Citizen Crane Year 8 Report

River Crane Smarter Water Catchments Project

February 2023

Working in partnership

Thames Water

Crane Valley Partnership

Report title			
Author(s)	FORCE/ZSL/FE		
Project	River Crane Smarter Water Catchments Project		
Theme & milestone	Water Quality		
Document Reference	Reference No.	Version	Number

Document history and revisions			
Author	Description	Revision	Date
Rob Gray	Final	3	February 2023

Authorisation and assurance record		
	Name & organisation	Date & signature
Prepared by	Rob Gray (FORCE)	
Reviewed by	Citizen Crane team Citizen Crane steering group	
Approved by		

This document has been created for the purposes of Thames Water's Smarter Water Catchments initiative. Although Thames Water remain the primary client, this document will be made available to all partners associated with the project, in line with the true partnership ethos of the project. The work detailed in this report is based on the information available at the time. Any findings and/or recommendations will inform future phases of the project.

Contents

1 Introduction

This report sets out the findings of years seven and eight of the Citizen Crane programme. This programme started in 2014, following major pollution incidents in the River Crane catchment in West London. A project team of three organisations; Friends of the River Crane Environment (FORCE), Frog Environmental (fe) and Zoological Society of London (ZSL); came together to set up the programme. The team were supported from the start by a steering group consisting of Thames Water (TW), The Environment Agency (EA) and Crane Valley Partnership (CVP). Teams of volunteers were recruited to collect water quality and ecological data from up to 16 sites across the River Crane catchment and reports were produced each year that summarised these data.

The previous Citizen Crane report was the Year Six report. This brought together all the findings from the six years of operation and was published in 2020. It also provided a baseline condition assessment for the Smarter Water Catchment programme which started in April 2020.

The Year Six report can be seen here: https://www.cranevalley.org.uk/wp-content/uploads/2022/02/CC_Yr6_Report_04112020.pdf. It set out the work of the Citizen Crane project over these six years to understand and improve the River Crane ecosystem. It revealed the complexity of an urban system such as the Crane and identified 18 variables that are affecting the value of the ecosystem to some degree. It also showed that, despite all the positive interventions over this period, there was little or no evidence for improvement in the ecological value of the river. These findings brought home the challenges facing the Citizen Crane team at the start of the Smarter Water Catchment (SWC) programme.

A major programme of water quality investigations were commissioned in the first two years of the Smarter Water Catchment programme to build on the Citizen Crane findings and the outputs from this work are summarised in section 3.2 of this report. The scope of Citizen Crane has also evolved over the last two years in response to the SWC programme. The work has widened to include other citizen science components and is being co-ordinated by a Citizen Crane officer, appointed by ZSL in 2022.

This report presents:

- Core Citizen Crane data collected over the last two years
- An outline of other work undertaken by the Citizen Crane team and others
- Conclusions from a review of these data sets

This is a summary report only and further information can be found in the key reports referenced.

2 Citizen Crane Data

2.1 Overview

The Citizen Crane teams have continued to collect:

- RMI (Riverfly Monitoring Initiative) data every month from 12* sites across the catchment
- Water quality samples from two sites (Cranford Park and Mill Road) every quarter

*Note: there are several other sites recently set up along the Longford River. This is a separate artificial river channel which is also part of the overall catchment. The Citizen Crane team has not yet had an opportunity to review these data.

The locations of the monitoring sites are shown in Figure 2.1 below:

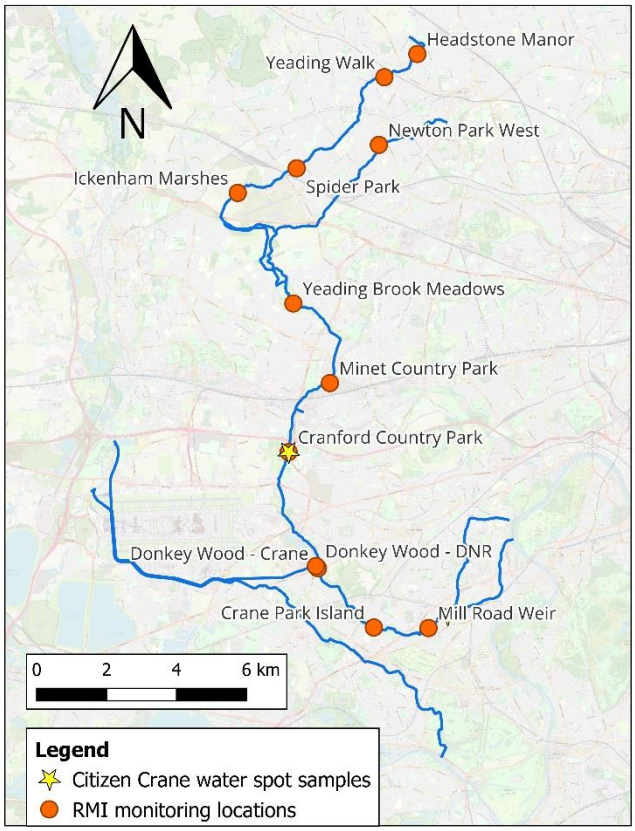

Figure 2.1: Crane catchment showing monitoring sites.

2.2 RMI Data

RMI data can be considered as a broad measure of the ecological condition of the river system as measured by the in-channel diversity and number of selected marker invertebrates. For an urban clay based catchment like the River Crane a score of 12 represents a reasonable high value whilst scores of 7+ may be acceptable dependent on the season. Any score of 6 or below indicates that a part of the ecosystem (water quality, geomorphology, shading and/or substrate for example) is sub-optimal whilst score of 3 or below are indicative of poor conditions.

The RMI data are presented for all eight years of the project and grouped as follows:

- Crane sites
- Yeading Brook sites
- Upper Duke's River site

The data for the five River Crane sites are shown in Figure 2.2 below:

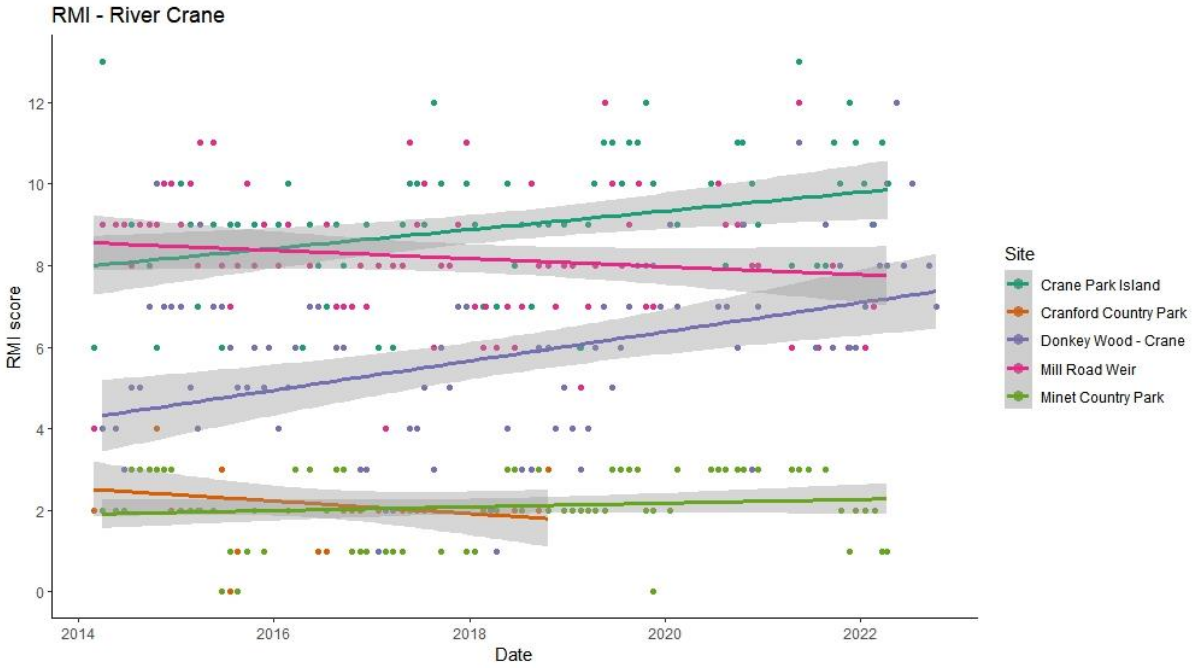

Figure 2.2: RMI data for the lower and middle reaches of the catchment.

