Cody Dock Tidal Lea Ecology Report 2021 - 22

GASWORKS DOCK PARTNERSHIP

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Gasworks Dock Partnership

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Thank you to Danesha Perryman who was an invaluable Environment Assistant, and all the passionate volunteers who have worked with us over the years, especially Khadijah Patel, Chloe Duffin, Simon Veal, Robbie Judkins, Karina Townsend, Frankie Robertson, Laura Watterson, Josiah Burdsall, Paul Day, Richard Elkan, Vanessa Levrat, Zainab Zeb, Ron Harris, Lori Chiriac, Lee Ellwood, Emily Jones, Paul Nebel, Milly O'Connor, Zoe Tsavdarides, Sharon Prince and Ross Baker.

Comments and Testimonies

"The Environment and Ecology volunteer programme at Cody Dock is a fantastic example of a community-led biological recording and monitoring project. Projects like this provide vital evidence to support local nature recovery. Importantly, the project also shares its data through the NBN Atlas, the UK's open repository of biodiversity data. This ensures that every one of the wildlife records from Cody Dock is available for conservationists and researchers to reuse, both in the UK and globally, for the benefit of nature. The NBN Trust is proud to be involved in this inspirational project."
Sophia Ratcliffe - NBN Atlas Data Manager for National Biodiversity Network Trust

"Cody Dock is a much-needed haven for people and wildlife - and represents a remarkable transformation from an unloved, unused site. Seeing what the team there has already done - and plan to do - is truly inspiring and shows what can be achieved for urban nature when a community comes together with a mission in mind. The impact of projects like this can far outweigh their size and we need more of them so that people and wildlife can thrive side by side in our cities."
Claire Sharrock - Assistant Producer, Silverback Films for The BBC Natural Histories Unit

"Cody Dock is an incredible community space for people and nature, and it is a pleasure working with them! We need more projects like this all across London National Park City to create an urban environment where everyone can thrive."
Floree Zama-Neagra - Ranger Programme and Community Manager for London National Park City

"Driven by the people power of volunteers and the needs of the local community in response to the impacts of climate change, this project provides sustained activity, creating a deep impact for the wellbeing of its neighbourhood and its inhabitants."
Hilary Jennings - Director of Happy Museums (for Culture Health and Wellbeing Alliance Awards)

Abbreviations

BDS - British Dragonfly Scheme
BCT (I) - Bat Conservation Trust
BCT (II) - Bumblebee Conservation Trust
BTO - British Trust of Ornithology
CSEC - Citizen Science and Environment Conservation
GDP - Gasworks Dock Partnership
NBMP - National Bat Monitoring Project
NBN - National Biodiversity Network
SINC - Sites of Importance for Nature Conservation
SSSI - Site of Special Scientific Interest
STW - Sewage Treatment Works
UKBAP - UK Biodiversity Action Plan
UKBMS - UK Butterfly Monitoring Scheme
ZSL - Zoological Society of London

Contents

The structure of this report:

In Section 1 and 2 we aim to discuss the baseline, the history and the state of our local area prior to work beginning. Review and list historic data and previous work carried out by GDP. We also review the challenges that the local environment faces.

In Section 3 we review our work programmes, setting out a baseline, detailing work carried out and summarising the findings of each project.

In Section 4 we look ahead to the future of the project, how it will be sustained, its goals and conservation targets.

In Section 5 we conclude our work and discuss the importance of work like Cody Dock's Citizen Science and Environmental Conservation project.

In Section 6 we offer guidance and best practice from our learning in the form of recommendations. We also detail the importance of transformative biodiversity governance in cities.

Executive Summary

This report aims to support local authorities, developers and residents in the future planning and development of the local area around the Tidal River Lea. This project and its findings can be used as a reference tool for developers to mitigate adverse impacts from future works, and to create conservation targets for their sites. It is also offered as a resource to support authorities' at a local and regional level when drafting biodiversity action plans.

Cody Dock is based in Newham, a borough with one of the lowest proportions of green space in London. Though long forgotten due to its past inaccessibility - the Tidal Lea and its surroundings are a valuable source of natural heritage that GDP's environment programme have been helping to bring back to life. This report illustrates the remarkable levels of biodiversity we have found in and around the Tidal Lea, and will put forward recommendations that can be enacted by stakeholders to ensure the continued protection of this incredible environment.

