgeon were infrequently, though regularly reported from the Ouse, Trent and the Don, specimens coming in from the sea usually during the early summer. The Salmon nets on the Ouse at Goole and at various points along the Trent regularly caught specimens, though only a handful of accurate records are available. Individuals which were unfortunate enough to find their way up the Don were energetically and mercilessly harpooned, netted, shot or stabbed to death whenever they reached the weirs and locks at Doncaster. A specimen which appeared in Doncaster Museum had apparently been killed with a pitchfork and landed at Sandall Lock during the 19th Century and was for years displayed in Claybourn's fish shop in St Sepulchre Gate, Doncaster. The following is a catalogue of recorded occurrences in the Ouse at Goole, the Trent and the Don. No doubt further investigation through old histories would reveal more.

1639	one in the Don at Mill Pit, Doncaster
1670	one in the Don at Dockin Hill, Doncaster
1688	one in the Don at Engine Dam, Doncaster
1727	one in the Don at Engine Dam
1824	one in the Don at Sandall near Doncaster
10.6.1835	one in the Don at Sandall, a 198.12cm (6ft 6in) specimen with a girth of 112.7cm (3ft 3in)
28.7.1843	one 213.36cm (7ft) specimen weighing 120lb caught in the Don at Corn Mill Bridge, Doncaster 'Others were recently taken their'
15.6.1858	one 213.36cm (7ft) specimen caught in the Don at Sandall, one of two which reached the area on the spring tide
28.4.1860	one 243.84cm (8ft) specimen with a girth of 117.7cm (3ft 5in) caught in the 'Wash Hole', Marshgate, Doncaster
4.7.1860	one 274.32cm (9ft), 127kg (20st) specimen with a girth of 140cm (4ft) was speared with a hay fork and later found dead at Barnby Dun. Its preserved skin was donated to Doncaster Museum
25.7.1861	one 193.04cm (6ft 4in) specimen caught near Parkinsons Corn Mill, Doncaster
6.1869	one 243.84cm (8ft) 82.55kg (13st) specimen was shot near Wheatley Hall by Henry Poppleton. One the same day a smaller specimen was caught near the Corn Mill Weir.
1870	one in the Don at Dockin Hill, Doncaster
1.6.1871	one 259.09cm (8.5ft), 95.25kg (15st) specimen was shot near the railway bridge
1871	one 8$^{1}/_{2}$ft specimen weighing 16 stones, caught in the Trent at Muskham near Newark on 10 June

(Extracted from Howes, CA (1997) 'The Sturgeon (Acipenser sturio L.) in Yorkshire waters, the tributaries of the Humber and the Dogger, Tyne and Humber sea areas'. Unpublished MS in Museum & Art Gallery, Doncaster

APPENDIX VIII

THE FIVE WEIRS WALK, SHEFFIELD

The Five Weirs Trust was established in order to ensure that the regeneration of the River Don became a central feature of the renewal of Sheffields east end and that public access to the 7.5km of river with its five magnificent and historic weirs was given back to the people of Sheffield. The aims of the Trust are:

- to promote the idea of the walk in local planning policy and to ensure that sections of it are built as part of major construction projects on the Don wherever possible.
- to persuade local authorities such as Sheffield Development Corp. and the City Council to contribute to the achievement of the walk.
- to carry out construction of certain sections itself.
- to promote local community involvement in and 'ownership' of the walk and to encourage responsible recreational and educational use of it.

75% of the walk is now completed or under way. Salmon Pastures is one of the 3 last remaining sections to be achieved to link Sheffield City centre and Rotherham Town centre.Since 1988 the Trust itself has constructed 1km of walk at a cost of £500k. A further 2km has been built by others within a strategy and design framework prepared by the Trust.

The Lower Don Valley is Sheffields heavy industrial heartland where intense development by the steel companies in the 19th and early 20th Century was followed by decline in the 1980s leaving a devastated and impoverished environment.

Salmon Pastures, probably the most mature and attractive part of the Lower River Don in Sheffield, is now once again popular with anglers and naturalists, but it has had a most varied and interesting history. An idyllic area of water meadows in the pre-industrial era, it was the site of one of the earliest crossing points of the River Don, Washford Bridge. In the 16th Century the Burton Weir was constructed to provide power for a series of rural cutler wheels. In the 19th Century the banks became lined with steam powered factories and the landscape was grossly disfigured by the establishment of coke ovens which created a large slag heap on the river's edge and apparently obliterated all vestige of a natural habitat. The river then effectively 'died' for a century.