The conclusions from these data are as follows:

- Overall, the results from each of the sites have remained in a reasonably consistent range over the eight year period
- The pattern of the abundance and diversity of RMI taxa improving (strongly indicative of river ecosystem improvement) with distance downstream has been maintained throughout the eight year monitoring period
- Scores at Donkey Wood have fluctuated over the monitoring period, with yearly averages ranging from approximately 8 when monitoring began in 2014, down to less than 5 in 2019, before increasing again to an average of 7 in 2022 (and resulting in a significant overall positive trend line)
- These fluctuations appear to be largely a result of the proximity of this site to Heathrow, and the major impact of glycol discharges from the Heathrow site during winters from 2015 to 2019.
- These discharges have reduced or stopped in recent years due to the new treatment works at the site, recent warm winters and/or the reduced activity at Heathrow during the pandemic. The recent cold weather (in the winter of 2022/23) will be the first major test of the treatment works system during a period of full scale airport operations
- There has been a significant positive shift over this period has been at Crane Park Island (Site 11), where the mean score has risen from 8 to 10. Note that this site was also affected by glycol discharges from Heathrow, albeit less severely than Donkey Wood, and therefore a subdued version of the Donkey Wood pattern may be seen in this trend line
- By contrast, the scores at Mill Road (Site 12, just 1500 metres downstream) have reduced over the same period, from 9 to 8

- There have also been slight declines at Cranford Park. Note that monitoring here stopped in 2019 and the team remain hopeful that new volunteers can be found for this site
- The scores at both Cranford Park and Minet Country Park have been consistently low over the eight year period. This is believed to be largely due to the poor geomorphological conditions at these sites – though there may also be local water quality issues around Minet which contribute to this low score
- None of the changes in score over the eight year period are major, and may well be due to local factors, such as changes in the amount of light able to penetrate to the river bed over this period. It is noted for example, that the Crane Park Island site is the only one where there have been reductions in shading, whereas there has been a noticeable increase in shading from ivy covered trees at the Mill Road site

The data from the six Yeading Brook sites are shown in Figure 2.3 below:

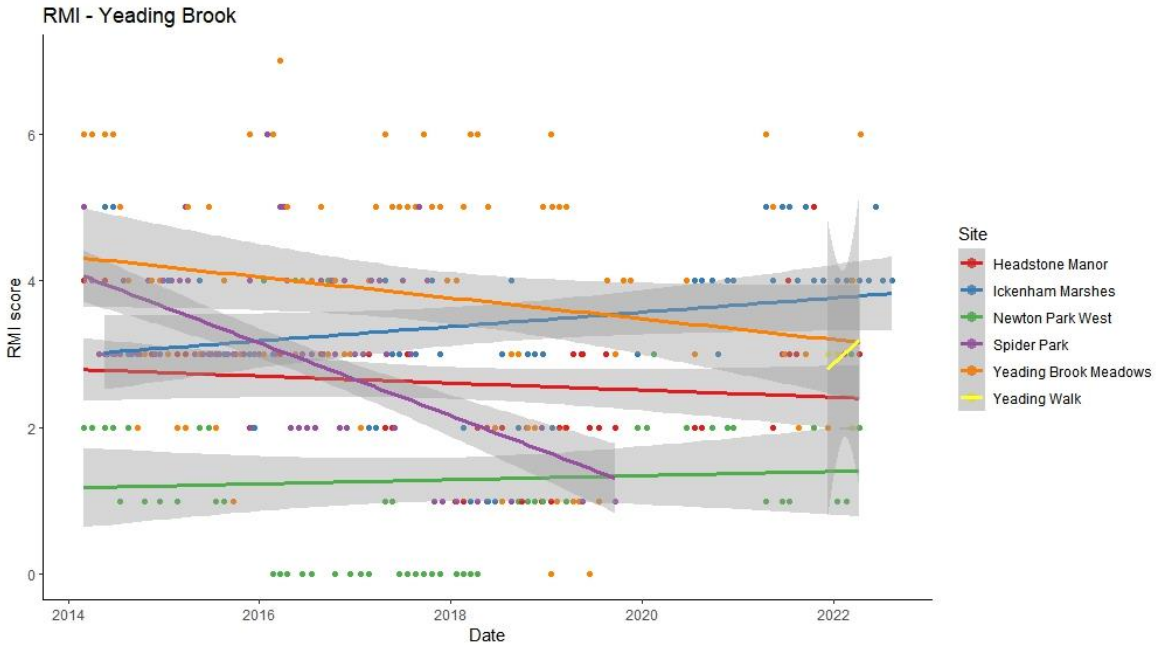

Figure 2.3: RMI data from the upper reaches of the catchment.

The conclusions from these data are as follows:

- Overall, the data have remained reasonably consistent over the eight year period
- There is a general improvement in ecosystem condition from upstream to downstream
- The scores at both main sources of the river (Newton Park and Headstone Manor) have remained poor, with typical RMI scores of between 1 and 3
- There are some early signs of an improvement in RMI scores at both sites over the last year or two, following the opening of the wetland schemes in 2018 (Newton Park) and 2021(Headstone Manor) though these are yet to be reflected in the trend lines
- There may be slight signs of improvement at Ickenham Marshes. 2022 RMI data continued this trend with scores between 4 and 5.
- There is a clear decline in the scores at Spider Park, the causes of which are not yet known. Monitoring at the Spider Park site stopped in 2019 due to volunteer availability. However, in summer of 2022 it was reinstated as a monitoring site. There are plans for river enhancement works at Spider Park in the next year or two and it will be interesting to see if these lead to a recovery in the score at this site.
- The Yeading Walk site was added in 2022 and it is too early to draw conclusions from this trend line

The data from the Upper Duke of Northumberland's River site are shown in Figure 2.4 below:

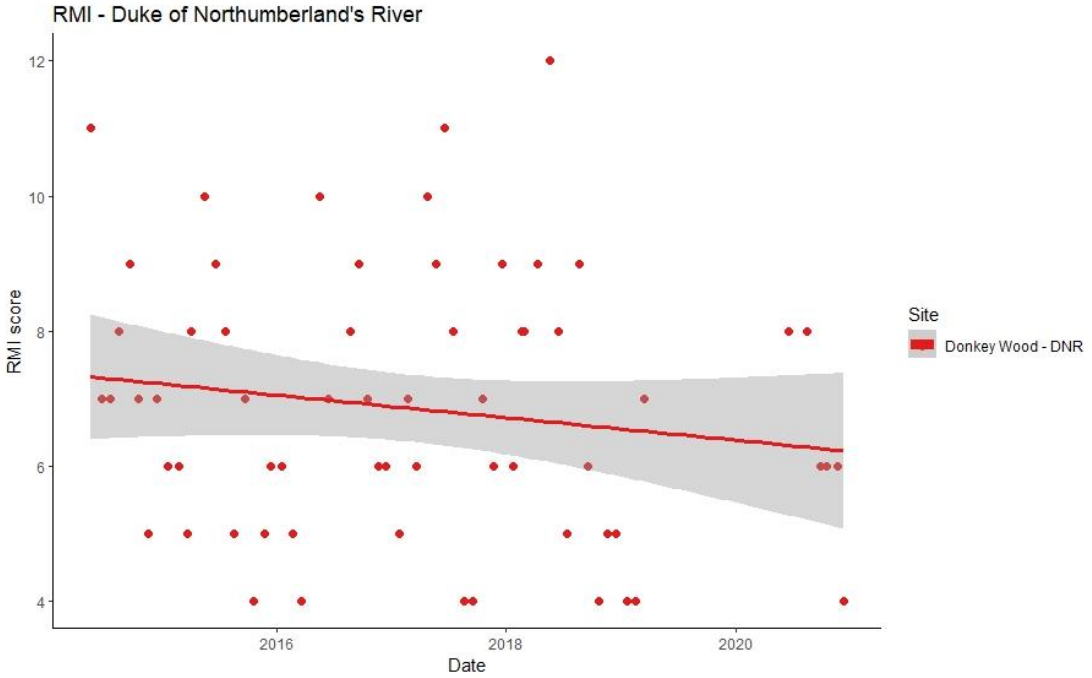

Figure 2.4: RMI data from the Upper Duke's River.

