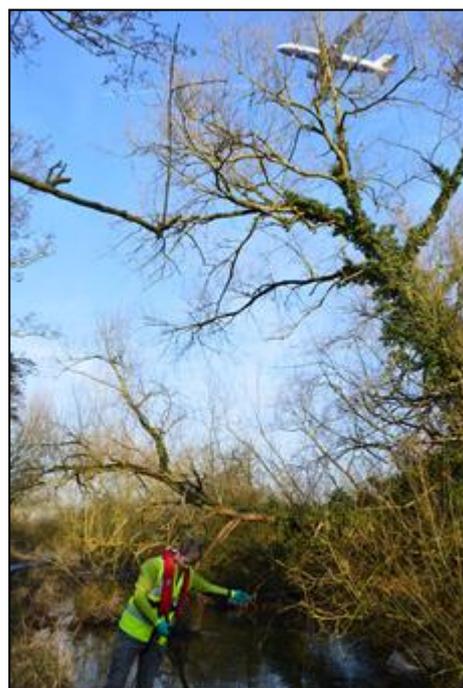




Monitoring the River Crane Water Quality and Ecology 2015



Heathrow Airport uses specialist accredited consultants to monitor water quality and biological indicators in the River Crane, a tributary of the River Thames, which flows next to the airport. Investigating the chemistry and biology is a valuable tool for understanding a river's health and this brief report presents the salient points of 2015 data, focussing on the River Crane east of Heathrow Airport and upstream of the Duke of Northumberland's River and Crane Valley Nature Park.

Water Quality

Good water quality is a fundamental requirement to sustain a diversity of aquatic life. Aquatic systems also underpin our daily lives, providing domestic water and supporting business and industry. There is legislation in place to safeguard water quality, including 'standards' with which businesses and industry must comply. At present, the primary over-arching legislation is the EU Water Framework Directive (2000/60/EC) (WFD), which aims for European waterbodies to achieve a 'good ecological status'. This status is defined by physical, chemical and biological parameters. For chemical standards, there are six key measures, against which the River Crane has been independently assessed, upstream and downstream of an airport outlet. The airport naturally cleans surface waters through lake systems before it returns to the river and undertakes continued monitoring of the quality to any receiving waterbody. The River Crane has been subject to recent pollution events elsewhere in the catchment, as determined by the Environment Agency, which has had an impact upon its aquatic life.

River Crane water quality 2015 against WFD chemistry standards (DEFRA, 2010¹) (OHES, 2016)

	WFD standard for 'good' status	Performance of River Crane	
		Upstream of outlet	Downstream of outlet
Dissolved Oxygen	60% saturation (90% of the time)	Standard met 8 out of 12 samples – 'poor' status	Standard met 10 out of 12 samples taken – 'moderate' status
Biochemical Oxygen Demand (BOD)	5 mg/l (90% of the time)	Standard met for 10 out of 11 samples	Standard met for 10 out of 12 samples taken – 'poor' status
Acidity: pH	6 – 9 (units)	Standard met	Standard met
Water temperature	< 28°C	Standard met	Standard met
Ammoniacal nitrogen	< 0.6 mg/l	Standard met	Standard met
Reactive Phosphorus	< 0.120 mg/l	Standard not met, annual average 0.21 mg/l – 'moderate' status	Standard not met, annual average 0.18 mg/l – 'moderate' status

Dissolved oxygen: Aquatic organisms require dissolved oxygen to survive. Overall concentrations during 2015 were 'poor' upstream of the EBR outfall and 'moderate' downstream of the outfall. On sampling occasions where 60% was not achieved, the downstream site always achieved a higher oxygen concentration than upstream.

Biochemical Oxygen Demand (BOD): BOD is related to oxygen, measuring how fast oxygen is being used up by organisms, usually bacteria breaking down organic matter. Results met the 'good' standard upstream and 'poor' downstream with 2 samples exceeding the value for 'moderate' status.

Temperature and pH: All standards were met for 2015.

Ammoniacal nitrogen: Known also as available ammonium and exchangeable ammonium, this is the dissolved form of nitrogen as ammonia, which indicates the presence of organic pollution. Consistent with previous years, all results met WFD standards.

Reactive Phosphorus: As determined in previous years, results upstream and downstream of the airport did not meet WFD standards, highlighting that this is an ongoing issue for the river.