We have engaged community members in over 3000 hours of environmental monitoring and environmental restoration of the tidal Lea. With funding from the Green Recovery Challenge Fund, we have been able to complete over 1200 volunteer sessions consisting of monitoring, conservation and nature education. We have vastly improved data availability for this area by contributing to national databases, and studying a previously underrepresented environment.

We have recorded over 200 species of birds, mammals, plants and invertebrates in and around the Tidal Lea. This is made up of over 2700 records added to national databases and describes the presence of 38 threatened bird species, 37 globally declining species and 30 London Priority Species. The abundance of threatened and declining species here reinforces the importance of protecting the River Lea and its surroundings as a meaningful section of green corridor through the densely populated urban centre we live in.

We have only just scratched the surface, it is critical that this work continues. The records we have made so far are an ecological baseline, created by around 600 volunteers over the course of a year. We are discovering new species all the time, and monitoring the populations present here over time will help us to protect them in the future. The project has big plans for the future, creating, restoring and conserving habitats for the species that call this place home.

Data collection and conservation actions on the Tidal Lea is time critical in the face of rapid development. As the Tidal Lea bears the addition of approximately 50,000 new homes, 5 new bridges and extra pressures including habitat loss and an increased footfall, it is vital that we acknowledge and protect the biodiversity that has made this area attractive for development in the first place. Stakeholders must work together so that people and nature can thrive, in coexistence, rather than work against each other.

Recommendations for the Lower Lea Valley; small actions can have large impacts

- Creation of a wildlife-friendly lighting strategy for the River Lea

- Incorporate ‘Estuary Edges’ techniques, recreate lost wetland habitats: using floating reedbeds, living river walls, and protect the river by reserving the river bank for green infrastructure, parkland and riparian habitats
- Nurture the wild! Allow wildflowers, native trees and shrubs to grow, and support them with wildlife friendly management practices
- Build for wildlife: homes for birds, bats and bugs are easy and valuable additions
- Support the monitoring of your local river and biodiversity

Transformative policy; follow and innovate new policy ideas

- Collaborate with community groups and land-owners to create joined up efforts for nature
- Increase engagement with underrepresented communities in nature conservation action
- Recognise nature's contribution to people and incorporate spaces for people and nature together

Without the work of GDP’s Environment and Ecology Team, species data would have remained unrecorded, putting biodiversity and the local environment at risk. We could not have carried out a project of this scale without the generous support of the Green Recovery Challenge fund.

Ben with our volunteers after a community litter pick event during Great Big Green Week.

Volunteers after a successful river clean-up and training session.

Introduction

Cody Dock, home of the Gasworks Dock Partnership, is situated in the heart of a historical industrial estate and borders the River Lea in Canning Town, East London. The site has seen rapid land-use change and development over the last hundred years, changing from an active gasworks, to fly-tipping dump, and finally to a thriving community hub. This part of London has historically received little attention, from investors and scientists alike, resulting in an area of low economic income and poor access to nature [1]. As there is little evidence of ecological surveys on this section of the River Lea or its banks earlier than 2012, it was previously assumed to be of little ecological value, especially as the River Thames itself was categorised as biologically dead as recently as 1957 [2]. However, spending any amount of time on the River Lea quickly proves that to be false, as almost every visitor is shocked at the level of biodiversity they are able to observe.

The gap in ecological knowledge of the Lea and the surroundings of Cody Dock, both scientifically and within the local community, is what the GDP environment team aims to address. With groups of community volunteers, we conduct regular surveys of the local biodiversity, including birds, mammals and invertebrates, both terrestrial and aquatic. We have designed and conducted our own independent surveys (ie. of the intertidal mudflats), and contributed to national citizen science initiatives such as the Bat Conservation Trust's National Bat Monitoring Programme (NBMP).

Recording this information has brought a number of benefits. Firstly, we are helping to fill a gap in the national biodiversity database for this locality. Our data is fed into national databases such as iRecord for the NBN Atlas, and BirdTrack for the BTO; which are resources used to inform scientific research and government policy. We hope availability and access to this information will encourage governing bodies and developers to make the necessary accommodations to protect and restore these underappreciated urban ecosystems. Secondly, we are engaging ordinary people from the local area with a natural environment that has been forgotten for decades. This exposure, and engagement with, nature and community has evidenced benefits to personal physical and mental wellbeing [3,4]. In an increasingly densely populated urban area, green space comes at a premium and must be protected in order to maintain a good quality of life for local residents.