The conclusions from these data are as follows:

- These data show the widest variance of any of the RMI data sets
- This may be due to; (a) the relatively high intrinsic quality of the ecosystem and associated water quality in the Upper Duke's River combined with; (b) the vulnerability of this ecosystem to the much reduced flows seen during dry conditions
- There is a trend of reduced ecosystem value over the eight year period and this may be due to this problem of reduced flows increasing over this period
- This trend will also negatively affect the river system downstream of the confluence with the main river (as monitored by sites 11 and 12)

These RMI data are a valuable data set, covering 12 sites across the catchment over a period of eight years. The data reveal that the ecosystem value of the river catchment is reasonably stable, with poor conditions upstream, as well as in parts of the middle catchment, and much better conditions in the lower part of the catchment.

2.3 Water Quality Data

Water quality samples were collected from between 12 and 16 sites across the Crane catchment for six years between 2014 and 2020 and analysed for phosphate and ammonia. Flow estimates were also made at each site and these were used to calculate loadings for each data set. These data are presented and reviewed in detail in the Citizen Crane Year 6 report.

At the end of this period it was decided that sufficient monthly water quality data had been collected to understand the overall river condition and the focus switched to real time monitoring using sondes.

Over the last two years (year 7 and year 8) water quality samples have been collected every three months and from two sites only.

- Site 8 at Cranford Park in the middle of the catchment
- Site 12 by the Mill Road entrance to Crane Park at the base of the catchment

This continues to provide an overview of the system whilst greatly reducing the workload for local volunteers. These two locations were selected as they provide an overview of the conditions in the catchment and can be collated with flow records from EA gauging stations at Cranford Park (Site 8) and Craneford Way (Crane) + Mogden (Lower DNR) combined to approximate for Site 12.

The full eight year data set is combined as follows on the following four plots:

- The median points for the full six years of data are plotted as a curve of concentration and loading against distance down the main channel from Headstone Manor (Site 1) to Mill Road (Site 12)
- The data for Newton Park on the Eastern tributary of the river are plotted as a point at the confluence
- The data for the Upper Duke's River are plotted as a point on the confluence with the Crane
- The median data for Sites 8 and 12 in Years 7 and 8 are plotted as further points on each graph
- Note that the plots for years 7 and 8 are based on four data points only
- The concentration data for ammonia and phosphate are shown on Figures 2.5 and 2.6
- The loading data for ammonia and phosphate are shown on Figures 2.7 and 2.8

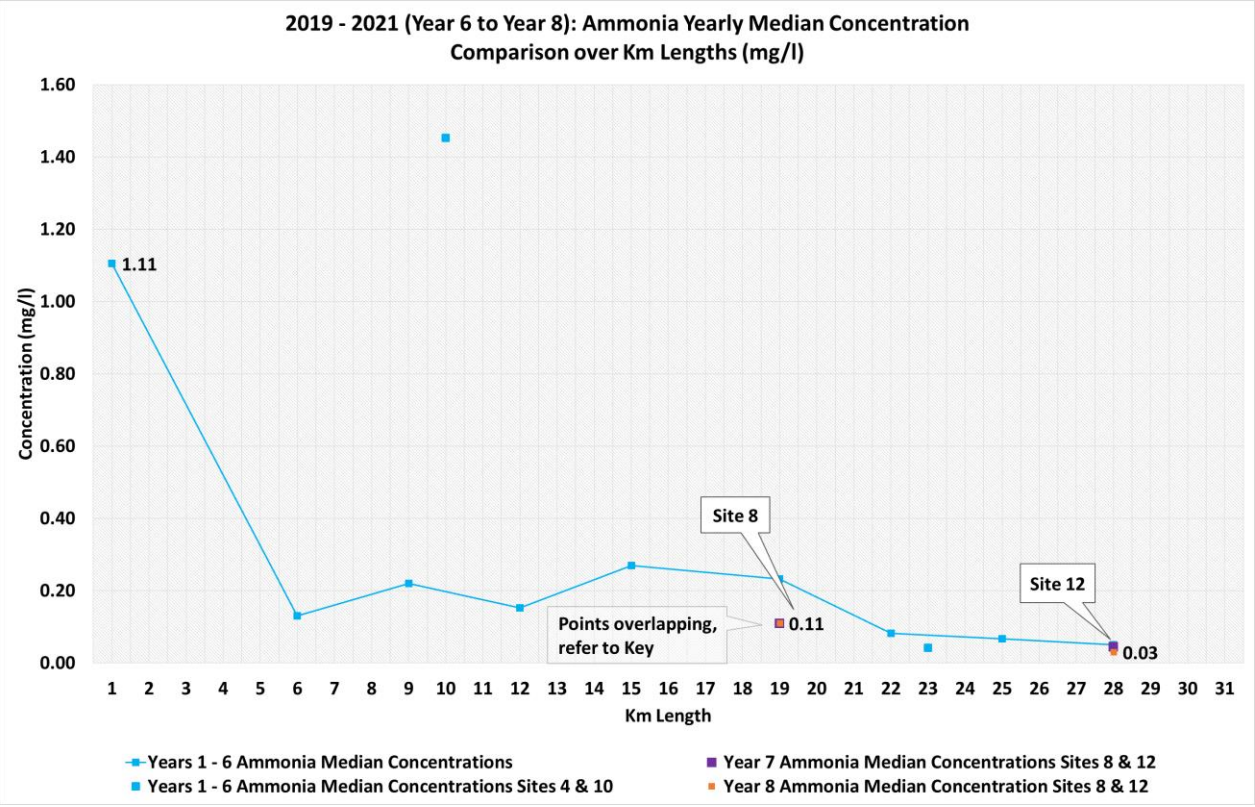

Figure 2.5: Median ammonia concentrations.

Key conclusions from this plot are as follows:

- The data for the first six years show that the median ammonia concentrations at the top of both arms of the catchment are over 1mg/l, representing poor status

- Concentrations reduced in the middle parts of the catchment to around 0.2mg/l, representing moderate status
- Concentrations in the lower part of the catchment reduced further to around 0.1mg/l, moving towards good status
- The data for years 7 and 8 indicate a further reduction in ammonia concentrations over the last two years

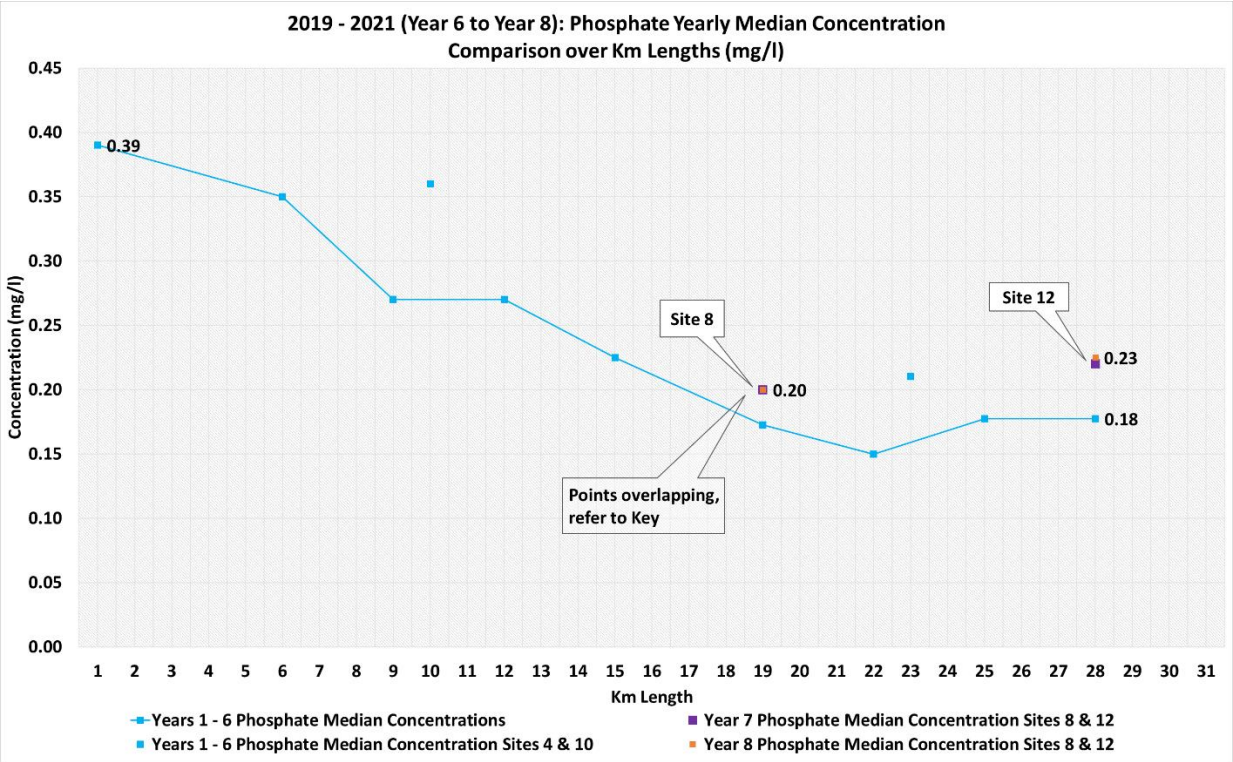

Figure 2.6: Median phosphate concentrations.