Aquatic Ecology

Pollution can change macroinvertebrate and fish species assemblage and abundance, as well as the number of individuals present for a species. Change may be due to the *in-situ* demise of individuals or the migration of individuals away from pollution. Investigating this is primarily concerned with translating data into an applicable value. Advantages over chemical analysis are in the lasting response by organisms following pollution, where chemical analysis is a snap shot in time and may not screen all possible types of pollution which biological indicators respond to.

Macroinvertebrates surveys

Aquatic invertebrates live or spend part of their life-cycle in or around sediment on the bottom, among submerged and emergent plants or in the margins and drawdown zone. The Biological Monitoring Working Party (BMWP) has been applied to assess the River Crane's macroinvertebrate communities, with ongoing bi-annual data. The BMWP scores 'Families' from 1 to 10, based on sensitivity to pollution and oxygen requirements' with highest scoring Families most sensitive. The BMWP score is the sum of Family scores. With any science-based tool, there is potential for review as research continues.

OHES has summarised and contextualised the macroinvertebrate survey results using the RIVPACS (River Invertebrate Prediction and Classification System).

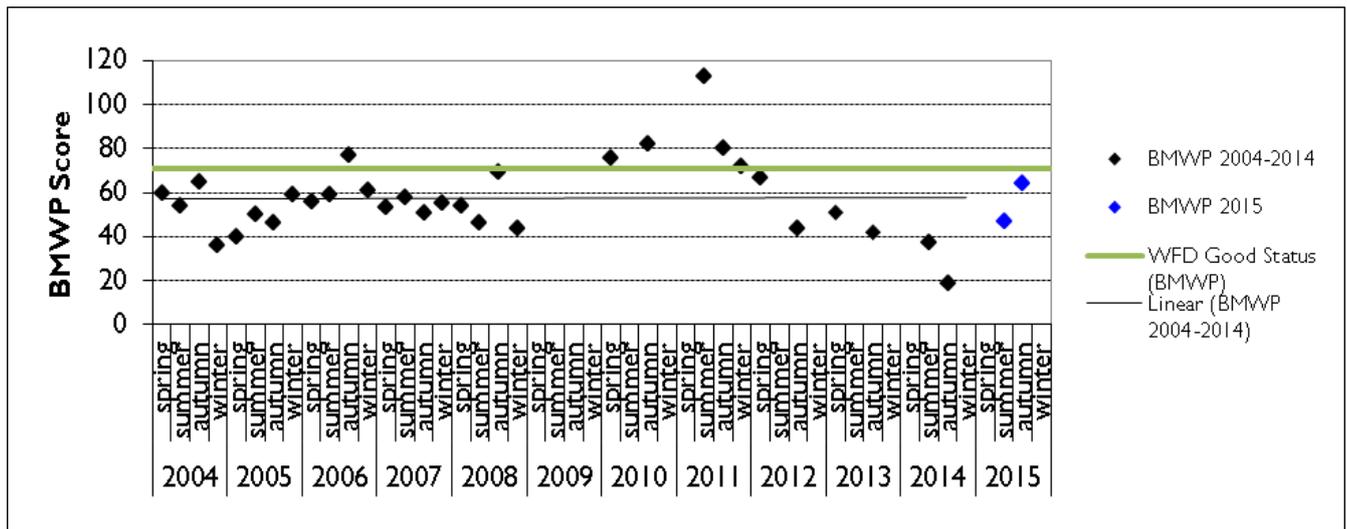
RIVPACS is a statistical model which allows the classification of a macroinvertebrate population. The system is used to predict the expected fauna of a site, which is then compared to the observed fauna. An Ecological

¹ DEFRA (2010) River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Direction 2010, ISBN 978-0-85521-192-9