This report aims to summarise and present all the work the GDP environment team have completed with volunteers up until this point, particularly in the last year, during which we have been funded by the Green Recovery Challenge Fund. The report outlines the ecological state of the tidal Lower Lea Valley and reviews the importance of including all sectors of society in the management, monitoring and conservation of urban biodiversity and ecosystems, using the scope of the project and GDP's Green Recovery Challenge Fund work as an example of this.The aim of Cody Dock's Green Recovery Challenge was to set in place a long term strategy of community engagement in Citizen Science and Environment Conservation (CSEC), specifically targeting areas within the Cody Dock study area.

We will further consider the following themes in relation to our work and local area:

- Policy: how biodiversity is considered, protected and improved in cities
- Engagement: how a whole-society approach should be taken when determining actions and considering outcomes that will impact nature
- Urban approach: opportunities for rapidly developing cities like ours to meet GBF targets and address the ecological crisis

We have been working to establish an ecological baseline that can be used to track any changes that may occur over time, as conservation efforts take place in parallel to rapid urban development in the vicinity of our site and along the Lower Lea. In addition, the outcomes of this report can be used to inform best practice management of local green spaces, in order to maximise value to local ecosystems and community wellbeing. We envision the review of data we have collected to be repeated every 2-3 years, to ensure any ecological change is recorded and taken into account as soon as possible.

Our Study Area

a. Local area

Cody Dock is a historic, ex-industrial site in East London that has been regenerated over a period of approximately 10 years to become a hub for the community and the environment. Though the site itself is small, the environment team and our incredible volunteers regularly work throughout around 0.4km^2 of the surrounding land, along roads, throughout the industrial estate and in our local river, the Lea. The figure below illustrates the Cody Dock site relative to its surroundings. Our study area includes places we make regular, weekly visits to such as the River Lea, Memorial Park, Cody Wilds and the industrial estate - and also irregular visits to sites further afield: Channelsea, Three Mills, and the derelict Bromley-by-Bow Gasworks (Fig. 1).

Figure 1 - The study area for the Environment Team at Cody Dock: Cody Dock site is visible as well as (A) River Lea, (B) Wildlife Corridor, (C) industrial estate, (D) Memorial Woods, (E) Bromley-by-Bow Gasworks, (F) Three Mills, and (G) Channelsea.

The development of Cody Dock and the wider area follows a period of long term vacancy, due to the closure of many of East London's historic industries, including gasworks, ship building, chemical works and iron works. Local land use remains predominantly industrial,

containing distribution services and waste management. Following the Olympics 2012, sites along the Lower Lea have been catalogued into a long term strategic plan to introduce large scale residential development, particularly along the Tower Hamlet's bank of the Lower Lea. This change in land use has the *potential* to improve the area's environment and community; whilst offsetting any negative impacts on biodiversity through loss of habitat. However, until now reduced disturbance to the local environment including the tidal river has been an encouragement to wildlife making this area their home, and has also allowed for the succession of post industrial habitats into open mosaic habitats and scrubland. The development of these sites is likely to have had a significant impact on biodiversity already, and may continue to contribute to biodiversity loss, if outdated historic data sets are used to inform planning.

Our work so far has been considerate of statutory and non-statutory designations, protecting nearby natural spaces. These are indicative of potential for biodiversity by their offering of green infrastructure. Different levels of protection are offered by each designation, of which there are a number of in the immediate vicinity (full list available in Appendix 2.1).

b. History

i. Natural History

The River Lea originates in the Chilterns, and runs through Luton, Hertford, Tottenham, joining the Thames at the boundary of Poplar and Canning Town. Up until around two hundred years ago, the floodplain of the river would have formed an extensive marshland across the district of Essex, for which the Lea formed the western boundary, as seen on a map of the lower Lea from 1761 (Fig. 2). This saltmarsh habitat provided conditions for halophytic plant species, juvenile fish, breeding birds and a diverse array of invertebrates.

Figure 2 - Map of the Lower Lea Valley from 1761, showing the marshes to the west and east of the river, and industry beginning in Bromley-by-Bow. Publisher: John Rocque.

ii. 1830's - Early 2000's

Industrial revolution

The pressures and impacts of the industrial revolution on the local ecosystem, although not well documented, were significant. Drainage of the marshes, channelisation and dredging of the river reduced the available habitat for species dependent on wetlands. This land-use change likely led to the local extinction (extirpation) of species, and contributed to national extinction of iconic species requiring larger range and distribution, such as the common crane, *Grus grus*.