Key conclusions from this plot are as follows:

- The data for the first six years show a similar but less pronounced trend as for ammonia. The highest concentrations are at the top of the catchment and these reduce significantly with distance downstream
- In broad terms levels above 0.2mg/l represent poor status and this applies to the upper half of the catchment
- The river does not reach the good status level of 0.1mg/l
- The data for the last two years indicate that concentrations have been higher than the long term median level at Site 8 and Site 12

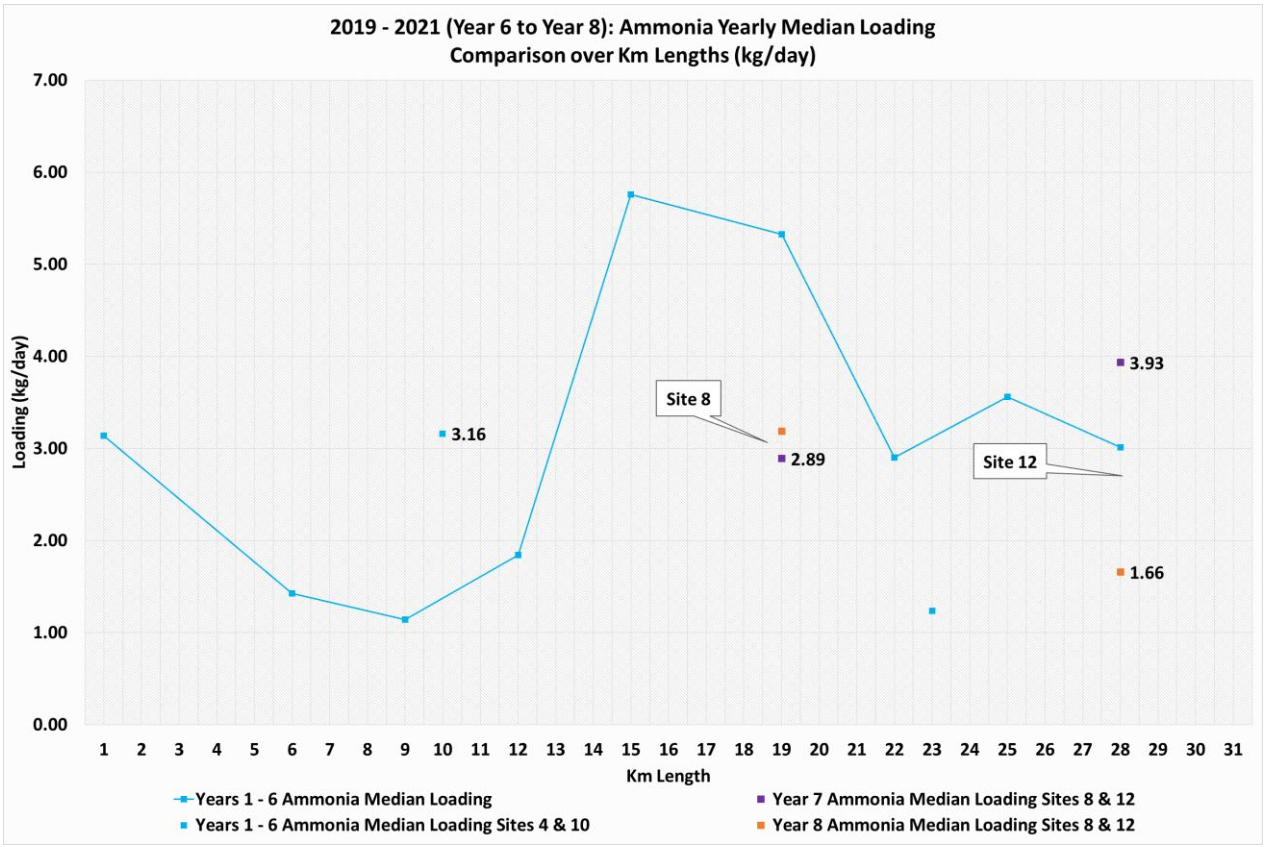

Figure 2.7: Median ammonia loadings.

Key conclusions from this plot are as follows:

- The combined ammonia inputs at the top of the two tributaries are around 6kg per day
- There are further inputs with distance downstream, but the overall loading does not increase above 6kg/day
- The overall loading reduces towards the lower part of the catchment to around 3kg/day.
- This indicates the capacity of the river system to remove a significant amount of ammonia (3kg/day net) through natural processes. This is likely to be largely due to organic breakdown and de-gassing
- The loadings in Years 7 and 8 generally indicate a further reduction in ammonia (although the loading at Site 12 in Year 7 is higher). This inconsistency also indicates the limitations of a data set with only four spot samples, particularly given the innate variability in ammonia levels on a short term basis, revealed through the sonde data (as presented later)

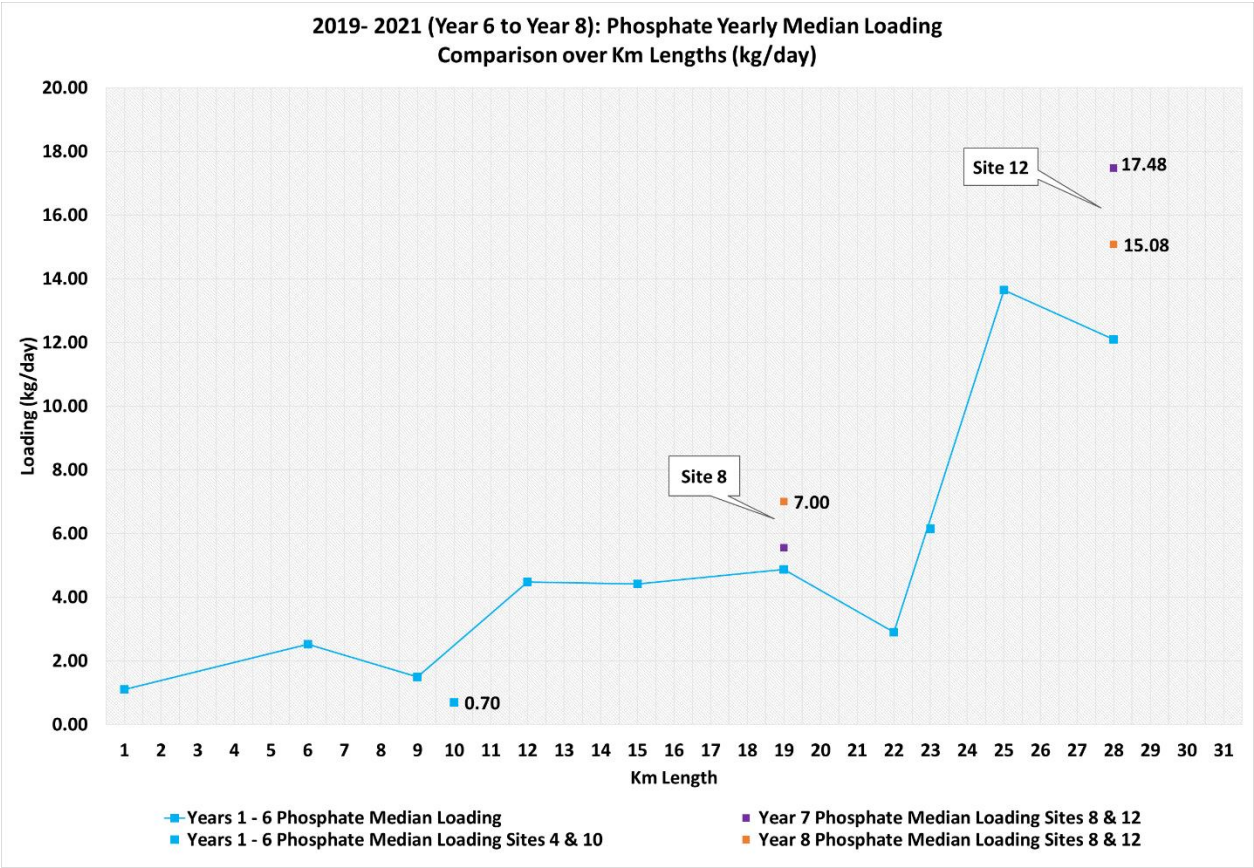

Figure 2.8: Median phosphate loadings.