In 1959 the City Council carried out a major bank stabilisation and a reclamation scheme which included the creation of new banks and formal tree planting. In the 1980's water quality in the urban Don improved dramatically as a result of better control of pollution, the closure of many factories and the construction of a new trunk sewer which diverted storm water overflows of sewage.

AMENITY

Since the late 19th Century industry in Sheffield has gradually moved away from the riverbank locations which were originally dictated by the need for water power. This happened first in the city's south western river valleys where the parks and green links which have now largely replaced factories. The east end of the city has, until recently remained densely industrialised and as a result access to natural environment has been very limited for residents of the valley side communities of Darnall, Tinsley, Brightside, Wincobank, Burngreave and Manor, which include some of the city's most disadvantaged people.

In recent years the lower Don Valley has also become a popular location for educational field-study trips by schools and universities looking at the effects of industrial change and regeneration. The Trust has sought to provide a facility which initially meets the needs of local residents and workers but which will also gradually become an attraction for visitors from a wider area as it develops and links to other routes and attractions. In particular the Walk relates closely to the recently restored Sheffield Canal which follows a parallel route down

the Valley and which is now fully accessible. Taken together the two will soon offer a 16km circuit of continuous waterside paths with cross links at various points.

Beyond the immediate locality the Walk will form part of a wider strategy to open up the whole River Don from the Pennines to the Humber with complementary action taking place in the upper Don Valley, in Rotherham and in Doncaster. The route will link Sandersons Mill Race Ecology Park, the Blackburn Meadows Nature Reserve and the Earth Centre. The Fiver Weirs Walk will also connect to the Trans-Pennine Trail via the proposed Chapeltown Railway cycle-footway.

ANGLING

Sheffield is a city of half a million inhabitants located far from either coast, yet it has more licenced anglers per capita than any other city in the UK. Traditionally most of these were obliged to seek out fishing on the rivers of rural Nottinghamshire and Lincolnshire because local waterways were too polluted and inaccessible. Now the Don in Sheffield supports a good and improving coarse fishery and a salmon has appeared downstream of Doncaster. The Sheffield Canal is now the most heavily fished waterway in British Waterways ownership.

As a heavy industrial centre Sheffield has a particularly high proportion of disabled people and a strong disabled anglers association, but facilities do not meet current demands. The development of fishing opportunities close to home assist the disabled and also encourage children to participate in the sport.

The Walk is available for free public fishing and the Trust has taken trouble to ensure involvement and ownership from both the Environment Agency's Fisheries Recreation and Conservation Department and wheelchair anglers groups. (In common with all waters in England and Wales, a licence to use a fishing rod is required to fish waters on the Don system. Also local byelaws should be checked and followed.)

HERITAGE

Although water powered industry is now virtually extinct in Sheffield, the physical infrastructure remains often surprisingly intact. There are few better locations to appreciate and understand Sheffield's industrial heritage than from its riverbanks, especially in the east end with its five magnificent weirs and two surviving goyts one of which is located at Salmon Pastures.

WILDLIFE & ECOLOGY

The ecology of the urban Don is among the best documented in Europe thanks to the efforts of local naturalists. Its proximity to the gathering grounds of the Peak District and its history of industrial change make it particularly rich now that water quality is improving.

Salmon Pastures is a fascinating and dramatic case study of environmental devastation followed by spectacular recovery. An ecological survey commissioned by the Trust substantiates this statement and indicates a particularly rich insect population and breeding sites for a number of water birds as well as unusual areas of heather and other species possibly dating from before the industrial exploitation of the site.

GLOSSARY

ALLUVIUM	–	fine, fertile soil of mud, silt and sand deposited by flowing water
ANADROMOUS	–	saltwater-living, freshwater-reproducing eg salmon
ANAEROBIC	–	does not require oxygen for breakdown by bacteria
BIODIVERSITY	–	the variety of species within a given natural environment
BIOMASS	–	quantity weight of living material in a unit of area
BIOSPHERE	–	the part of the earths surface/atmosphere inhabited by living things
CATADROMOUS	–	freshwater living, saltwater-reproducing eg eel
CORACLE	–	small round boat made of waterproof hides stretched over wicker frame
CRADGE	–	temporary/intermediate flood bank
ECOLOGY	–	study of plants, animals in relation to environment
ECOSYSTEM	–	involving the interactions between a community and its non-living environment
FLUVIAL	–	occurring in a river
GAFF	–	a large hook on a pole
GLACIAL	–	characterized by the presence of masses of ice
GOIT	–	colloquial word for trench bringing water to a mill wheel
GRAVID	–	preparing to spawn, ready to deposit eggs or milt
IMPOUNDMENT	–	to collect water in a reservoir, dam or weir
INDIGENOUS	–	native, occurring/originating naturally (in a country etc)
INVERTEBRATE	–	any animal lacking a backbone
HECK	–	form of fish trap
PISCIVOROUS	–	fish eating
RACE	–	a channel/stream conducting water to or from a mill water wheel
RIVERINE	–	normally only found in flowing water conditions
SALMONID	–	of the Salmon species ie. salmon and trout
SAPROBIC	–	pollution, decaying
SINUOUSOIDAL	–	full of turns & curves
SPATE	–	a flood, sudden rush or increased quantity, fast flow
TAXONOMY	–	classification of organisms
TECTONIC	–	art/science of construction or how earths surface attained its present structure
TOPOGRAPHY	–	detailed study, description of features of a limited area
TOXIC RED LIST		a list of hazardous substances as identified by the DOE and EEC