> *'From an environmental or social perspective the marshlands in the Lower Lea Valley and Thames estuary were not an ideal location for rapid urban expansion. The speed and scale of the industrial development completely transformed the environment and severely damaged the River Lea.'*
>
> - West Ham and the River Lea: A Social and Environmental History of London's Industrialized Marshland, 1839–1914. Clifford, J. (UBC Press, 2017).[5]

The industries that developed throughout the 19th century were also responsible for large quantities of unregulated pollutants entering watercourses. These contaminants were byproducts of 'necessary' industrial processes, which fuelled the growth of London and expansion of the economy. Although uses were found for some of these products in the case of the Bromley-by-Bow Gasworks, inevitably there were solid and effluent byproducts that were released into the environment.

Post-industrial legacy

The legacy of the Lower Lea Valley, an environment consisting of disused sites, no-go areas and inaccessible routes, created opportunities for post-industrial habitat succession. These 'wastelands' have been shown to have significant value to urban biodiversity, holding unique assemblages of species and high levels of species richness. [6] Some locations present examples of 'new' primary successional habitats, with unique ecosystems, and become a refuge for urban wildlife. [7]

> *'Urban and post-industrial ecosystems can become a refuge for species and can increase the biological richness of cultural landscape (Tropek et al.,2010). That makes them among the most important ecosystems on Earth.'*
>
> - Hodecek, J. *et al.* (2015).

Satellite imagery shows predominantly industrial activity and brownfield sites on land surrounding the Lower Lea until 2006 (Fig. 2). Fig. 2 illustrates the number of brownfield sites present in 2006, that are in 2021 redeveloped, or have planning permission for redevelopment.

Figure 3 - Land use around the Lower Lea in (a) 2006, and (b) 2021. Red indicates active industry, dark blue indicates brownfield sites and light blue indicates redevelopment either in planning, progress or completed.

This loss of brownfield sites due to redevelopment is another blow to urban-dwelling species who have suffered devastating loss of their natural habitat due to urban expansion. Mitigation for this habitat loss by private developers is possible if access to the right up-to-date information is available.

iii. Post-Olympic Legacy

The development of the Olympics site was a long term legacy plan which introduced new landscapes, habitats and parkland to the Lower Lea Valley, as well as amenities and leisure facilities. The 'Lea River Park' connects Cody Dock with Canning Town and routes through East London. This in itself makes up the final section of the Lea Valley Regional Park, which aims to link the inner-city to the countryside through a "continuous chain of open space" [8]. The section of the LRP from Cody Dock to Bow Locks was named 'Cody Wilds' with the aim of reconnecting the local community with the previously inaccessible river and its surroundings.

The investment and improvement in access brought about by the Olympics has culminated in the redevelopment of 40 sites along the LRP that has already brought a higher level of engagement with the river by the community. This redevelopment is described as an important tool for addressing long-term environmental contamination that occurred as a result of its industrial past, however increases in living and working populations will ultimately also result in increased pressures on blue and green spaces. [9] Whether it is approved of or not, the Olympics sparked a period of rapid change for the people and wildlife of East London.

Baseline

a. Historic data

Biodiversity has historically not been well-recorded in and around the River Lea, largely due to a lack of access to the heavily industrial area, and a misunderstanding of the value the data collected would represent. Lack of human access may have given people the impression that there was no biodiversity worth recording, where the opposite was actually true, and the lack of disturbance allowed wildlife to thrive. Here we describe the data that was available and accessible to us, previous to the beginning of our own wildlife survey programmes.

Local historic records available on the NBN atlas include species records from data partners including the environment agency, GiGL, Peoples Trust for Endangered Species and other taxon specific record holders. Regular and extensive biodiversity recording along the Lower Lea Valley has not been undertaken prior to the work of Cody Dock. This has resulted in a low quality of environmental impact assessments and potential for representative biodiversity net gain on regeneration planned as a result of the post-Olympic development strategy. Data available to local authorities and corporations falsely demonstrates that large scale land- use change would result in low ecological impact. This is based on data available through NBN Atlas that shows less than 20 biological records along the lower lea before 2012.