Key conclusions from this plot are as follows:

- In contrast to the ammonia data, the phosphate loadings do increase significantly with distance downstream
- There is a major input of phosphate from the Upper Duke's River, equivalent to around half the total phosphate load
- There is limited evidence of the capacity of the river to remove phosphate. The main mechanism is likely to be sedimentation
- Previous work has indicated a very large phosphate load in the sediment – in the order of around 50 tonnes for the catchment. This indicates that large amounts of phosphate have been removed by sedimentation in the past – but also indicates the potential for phosphate re-mobilisation from this sediment
- The data for Years 7 and 8 support the concentration data and indicate that phosphate inputs have increased during the last two years.
- The cause of this increase is not understood at present. Note that there are risks in drawing too strong a conclusion from these limited data points given the high variability of the parameters - as revealed by the sonde data (see section 3 below)

2.4 Discussion of Results

The overall findings of the first six years of Citizen Crane were that the upstream parts of the river system were most heavily polluted and had the lowest ecological value. The value of the river system generally

improves with distance downstream and approaches Good Ecological Status with respect to the key variable (ammonia) measured in the lower catchment.

This information was used to focus the efforts of Thames Water's (TW's) surface water outfall programme (SWOP), from around 2018, on the upper reaches of the catchment. In addition, LB Harrow has created two major new wetland systems at the top of the western arm (Headstone Manor) and eastern arm (Newton Park) of the catchment. The impacts of these wetlands are considered further in section 3.4 below.

There is some evidence that the new treatment system at Heathrow has helped to enhance the condition of the lower Crane during cold winter periods. However, this has still to be tested during full operational conditions and the team will know more following the conclusion of the 2022/23 winter period.

The findings from RMI and water quality sampling over the last two years show some local improvements, with other indicators of declining condition. However, there is little evidence of an improvement in the overall river condition as a result of these works. This may be due to:

- The improvement works not being of sufficient scale
- An inertia in the system such that any improvements have not yet manifested
- Other problems getting worse and cancelling out these improvements

The one thing that can be said with some confidence is that the river condition would be worse without the large scale removal of mis-connections and the other improvement works. Section 3 below considers the other investigations that have been carried out by Citizen Crane over the last two years to better understand the river processes and the impact of improvement works.

3 Summary of Other Data Collected by Citizen Crane

3.1 Overview

The Smarter Water Catchment (SWC) programme has led to a broadening of the range of work carried out by the Citizen Crane team and the wider CVP programme. This section summarises the work undertaken.

3.2 Water Quality Investigations

The ongoing and completed water quality investigations and reports by the SWC programme include:

- Real time water quality monitoring. Sondes were deployed at a total of eleven locations throughout 2021. The final report is here: https://www.cranevalley.org.uk/wp-content/uploads/2022/10/Crane-Real-Time-Monitoring-end-of-project-report.pdf
- Outfall safaris. A second outfall safari was carried out in 2021 and the results were compared with the first outfall safari from 2016. The final report is here: https://www.cranevalley.org.uk/wp-content/uploads/2022/10/Cra005_2021-09-Crane-Outfall-Safari-Report.pdf
- Engagement with the ongoing Surface Water Outfall Programme (SWOP) being conducted by Thames Water
- Engagement with the wider Thames Water (TW) team about the interactions between the TW network and the surface water system. A list of questions about these interactions has been drawn up and used as a mechanism for engagement with TW. A new "Crane Interest Group" has been set up by Thames Water to facilitate these discussions, which are ongoing
- An investigation into the "Chemicals of Emerging Concern" across the catchment. This is being led by Imperial College and facilitated by ZSL. Initial results from these investigations were shared at the end of 2022 with another data analysis session due to take place in early 2023

The main findings from this work to date are as follows:

- The eastern and western arms of the upper catchment continue to suffer from chronic pollution. The eastern Yeading Brook in particular is in a poor condition and Environment Agency (EA) ammonia data indicate it had worsened significantly over the ten year period to 2020 (from around 0.5 mg/l to 3 mg/l). A plot of the ammonia data sets from the EA is shown as Figure 3.1 below. These arms are subject to ongoing investigations by TW SWOP teams

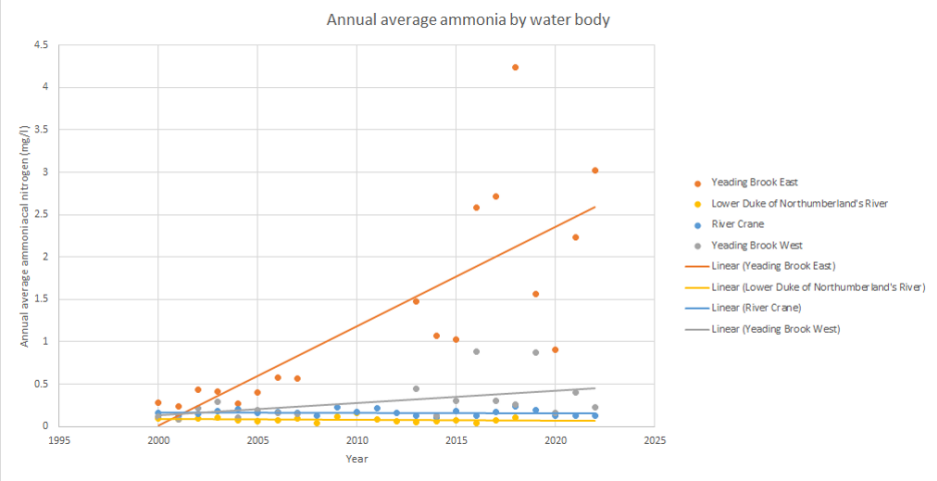

Figure 3.1. Ammonia data from the long term EA data set from 2000 to present.

- The sonde data reveal a strong diurnal pattern in Dissolved Oxygen in much of the upper and middle parts of the river, with night time concentrations dropping to critically low concentrations for the ecosystem. Night time oxygen sags are likely to be a key limiting factor for improvement of the ecosystem over much of the river. A particularly chronic example is shown in Figure 3.2 below for Newton Park West, where the DO consistently falls well below 40 per cent saturation during the night and is therefore classified as poor – despite daytime DO levels of 60 to 70 per cent. Oxygen sags of this nature are typical of a nutrient enriched system with high concentrations of organic contaminants

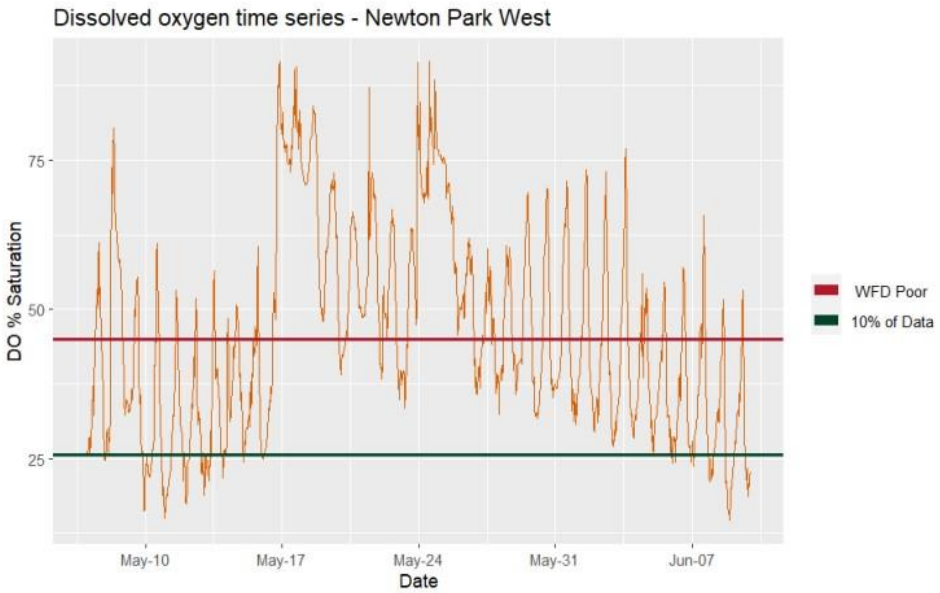

Figure 3.2. DO data from a sonde at Newton Park West in May – June 2021.