ABBREVIATIONS

AOD	–	Above Ordanance Datum
ASPT	–	Average score per Taxa
BMWP score	–	Biological Monitoring Working Party System
BOD	–	Biochemical Oxygen Demand
Cumecs	–	Cubic metres per second
Cusecs	–	Cubic feet per second
DOE		Department of Environment
EA	–	Environment Agency (1 April 1996)
EEC		European Economic Community
EU	–	European Union
HMIP	–	Her Majesties Inspectorate of Pollution
LEAPS	–	Local Environment Agency Plan
NRA	–	National Rivers Authority (1989-1996)
RSPB	–	Royal Society for the Protection of Birds
STW	–	Sewage Treatment Works
UNESCO	–	United Nations Educational, Scientific & Cultural Organization
YWA	–	Yorkshire Water Authority (1974-1989)
YWplc	–	Yorkshire Water Public Limited Company (1 September 1989)

DEFINITIONS

Gauging Flow Station

The term is used in this document to refer to a place on a river where water levels or some other factor related to the flow of a river is recorded continuously or at fixed and frequent intervals so that the flow of the river can be calculated.

Dry Weather Flow

The definition adopted in the document is that the dry weather flow at a point on a river is the average of all the 'seven day minimum flows' for all the years in the period of records of flows at that point.

Biochemical Oxygen Demand

The requirement for oxygen excess is called the *biochemical oxygen demand*, usually abbreviated to BOD. If there is an excess of oxidizable organic matter in a river or pond, arising from a discharge of an effluent such as that from a sewage treatment works or liquid manure slurry from a farm, the bacteria carrying out the oxidation may utilize all the available dissolved oxygen causing an acute shortage of oxygen for fish, which then die from asphyxiation. A simple measure of the potential of biologically oxidizable matter for de-oxygenating water is given by the biochemical oxygen demand (BOD). The BOD is obtained in the laboratory by incubating a sample of water for five days at 20°C and determining the oxygen utilized. Typical values of BOD are <3mg/l for Class 1A rivers in the UK (the least polluted Class), <5mg/l for Class 1B, 9mg/l for Class 2 (more polluted and only suitable for potable supply after advanced treatment) and 17mg/l for Class 3 (poor quality water with few fish present).

pH

Potential of hydrogen; a measure of the acidity or alkalinity of a solution. Pure water has a pH of 7, acid solutions have a pH less than 7 and alkaline Solutions a pH greater than 7.

Sewage Treatment

Primary Settlement – After the rags and grit have been removed from the sewage, the next stage is to separate the solids from the liquid sewage. This is done in a settlement tank.

Biological Treatment – Biological filters are beds of clinker or stone about 6ft deep over which the tank effluent is sprinkled. The surface of the stones become covered with a jelly like film containing bacteria and other small organisms which 'eat' the sewage. As the liquid is passed through the bacteria and other organisms remove the waste matter. In the Activated sludge process bacteria are added to the sewage and the two are mixed and aerated continuously. The bacteria congregates around small sludge particle hence the term activated sludge. The sludge and sewage are then mixed together.

Final settlement – The remaining dead bacteria, micro-organisms and slime is settled out in tanks. It decomposes in covered tanks without air, allowing the Anaerobic Bacteria to 'eat' the organic material in it. The sludge is disposed of at sea or incinerated. Also it is sprayed on to land to improve soil or used in solid form as manure.

Industrial effluent however may not be suitable for the latter.

Metric & Imperial Measures

Please note that calculations from metric to imperial and vice versa may not be exact but rounded up or down to the nearest $^{1}/_{4}$ or .25 decimal point.

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