Fish records 1984 and 1991

In 1984 and 1991, 11 records of 7 different fish species were sampled from the River Lea from a variety of sources including the Environment Agency; the Protected And Invasive Species Records; and the Database for Freshwater Fishes Atlas.

Table 1 - Historic fish records from 2 points along the tidal River Lea.

Accepted name	Common name	IUCN cat. (global)	Population trajectory	UK BAP	London Priority Species
Anguilla anguilla	European eel	CR	Decreasing	Y	P
Platichthys flesus	Flounder	LC	Decreasing	NL	P
Osmerus eperlanus	Smelt	LC	Unknown	Y	N
Mugilidae	Mullet sp.	-	-	NL	N
Gasterosteus aculeatus	Three spined stickleback	LC	Unknown	NL	N
Rutilus rutilus	Roach	LC	Unknown	NL	N
Leuciscus leuciscus	Common dace	LC	Unknown	NL	N

Species record from TQ383819 1984 & 1991[10]

GDP Preliminary Ecology Report

In 2017 GDP compiled a Preliminary Ecological Appraisal (PEA) with London based specialists. The appraisal identified 6 target notes and reviewed the feasibility and evidence of UK priority species based on available habitat and presence.

Relevant target notes:

1. Presence and management of native deciduous tree/shrub species.
2. Ephemeral/short perennial plant species, particularly; assemblages that classify brownfield habitat
3. Japanese knotweed
4. Bat roost sites

Protected Species:

Breeding Birds:
The appraisal noted breeding bird activity, however species were not identified.

Bat potential roosts:
3 species were identified onsite, bats and bat roosting sites are protected nationally and globally and all species identified are listed on the London Priority Species list.

Table 2 - Bat species identified in GDP's Preliminary Ecological Assessment.

Accepted name	Common name	IUCN cat. (global)	Population trajectory	UK BAP	London Priority Species
Pipistrellus pipistrellus	Common pipistrelle	LC	stable	NL	P
Myotis daubentonii	Daubenton's bat	LC	stable	NL	P
Nyctalus noctula	Noctule	LC	unknown	NL	P

Bat species identified in GDP PEA 2017 [11]

Invertebrates within 2km of site:
3 species were identified within proximity of Cody Dock that are listed on the UK Biodiversity Action Plan and on the London Priority Species list, including the Stag beetle which is near threatened globally.

Table 3 - London Priority Invertebrates Identified within the proximity of Cody Dock in GDP's Preliminary Ecological Assessment.

Accepted name	Common name	IUCN cat. (global)	Population trajectory	UK BAP	London Priority Species
Lucanus cervus	Stag beetle	NT	Decreasing	Y	P
Brachinus sclopeta	Streaked bombardier beetle	-	Unknown	Y	P
Tyria jacobaeae	Cinnabar moth	-	Unknown	Y	P

Invertebrate species identified within 2km of site GDP PEA 2017 [11]

b. Challenges

Ecological Connectivity

In cities green and blue spaces are key for biodiversity conservation [12]. Connectivity is described as structural and functional continuity in space and time, in this landscape level habitat connectivity is important in regulating distribution, range and population genetic variation [12]. Loss of habitat in urban developments reduces the connectivity of remaining blue/green spaces and corridors. Along the Lower Lea small habitat pockets are connected by the river and linear vegetated strips, such as grass and hedging. This provides a limited capacity for species to populate and reduces local ecosystem functionality. This has a higher impact on species which have localised ranges, particularly invertebrate populations.

Brownfield sites, as previously discussed, offer unique early successional habitats which can support rare and threatened species. Site features such as disturbed ground, temporary pools, stands of ruderal vegetation all key components of the value of these sites. These sites are being lost locally to redevelopment, see appendix 2.12 for Lea River Park Development Plan.

Water Pollution

Water management infrastructure is some of the most costly infrastructure. [13] Management of these infrastructures are crucial for the health and safety of the population. In an ecological context water quality and physical habitat are critical drivers of improvements to ecological status of rivers. Historically focus has been less on the relationship between physical habitat and biodiversity and more focused on pollution on as an indicator.[14] Furthermore riparian habitats/floodplain environments are less widely studied than aquatic environments and typically these zones are often the ones lost to the modification and regulation of rivers for flood defence.[14] The relationship between the physical and biological in river habitats provides key functional mechanisms which improves viability and biodiversity index of the river, this is why the need for integrated eco-hydromorphology, [14] where design and management of rivers integrate these core pillars of the WFD.