- The sonde data also show that all monitored parts of the river system are subject to regular incidents from ammonia rich pollution. These incidents are sometimes, but not always, linked to rainfall events, occur every few weeks and typically last for around a day. They raise the ammonia levels in the river by a factor of five to ten and are likely to be having a damaging impact on the invertebrate and fish life of the river. Figure 3.3 shows a composite plot of all the downstream sonde data between April and October 2021. These show regular ammonia peaks during the record (apart from the dry September period). Some, but not all of these peaks, appear to be directly related to rainfall events

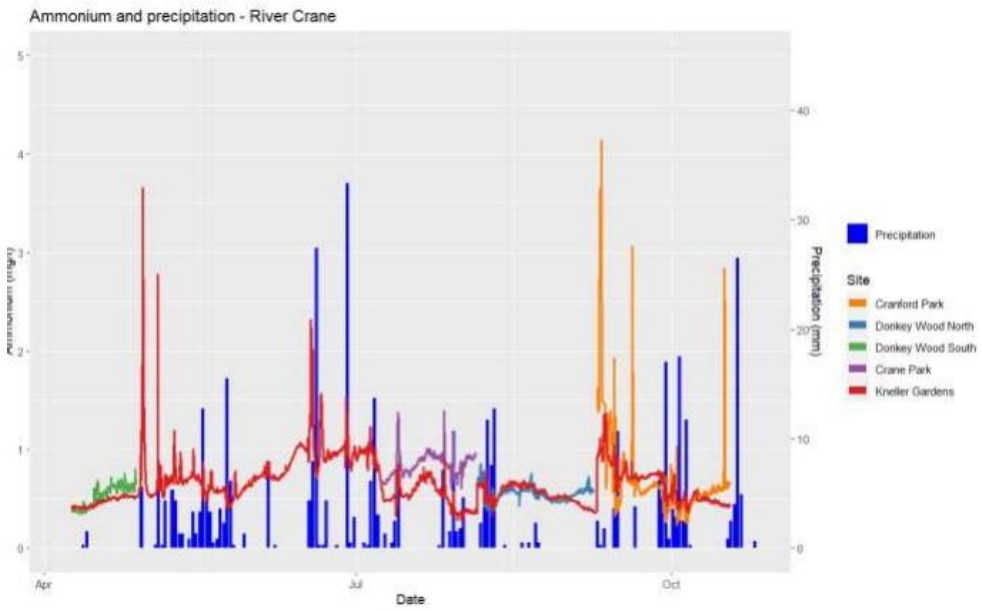

Figure 3.3. Composite plot of ammonia data from sondes in the lower and middle Crane catchment – April to October 2021.

- The most likely explanation for these ammonia inputs is the periodic release of sewage into the river system via cross-connections between the surface water and sewer networks. These are considered to be triggered by heavy rainfall and/or blockage related surcharges to the sewer system. Given that there were over 12000 sewer blockages recorded by TW across the Crane and Brent catchments in 12 months to mid 2022 this is clearly a major risk. The project team is engaging with TW to find out more about these cross-connections and understand how they can be stopped
- One key location is the Victoria Road area of Yeading Brook East. Visits by ZSL and CVCIC staff have identified sewage in the river in this location and ongoing investigations by TW indicate there may be multiple issues in this area
- The SWOP team removed 466 misconnected properties in the Crane catchment during the AMP6 period to March 2020. The team have identified 223 misconnected properties in the AMP7 period to October 2022 (i.e. around half way through the AMP7 programme) with a total of 554 misconnected appliances. These findings show that (a) The SWOP programme continues to do an effective job in identifying and removing misconnections, but (b) there are still around the same number of misconnections being found
- The SWC report comparing the findings from the Outfall Safaris in 2016 and 2021 showed that the condition of the outfalls had not improved significantly over that five year period. A comparison of the results from the two safaris is shown in Table 3.1 below

	2016	2021
Length of river surveyed	34km	45km
Number of volunteers	15	46
Total number of outfalls located and assessed	221	223
Outfalls with impact score		
0	162	172
1 to 4	26	24
5 to 9	24	19
≥10	9	8

Table 3.1: Comparison of 2016 and 2021 Outfall Safari Results.

- This indicates that there may be a comparable rate (i.e. 50 to 100 per annum) of new misconnections being added to the network and the SWOP may be doing little more than keeping pace with these additions

The data continue to show an improved ecosystem in the lower part of the catchment, with conditions approximating to good status in some locations. The ecosystem in this part of the catchment also benefits from ongoing maintenance and improvement works over many years by teams of volunteers and contract staff that have led to steady improvements in the geomorphological value of some at least of the lower catchment.

Where improvements have been implemented, and not been subject to ongoing maintenance, the river condition can revert rapidly to its former state. River restoration works carried out in the middle and upper catchment (at the Ten Acre Woods, Yeading Brook Meadows and Huckerby Meadows nature reserve sites) in and around 2015 have received very little maintenance support since and, in less than ten years, the river has to a large degree reverted to its pre-restored condition. This is likely due to the high peak flows and heavy silt loads, combined with the urban setting, which result in considerable cumulative damage in the absence of a maintenance regime.

These examples have shown that ongoing regular maintenance is required to ensure that improvements are retained over the medium to long term. Experience in the lower catchment has shown these can be delivered through volunteer led activities, supported by contractor inputs where necessary for dredging and tree works for example. This approach ensures the work is carried out through small scale and cumulative actions. Publicity, through local engagement, information walks and posters, and social media for example, ensures these works are understood and respected by the wider community that use the associated open spaces.

3.3 Environment Agency Data

The Environment Agency have long term invertebrate data for three sites in the Crane catchment dating back to 2000. These have been reviewed and used to create RMI scores for this longer term period. These data are plotted in Figure 3.4 below and a long term trend line drawn (in blue). A second trend line has been drawn to show the data for the Citizen Crane data set (in red).

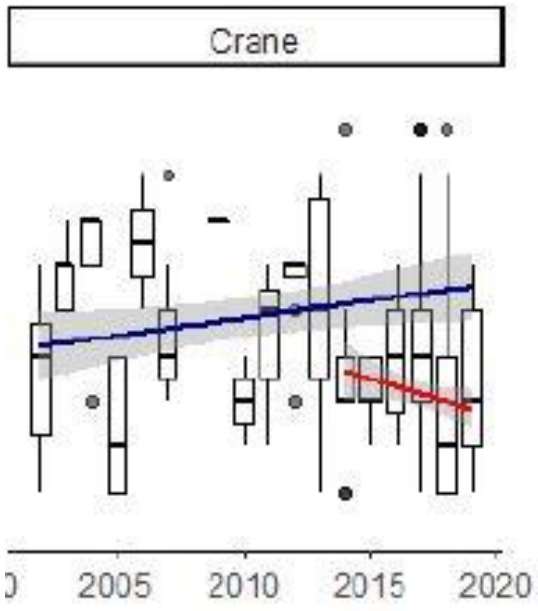

Figure 3.4: Long term RMI data from the EA and Citizen Crane. Credit Leanne Tough (EA)

Initial comments on these data are as follows:

- The EA data indicate a long term improvement in the ecosystem condition over the last 20 years
- The Citizen Crane data (from Site 12) indicate a deterioration in ecosystem condition over the last eight years
- A broader interpretation of the Citizen Crane data, as presented in this report, indicate some evidence for improvement in parts of the catchment and evidence for deterioration in other parts.
- These data are not necessarily contradictory, as they are from different sites and cover different time periods
- Long term EA data on phosphate, presented in the Citizen Crane year 2 report also indicated a reduction in phosphate over the last 20 years in the lower catchment – which was linked to phosphate stripping installed at sewage works in the Colne catchment and improving the quality of inflows from the Upper Duke's River

The Environment Agency also produces River Basin Management Plan (RBMP) assessments of river condition and the data sets have been summarised for the main River Crane catchment (ie below the Yeading Brook confluence) in Table 3.2 below.