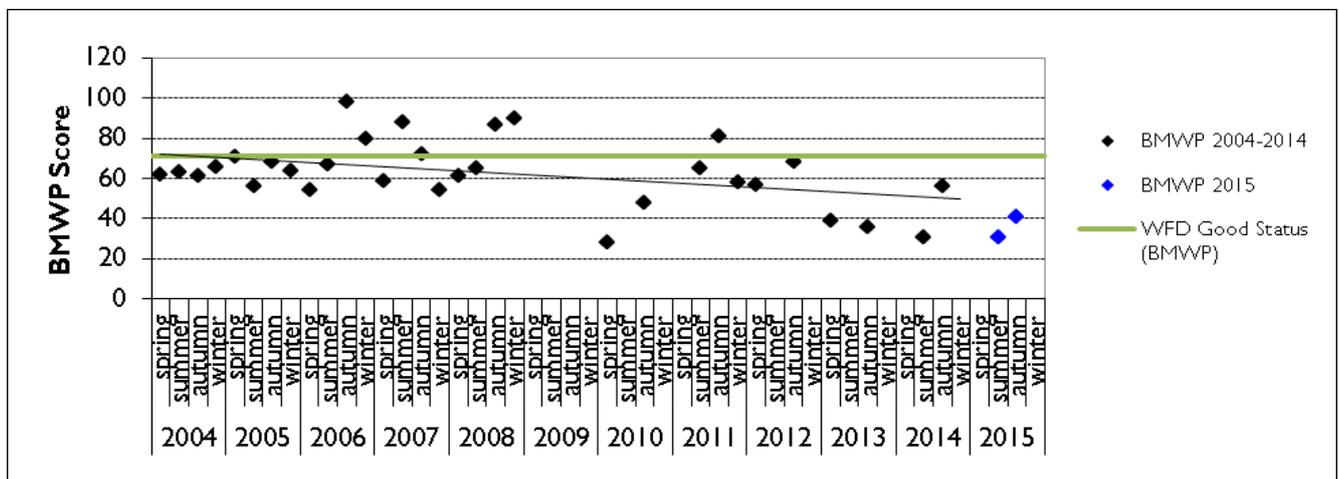
Status Class can then be awarded to each BMWP score, which generally corresponds to reference conditions under the WFD.

There are five classification categories based on the BMWP score, which are outlined in the table below:

BMWP Score	Category	Interpretation
0-10	Very Poor	Heavily Polluted
11-40	Poor	Polluted or Impacted
41-70	Moderate	Moderately Impacted
71-100	Good	Clean but Slightly Impacted
>100	Very Good	Unpolluted / Unimpacted



Biological Monitoring Working Party (BMWP) scores over time for the River Crane Upstream of the EBR outfall



Biological Monitoring Working Party (BMWP) scores over time for the River Crane Downstream of the EBR Outfall

2015 BMWP scores for Upstream (U/S) were 'moderate' (mean score 56) and Downstream (D/S) 'poor' (mean score 36). The mean score upstream of the outfall has increased on the 2013 and 2014 results, indicating an improvement in biological water quality. Since 2004 at the downstream site, there has been a marked decline in the BMWP score, suggesting a decline in biological water quality. Both sites were dominated by pollutant tolerant species. The presence of top scoring long-horned caddisfly (*Leptoceridae*) in the upstream sample (both summer and autumn samples) is encouraging and can be indicative of improving water quality as this species was not recorded in 2014.

Fish Surveys

OHES undertook electro-fishing surveys at six locations on the Crane, repeating those of 2014, including both upstream and downstream of the airport outlet. The uppermost site at Cranford Park is still producing very low numbers of fish, with only minor species present. Further downstream, at Waye Avenue, a more diverse fish population was present, with nine species caught. There was a greater variability in the river habitat and water depth at this site offering better opportunities for fish to occupy suitable niches. One of the most notable improvements was the improvements in fish numbers in the river section upstream of the EBR outfall, where large numbers of dace were present. Downstream of the EBR outfall, fish numbers were lower. Within the Crane Park section, significant habitat improvements have taken place within the river. This has been enhanced further during 2015 by the introduction of more woody debris source from recent tree works. The upstream site at Crane Park only produced a small number of juvenile chub, which although is a poor result, in terms of fish numbers, is still a major improvement on past results. The lower site produced a significant change to the fish population, with both fish species richness and density increasing notably. Species such as, barbel, chub and dace were noted as present. These fish are most likely linked to a stocking programme either by the Environment Agency or a local action group.

It is evident from the results of this survey, and previous surveys that fish populations in the River Crane have suffered as a result of sporadic and often significant pollution events which have affected the entire reach surveyed. Whilst habitat quality is variable throughout the catchment, there is suitable habitat for coarse fish, and larger and more diverse populations of fish would be anticipated, than those which have been observed.

Please note: electro-fishing surveys are subject to Environment Agency consent and adhere to strict health and safety procedures, such work must only be carried out by suitably qualified professionals.



Photograph: Adult pike (*Esox lucius*) (428 mm in length caught and released in 2015 downstream of the EBR outfall)