

## The Manchester Ship Canal and Salford Quays

By Heather Webb, BSc (Hons) MSc,  
Senior Aquatic Scientist, APEM Limited.

### Manchester Ship Canal History

The Manchester Ship Canal (MSC) was opened in 1894 and at the time, was the largest navigation in the world. The Canal is 58 km long, linking Eastham on the Mersey Estuary to Manchester, terminating upstream at the four docks in Salford (formerly known as Manchester Docks) and four smaller docks at Pomona (1 km upstream). The docks prospered and became one of Britain's largest ports, reaching a peak in the 1950's. During the second half of the twentieth century, however, containerisation and changing world trade patterns led to the demise of the docks and they were closed in 1984 leaving an abandoned 60 ha site including a polluted water course.



### Legacy Problems



The industrial history associated with the Mersey Basin, encompassing the Rivers Mersey and Irwell and the MSC, left a legacy of poor water quality and sediment contamination. The MSC was one of the most severely polluted waterways in the UK with a one hundred year legacy of industrial, agricultural and sewage pollution. Water quality was very poor, being characterised by low water column dissolved oxygen, high levels of suspended organic material and elevated nutrient concentrations. There was also excessive gas production from the anoxic sediments which produced foul odours and lifted mats of sediment to the surface, both of which acted as a serious deterrent to waterside development.

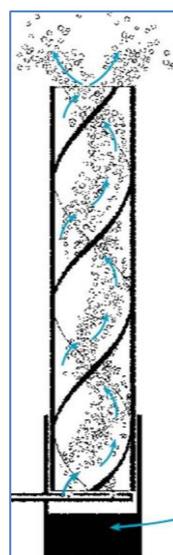
The structure of the MSC (deep, slow flowing and with steep vertical sides) further exacerbated the water quality problems. The consequential high residence time renders pollutants difficult to flush out and particulate contaminants settle readily onto the sediment layer, building up gradually to eventually create a thick layer of severely contaminated sediment.

## Salford Quays



Following closure of the MSC in 1984, the potential real estate value of the disused docks at Salford became highly attractive. Salford City Council (SCC) purchased the land surrounding Salford Quays and regeneration commenced in the mid 1980's. However, poor water quality precluded the initiation of such development and so SCC decided to isolate Salford Quays from the MSC by constructing bunds across the entrances to the docks.

An immediate effect of isolation was to reduce the polluting load including ammonia and suspended solids. However, the deep, vertical walls and legacy of contaminated sediment meant the docks remained susceptible to stratification and anoxic bottom waters. To prevent this, Helixor mixing systems were installed into each basin shortly after isolation. Water movement is achieved by input of compressed air from a land-based unit entraining water at the base of the Helixor tube, so enabling atmospherically oxygenated air to circulate to the bottom water.



APEM has been involved in the water quality management of Salford Quays since its inception in 1986. As aquatic scientists, APEM is responsible for the design, improvement and management of the water management system in the Quays, and to implement any necessary improvements to maintain the highest possible levels of environmental quality with a long term brief to move towards an ecologically stable and sustainable water environment.

APEM's remit is as follows:

- To provide management information for the efficient operation of the Helixor system to maintain the aesthetic and environmental quality of the Quays Inner Basin water environment
- To provide management information on compliance with the EC Bathing Water Directive (76/160/EEC) to allow the safe pursuit of watersports
- To monitor the success of the management strategy with regard to the eventual attainment of ecological stability within the Quays.



APEM and SCC's work has transformed the docks from their heavily polluted industrial condition with extremely poor water quality, into their current condition with Blue Flag water quality, enabling them to host a number of major events including the Commonwealth Games Triathlon swimming stage in 2002 and the Great Salford Swim since 2010. Salford Quays are now regarded as an internationally important waterfront redevelopment for private housing, commerce, recreation and Media City.

## MSC Oxygenation Programme

Since 1987 APEM has also been involved in an extensive program of research and collaborative projects with United Utilities, the Environment Agency, Salford City Council, the Mersey Basin Campaign and Healthy Waterways Trust to investigate methods of improving water quality in the heavily polluted MSC. The principle objective was to improve the aesthetic value of the MSC upper reaches by resolving the problems of foul odours, gaseous bubbling and sediment mat generation occurring due to low dissolved oxygen concentrations. The short term measures were therefore based around satisfying the oxygen sink of the sediments and the water column.



Following comprehensive field trials of suitable oxygenation technology, APEM recommended the installation of a direct oxygenation system. This system has subsequently been successful in elevating dissolved oxygen levels, and thereby improving water quality in the Turning Basin of the MSC, since 2001. APEM have been involved in the management and operation of this system since 2001.

## Aeration Trials

In 2011 the MSC oxygenation system reached the end of its design life. In 2010 APEM were therefore commissioned to conduct field trials to identify the most cost-effective and sustainable replacement system.

The initial stages of the project in 2010 involved an equipment review to identify manufacturers of mixing/destratification devices. A short-list of manufacturers were then invited to participate in field trials of their equipment in the enclosed basins at Salford Quays. The performance characteristics of the short-listed equipment were then assessed using Rhodamine WT dye as a tracer to generate data relating to turnover time and mixing extent. Assessing the performance characteristics of the different types of equipment generated performance data which aided design and modelling for full-scale trials in the MSC Turning Basin. Data on energy usage were also determined to provide cost per unit volume data for mixing power generated. Further trials were undertaken in 2011 of the new commercially available Helixor devices. These data were then used to identify the most suitable systems to be taken forward to the next stage: the full-scale trials in the MSC Turning Basin.



Following this in 2012, 30 Helixors were successfully installed into the Turning Basin of the MSC and APEM are now responsible for the monitoring and management of their performance to maintain target oxygen concentrations throughout the water column.

APEM is also currently using the data from this monitoring to undertake mass flux modelling to determine the oxygen demand of the MSC and then using performance data from the Helixors the number of units required to satisfy the oxygen demand of the remainder of the MSC, downstream of the Turning Basin.