Classification Item	2013	2014	2015	2016	2019
Ecological	Poor	Poor	Poor	Poor	Moderate
Biological quality elements	Poor	Poor	Poor	Poor	Moderate
Fish	Poor	Poor	Poor	Moderate	Moderate
Invertebrates	Poor	Moderate	Moderate	Moderate	Moderate
Macrophytes and Phytobenthos Combined	Moderate	Moderate	Moderate	Poor	Moderate
Macrophytes Sub Element	Moderate	Moderate	Moderate	Poor	Moderate
Phytobenthos Sub Element	Moderate	Moderate	Moderate	Moderate	Moderate
Physico-chemical quality elements	Moderate	Moderate	Moderate	Moderate	Moderate
Acid Neutralising Capacity		High	High	High	High
Ammonia (Phys-Chem)	Good	Good	High	Good	Good
Biochemical Oxygen Demand (BOD)			Good	Good	Moderate
Dissolved oxygen	Good	Good	Good	Moderate	Poor
Phosphate	Poor	Poor	Poor	Poor	Poor
Temperature	High	High	High	High	Moderate
pH	High	High	High	High	High
Hydromorphological Supporting Elements	Supports good	Supports good	Supports good	Supports good	Supports good
Hydrological Regime	Does not support good	Does not support good	Supports good	Does not support good	Does not support good
Supporting elements (Surface Water)	Moderate	Moderate			

Table 3.2: RBMP data sets for the River Crane.

Initial comments on these data are as follows:

- The data show some improvement from 2013 in terms of fish and invertebrates. However, it should be noted that the fish and invertebrate populations of the lower half of the river were essentially wiped out in 2011 and again in 2013
- The overall condition of the river system is moderate with some good elements and some poor

The reality, as shown through the Citizen Crane programme, is that the condition of the river is very dependent upon when and where the measurements are made.

Note that the RBMP classification for the Yeading Brook (upper Crane) is “Bad” for ammonia.

Considering the data as a whole there are indications of:

- Some improvements in river condition in the early 2000’s (possibly linked to phosphate reduction measures in the Colne)
- A major impact on the ecosystem from the pollution incidents of 2011 and 2013 (which effectively wiped out the middle and lower reaches)
- A recovery from 2014 onwards
- Some local improvements since then but other significant degradations (including along Yeading Brook East)
- No system level improvements since 2014 despite significant investment

The implications are considered further in section 4 below.

3.4 Other Relevant Investigations

Related ongoing and completed investigations by the SWC programme include:

- Headstone Manor investigations
- Newton Park investigations
- Thames Water engagement with SWC
- Lower Crane Restoration monitoring
- MORPH investigations
- Wetland and SUDS assessments
- Other citizen science based opportunities

The relevant findings from this work to date are considered in turn below:

Headstone Manor Investigations

A major new wetland system was commissioned in Headstone Manor Park, at the top of the western arm of the Crane catchment, in 2020 (see Figure 3.5 below). ZSL are working with the Friends of Headstone Manor Park and others to assess the community and environmental benefits of these wetlands.

Figure 3.5: Marginal habitat around Headstone Manor Park wetland.

Findings to date indicate that the system is creating a new high quality habitat for the upper part of the Crane valley. This has attracted a much wider diversity of invertebrates, alongside kingfishers and egrets for example. The public response to this new feature has been very positive. There is also some evidence of benefits to the downstream water quality and ecosystem condition, but it may be too soon to be sure of these.

Note however that this ecosystem is vulnerable to extreme natural as well as man-made events. A period of unprecedented high temperatures in late summer 2022 led to a large scale algal bloom and associated oxygen sags that appeared to have killed a large part of the invertebrate ecosystem by September 2022.

Monitoring work is continuing through 2022 and 2023 with the support of local citizen scientists. The intention is to develop a methodology for citizen science based and supported monitoring that can be used on other wetland schemes. A full report is due to be released later in 2023.

Newton Park Investigations

A major wetland system was installed in Newton Park, at the top of the eastern arm of the catchment, in 2018. Monitoring work by Citizen Crane showed that this system is being effective in halving the ammonia and phosphate inputs from this part of the system (see Citizen Crane year 6 report).

However, the wetlands have also been subject to high levels of hydrocarbon pollution, with a thick deposit of oily sediment accreting in the upstream wetland basin. Investigations to date have not been able to find the source of this pollution. Harrow Nature Conservation Forum launched a fresh investigation into this issue in 2022, supported by Thames 21, and funded through the SWC Project Fund. The results should be available in 2023.

Thames Water Engagement with SWC

Thames Water have engaged with Citizen Crane (CC) over the last eight years by:

- Providing laboratory analysis for CC samples
- Attending quarterly CC meetings
- Sharing the findings of the SWOP programme
- Supporting the development of the Outfall Safari programme (with an initial safari in 2016 and a repeat in 2021)

Through the SWC programme TW has also, over the last couple of years:

- Engaged at a broader level regarding the connections between TW infrastructure and the natural drainage system
- This has led to the creation of the Crane Interest Group (between key TW staff and the CC and SWC teams) where these issues can be debated
- A series of questions have been raised with this group regarding eg: (a) how to use the SWOP programme to better understand the causes of new misconnections; (b) the role of cross-connections in the pollution issues seen; (c) how to enhance the effectiveness of EHO's in following up on misconnection issues; (d) how to link the wetland and SUDS programmes being developed elsewhere in the catchment by TW into the SWC; (e) how SWC fits into TW's Mogden catchment planning; and (f) how best to use the enhanced community connections from SWC in engaging the wider public on these issues
- TW agreed to support a further Outfall Safari in 2023 that will also test each outfall for ammonia. This work should help to enhance our understanding of the overall impact of outfalls and evaluate any progress made with the pollution issue

It is envisaged that this process may help to mainstream CC into the TW programme over this AMP cycle.

Lower Crane Restoration Monitoring

In early 2022 LB Richmond delivered a field trial for restoring the concrete lined lower Crane by: (a) removing around 25 metres of concrete wall; (b) excavating a new backwater area; (c) creating a 25 metre berm opposite this backwater; and (d) installing gravel into the river bed throughout this section. Figure 3.6 below shows the newly completed scheme.

Figure 3.6: The lower Crane Restoration Field Trial site in summer 2022.

ZSL were engaged by the SWC programme to monitor the effectiveness of this scheme. Preliminary data indicate that (a) the invertebrate and fish biodiversity has significantly increased in a few months following the scheme installation and (b) the public are enthusiastically supportive of the scheme. The final report will be available at the end of 2022.

As a result, LB Richmond are seeking funding for further restoration schemes along the lower Crane corridor.

MORPh Investigations

Cartographer were engaged by the SWC Programme to deliver on the theme of geomorphology. Urban River Survey (URS) data were collected, collated and analysed to indicate the geomorphological condition of the entire river system in broad terms – identifying reaches that have been straightened, over-widened and over-deepened, reaches subject to shading, as well as reaches that retain a broadly natural form.

The Modular River System (MORPh) approach is a development of URS that allows more detailed assessment of geomorphological conditions as well as identifying where enhancements might best be made. The MORPh approach is suitable for delivery with citizen scientists and Cartographer are delivering two training courses in support of this in 2022 and 2023. They are also undertaking MORPh assessments at three priority sites as follows:

- Lower Crane Restoration Field Trial site - as referenced above. This is a small scale field trial applicable to around two km of concrete lined corridor in the lowest part of the main river, below Mereway Road weir and above the tidal reaches
- Little Park and Pevensey Nature Reserve – a 500 metre length of river corridor on the border between LB Hounslow and LB Richmond and immediately above Crane Park in the main part of the Lower Crane. This section is typical of the straightened, toe-boarded and overwide lower parts of the river above Mereway Road weir. The project is considered as a large scale field trial for restoration works in this part of the corridor. Extensive river restoration and backwater habitat works are planned here over the next year as a prequel to water vole release scheduled for 2024
- Spider Park – a 300 metre middle Crane site in LB Hillingdon. This section is typical of the over straight, over deep and shaded part of the middle (and parts of the upper) Crane catchment and is considered as a field trial for these parts of the corridor. Feasibility studies started in 2022 and it is anticipated that restoration work will follow in 2023 and 2024

The Citizen Crane team are supporting all of these works and working with the geomorphology team from Cartographer to assess how citizen scientists might best support the monitoring and evaluation process.

Wetland and SUDS assessments

The SWC programme is engaged with wetlands and SUDS as follows:

- Metis has produced an overview of the flood risk across the catchment from surface water, groundwater, rivers and sewers in 2021. The report on this can be seen here https://www.cranevalley.org.uk/wp-content/uploads/2022/10/River-Crane-SWC-Flood-Risk-Report.pdf
- In 2022 Metis: (a) assessed the priority areas for wetland and SUDS development; and (b) brought together a list of over 20 wetlands and SUDS schemes which are currently at the planning stage. The reports on these works will be issued in early 2023
- The team is engaging with a major programme of work, funded by TW and being delivered by Metis and Thames 21 with LB Hounslow, to identify priorities for wetlands and SUDS development in Hounslow borough
- SWC is part funding a major new SUDS and associated habitat development programme for the Pinkwell Estate in LB Hillingdon, being delivered by Groundwork

The intention is to support these work programmes in a structured way, identifying and promoting best practice, and providing additional support where this may help deliver wider SWC benefits through these schemes.

