



## Water Quality Monitored Continuously at Heathrow's T5

London Heathrow's Terminal 5 is one of Europe's largest construction projects; however, before work could commence it was necessary to divert both the Duke of Northumberland River and the Longford River. The 'Twin Rivers', to which they are collectively referred, are man-made and were originally constructed over 400 years ago. The major concerns in their diversion were to protect water quality and enhance the habitat that they represent.

Designed to maximise the ecological value and biodiversity of the diverted channels, various features and in-channel enhancements were incorporated to create a range of flow conditions and an associated range of colonisation conditions for wildlife. The new channels incorporate a variety of features including gravel-subsoil beams, gabion baskets of stone and submerged logs and large tree limbs. These features are deployed and arranged so as to replicate meandering flow patterns. Gabion baskets have also been used to create backwaters. Collectively these features provide a variety of habitats for development of plant, macro-invertebrate and fish communities. Even the surface face of vertical concrete wall sections is rough-textured to encourage colonisation by algae and macro-invertebrates. Naturally, a monitoring regimen would be necessary in order to ensure that environmental objectives were being achieved, and occasional biological monitoring would be supported by continuous water quality monitoring systems (WQMS).

In order to ensure the protection of these rivers, the Environment Agency Monitoring and Data team in Thames Region was contracted to install a water quality monitoring system that reported real-time data back to its offices in Reading. Technical specialists for the Environment Agency were responsible for the installation and operation of the monitoring system. The main concern for a watercourse in this area was the potential for algal blooms. However, in addition to the ability to record any build-up of algal activity, the WQMS was designed to detect a wide range of other potential pollution incidents.

Two monitoring systems are in place to monitor the Twin Rivers, each incorporating a YSI multiparameter monitor known as a 'sonde'. These sondes cleverly incorporate a number of sensors into an instrument no larger than two feet of an average

drainpipe. The Environment Agency manages a large number of such sondes within the Thames region, and has around 80 similar devices monitoring the Thames and its tributaries.

YSI has worked closely with the Environment Agency for more than a decade to develop its specific needs and requirements. "We were delighted when the Environment Agency once again awarded the contract to YSI as it underlines the partnership that has been established. We look forward to continuing the progress we have made with the Agency," says Ian Thompson, a Director of YSI Europe.

Each sonde is loaded with sensors for dissolved oxygen, temperature, pH, conductivity, turbidity, ammonium and chlorophyll; and as such it is able to detect pollution from almost any source.

Many pollution incidents result in a loss of dissolved oxygen (which often accounts for fishkills); however, they will often also give rise to alterations in conductivity and pH. A rise in ammonium levels may indicate a pollution incident from manure or biological slurry or possibly from artificial fertilizers; a rise in turbidity can indicate that solids have been dumped in the watercourse or that a disturbance of the riverbed has occurred.

In addition to pollution from what are known as 'point sources,' a continuous WQMS is able to detect 'diverse pollution.' This is pollution that builds up slowly over a long period of time, which might not be detectable in the short-term but which shows up following an analysis of long-term trends.

A further advantage to long-term monitoring lies in its ability to provide a picture of the background water quality so that any subsequent changes in water quality can be judged according to whether they are normal for that time of year.

Environmental monitoring often takes place in remote locations where coverage from mobile phone networks is incomplete and the topography or distances involved preclude conventional radio. In order to be able to record 24 hours per day a data communications system is necessary. YSI normally provides this facility with the use of radio, mobile phone or satellite telemetry; however, the Environment Agency in the Thames Region already runs a telemetry system based on 'Meteorburst' so it was relatively simple and more cost-effective to incorporate the two Twin Rivers WQMSs into the network.

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London Heathrow's Terminal 5, with one of the 400-year-old man-made Twin Rivers.

Data is transmitted via Meteorburst by bouncing signals off of ionised particles high in the atmosphere that result from meteorite activity. Using this method it is possible to transmit data over distances of up to 600 km.

Data from the Twin Rivers is described as real-time because sampling takes place every 15 minutes. The procedure is as follows:

1. A pump from within the WQMS draws river water, over a period of 4 minutes, into the sample chamber that contains the sonde. This ensures that the sample is representative before a reading is taken from each of the sensors.
2. Once a reading has been taken the pump stops and back-flushes to prevent any build-up of solids.
3. The telemetry unit then transmits the data repeatedly via Meteorburst and the base station in Newbury automatically sends a return message once it has received and checked the data. The data is then wiped from the telemetry unit until the next 15-minute data set.

The Environment Agency has purchased large numbers of these sondes with internal batteries and dataloggers so that water quality data can be saved for subsequent manual download to PC, or simply maintained as a back-up to data transmitted via telemetry.



A WQMS pumping station with a YSI Sonde

One of the problems traditionally associated with long-term monitoring of natural water is the accumulation of biofouling; however, in the Twin Rivers installations the Environment Agency has resolved this issue by pumping samples into a test chamber and by the inclusion of back-flushing in the monitoring routine. In many other applications, particularly in those for which mains power for pumps is not available, it is necessary to deploy sondes that are capable of withstanding biofouling for

extended periods. For these circumstances, YSI has developed an ingenious adaptation to their sondes known as 'Clean Sweep™' which incorporates a small wiper that regularly clears the sensors of any fouling before readings are taken. Trials have found that unattended YSI sondes are able to operate for up to three months in even high-fouling conditions when deployed with YSI's extended deployment feature.

Ecological monitoring has revealed that the new river courses are progressing well. Nevertheless, the development of filamentous algae has hampered vegetation development, and water-cress colonisation is competing with other plants on the berms.

Biological scores have increased for all macro-invertebrate sampling sites; and numbers of macro-invertebrates in the downstream monitoring site of each river channel were lower than other sites, suggesting that colonisation was taking place by downstream drift. Several high-scoring macro-invertebrate taxa were present, indicating good water quality in the channel environs. Fish biomass and density increased dramatically in the lower reach of the Longford between May and September, reaching a biomass level considered "excellent for a lowland fishery".

The Heathrow water quality monitoring system provides reliable and consistent data. However, it is important to remember that every system should be designed to meet the specific monitoring needs, following detailed discussions with all stakeholders.

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