The Citizen Crane team will also assess where and how citizen science can be used to investigate and optimise the benefits of each scheme and engage the wider population with these benefits.

Other Citizen Science Opportunities

ZSL are also leading on the biodiversity aspects of the SWC programme. An initial assessment of the habitats and priority species across the catchment was produced in 2021 and can be seen here https://www.cranevalley.org.uk/wp-content/uploads/2022/10/2022_ZSL_Habitats-and-Biodiversity-in-the-Crane-Catchment.pdf

The priority in 2022 has been to investigate the distribution of water voles across the catchment and develop opportunities for water vole re-introduction. Citizen scientists are engaged with this programme by:

- Monitoring mink traps
- Carrying out water vole surveys

Further citizen science work is anticipated over 2023, both monitoring and supporting a water vole release, planned for early 2024.

Further citizen science opportunities are anticipated with the ongoing monitoring and support of key species, such as bats and hedgehogs for example.

3.5 Wider Engagement and Reporting

This section considers the wider engagement with the public and other stakeholders through the Citizen Crane programme as follows:

- Pollution incident reporting

- Community and group engagement
- Other outreach work

These are considered in turn below.

Pollution Incidents

TW reported in 2022 that there had been 12336 blockages in the sewerage system and 30 category 1 to 3 pollution incidents in the Mogden catchment (Crane and Brent) over the previous 12 months. It is essential to identify and deal with these incidents as soon as possible.

The Citizen Crane team has been encouraging the public to report pollution incidents through both the TW and the EA reporting systems and this has been re-enforced through social media postings by CVP, FORCE and other partners.

There are regular pollution incidents reported in this fashion and these reach the wider public, typically on a monthly basis, through postings on social media (see Figure 3.7 below). The causes and impacts of these incidents are often not reported. As well as sewer blockages, they may be caused by industrial pollution, or the discharge of pollutants into a road drain for example. Whilst in general the process of reporting pollution events, and the response to them, appear to have improved over the last eight years, there remains scope for further enhancements.

Fig 3.7: Pollution in the lower Crane reported, via FORCE social media, to the EA and TW in October 2022.

Community and group engagement

One of the key themes of the SWC programme is the community of 650,000 people that live within the Crane catchment. Local community interest company “Let’s Go Outside and Learn” (LGOAL) are leading on this theme and are currently producing a Public Engagement Strategy that will be issued in 2023.

LGOAL have identified around 70 community groups that have an interest in one or more of the SWC themes. LGOAL are currently working with CVP hosts Crane Valley CIC to engage these groups and link them more closely to each other and the wider objectives of the programme.

A new Communities Fund was launched by the SWC programme in 2022, and ten groups have been awarded up to £2000 each by this fund, with four further rounds of funding available through 2023.

LGOAL are also working with ZSL to promote the opportunities for citizen science training and delivery. One new RMI site has been created with a Friends Group at Yeading Walk whilst another has been resurrected at Spider Park. The intention is for more opportunities for community led citizen science to be developed over the future years of the SWC Programme.

Other Outreach

The State of the Crane Environment Report was produced in autumn 2022 and summarised the findings of the first two years of the SWC programme across all five themes of community; water quality; biodiversity; geomorphology and flooding. The report has been written for an informed public and wider stakeholder audience and sets out both the current status of the Crane catchment and the plans for transforming this status over the ten year SWC period to 2030. The report can be seen here: https://www.cranevalley.org.uk/wp-content/uploads/2022/10/State-of-the-Environment-Report-River-Crane-Smarter-Water-Catchment-October-2022.pdf

The Crane Conference was held on 18th October 2022 and launched this report. The conference also provided the opportunity for 150 delegates across all stakeholder groups, including many community representatives, to hear about the findings and plans first hand and to workshop key opportunities and outcomes.

The Citizen Crane team supported a Smarter Water Catchment workshop at the national River Restoration Centre conference in summer 2022.

The ZSL team gave a presentation to the London Recorders' Day at the Natural History Museum. This summarised all the London based citizen science work by ZSL and showcased the Crane SWC programme.

ZSL's annual forum for citizen scientists across London, in November 2022, featured the Citizen Crane work.

4 Overall Conclusions

1. The Citizen Crane programme has been running for eight years.

2. Over this period the team has developed a much better understanding of the ecosystem.

3. The investigations have revealed a complex urban system, subject to many (around 18 recorded to date – see year 6 report for the details) potential categories of impact, varying considerably in condition across the catchment and at different timescales (diurnally and across shorter and longer time scales).

4. The complexities are not fully captured by the EA RBMP assessment system.

5. In general, the ecosystem condition is bad to poor at the top of the catchment, moderate and poor in the middle catchment, and moderate to good in the lower catchment.

6. Despite enormous investment over the last five to ten years there is little evidence of improvements in the ecosystem condition and some evidence of declines in condition.

7. The problems at the top of the catchment appear to be due to chronic water quality issues – a combination of large scale misconnections and cross connections between the sewerage and surface water networks.

8. The SWOP programme is removing large numbers of misconnections but does not appear to be having a significant overall impact on water quality. This may be due to (a) a time lag between the improvements being done and the effects in the river – which could include the effects of sediment, for example in buffering the improvements (b) large number of new misconnections being added to the system and/or (c) cross connections being the dominant cause of water quality problems.

9. The enhanced engagement with a wider part of the TW team (through TW's Crane Interest Group) is intended to support greater engagement with the underlying issues causing these pollution problems.

10. The problems in the middle catchment are largely considered to be a result of poor geomorphological conditions. SWC is starting to design and deliver improvements to geomorphology and monitoring using citizen science.

11. Initial field trials are indicating the potential for moderate scale interventions to have a major beneficial impact on the local ecosystem condition.

12. Further field trials and larger scale implementation projects are being developed that will test the value of geomorphological interventions within the river system, and wetlands and SUDS within the associated drainage system.

13. The inflow from the Upper Duke's River is a major benefit to the condition of the River Crane downstream. There is evidence that the river is increasingly susceptible to low and minimal flows during dry periods.

14. The ecological conditions in the lower catchment are supported by better water quality, and improved geomorphology, in parts of the system at least.

15. Geomorphological improvements have to be supported by ongoing maintenance if the benefits are not going to be dissipated within the space of five to ten years. This finding supports the idea of smaller scale and cumulative improvements, supported by the community at large, with volunteer led maintenance programmes.

16. Citizen Crane is being expanded to support other disciplines where citizen science approaches can add significant value, such as geomorphology (using MORPh) and biodiversity (through water vole monitoring for example).

17. This approach is supported by a wider part of the community through engagement with the community theme of SWC, led by LGOAL and supported by Habitats and Heritage.

18. The Citizen Crane team, through the SWC programme, is reaching out to a wider constituency of stakeholders to explain the issues and help to resolve them in the medium to long term through collaborative working to deliver projects at scale.

19. The design of these projects will be optimised by monitoring, using citizen scientists, to understand their benefits and the maintenance requirements to ensure they continue to deliver in the long term.

20. The engagement of the wider public is essential to for example; (a) help ensure that improved ecosystems are respected and endure for the medium to long term and (b) spread the word about actions that can cause pollution –such as misconnections, disposal of waste to surface drains and fat to the sewerage system.

21. A further and more fundamental reason is that the public, through one means or another, will be funding much of the improvement works proposed. It is therefore essential that they understand and support these works and can appreciate their value. This work is only just starting and needs to be greatly expanded to reach a significant proportion of the 650,000 catchment based population.

22. The SWC programme is intended to deliver Good Ecological Status to the entire Crane catchment by 2030. In the words of the Citizen Crane team this would deliver "*an urban river corridor teeming with wildlife and unconstrained by pollution, serving as a vital community resource where people can connect with nature and improve their wellbeing*".

23. The Citizen Crane programme has shown that improvements are possible, at least at a local level. However, despite significant effort to date, there have been no significant large scale beneficial changes achieved to date.

24. This speaks again to the complexity and size of the challenge facing the SWC programme and that it is likely to take the full ten years to achieve the objectives set out for it.

The Citizen Crane project is part of a long term programme of work being delivered by the Crane Valley Partnership through the Smarter Water catchment programme and associated projects and initiatives. The project team would welcome engagement with all parties interested in the programme. Contact crane.monitoring@gmail.com for more information.

Working in partnership