The river is heavily modified and has lost much of its natural habitat. A good ecologically functioning river provides ecosystem services such as water purification and nutrient cycling [15], therefore the reduction in physical habitat in urban settings has a direct impact on the river's overall chemical index. Over time urban expansion along rivers has increased levels of run-off, number of outfalls, and harmful sources of pollution. As we discussed the Lea was subject to much of this ‘urban infringement’. With removal of the natural floodplain which features ‘creeks’ or channels for drainage into the main watercourse that were replaced with outfalls, directing run-off of an industrial area into the river. The river is listed in a Nitrate vulnerable zone NVZ

Overmanagement

Overmanagement of greenspaces through landscaping practices such as mowing, pollarding and over-trimming hedge rows, can reduce biodiversity. These management practices are being reviewed as these marginal and amenity habitats are better understood and the value they offer for nature conservation. Local authorities across the UK are following the lead of PlantLife in the pledge for a 'No Mow May' in an effort to encourage our public amenity grassland verges, playing fields and other grassland zones to promote flower-rich meadow habitats, that can support wildlife associated with these habitats, particularly pollinator species.

Litter

A common local problem, the tidal range of the river brings in litter from downstream increasing the spatial range of sources of litter. Litter in the river builds up in vegetated areas and also breaks down into micro-plastics which enter the food chain. In the surrounding area there are fly-tip hotspots which damage the woodland habitats, degrading the value of these sites and potentially creating the argument for removing these spaces altogether.

Air Pollution

Air pollution has a varying impact on species and habitats, both directly and passively, through processes such as acidification of soil and water. The impacts of air quality are hard to monitor as they can be species specific and pollutant specific interactions. These can affect biological functioning, toxicity accumulation, morality, growth and reproduction and abiotic ecosystem characteristics, which may influence communities, composition and competition. [16]

Invasive Species

Invasive non-native species are species which enter an ecosystem and disturb its communities, through either damaging, out competing or removing a native species from its niche The British Ecological Society has reviewed the impact of non-native species on native UK biodiversity and summarised that 'UK Biota is continental in nature', and therefore the introduction of potentially harmful species, is unlikely to impact a species' entire range. [17] However on a local level these species can be responsible for significant disturbance, causing extirpation of species and offsetting the balance of the local ecosystem. There are 9 'high profile species' that have been identified or are a possible threat to the Tidal River Lea.

Not all non-native species pose an innate threat to the natural biodiversity of an ecosystem .[17] In some cases species can be used to restore and conserve, benefits can include providing habitat, food, or can be catalysts for extinct ecosystem engineers and provide services. [18] In the Thames and subsequently the Lower Lea there has been a rapid colonisation of the golden clam *Corbicula fluminea* from 2004 onwards, to the detriment of native mollusc populations.[19]

Individuals can filter up to 1 litre of water per hour and reach high densities of hundreds of thousands per sqm.[20] Their ability to filter and alter the chemical composition of water makes them of interest as bioindicators of environmental impacts in freshwater ecosystems. This also provides the potential for ecotoxicological studies of bioaccumulation and amplification. [21] *C.fluminea* also provides shelter and substrate for other species, food resources for local species, can reduce the eutrophication process, increase water clarity which can enhance submerged vegetation cover. Generally the negative impacts of the species outweigh the positive impacts, and are interconnected, the increase in food resource, ultimately expose the local biota to the filtered contaminants and increases the levels of bioaccumulation. The elevated filtration rate of *C. fluminea* also limits food source to other native bivalve species, and the extreme consumption of food source can result in large quantities of organic waste 'biofouling', which increase levels of nutrients in the waterbody. [21]

On a local scale the presence of C.fluminea is likely to have put extreme pressure on native mussel species. ZSL's study of C.fluminea's impact on species occupying the upper estuary of the Thames including: Depressed river mussel, Pseudanodonta complanata; Duck mussel, Anodonta anatina; Painter's mussel, Unio pictorum; Swollen river mussel, Unio tumidus, concluded reduction of abundance of these species over time and an increasing population and density of C.fluminea. [22] However there are few records of native 'brackish' tolerant of mollusc along the middle estuary and its tributaries including the river Lea, leaving little indication of C.fluminea's impact on bivalve species in the Lower Lea Valley. An environment agency report, after 1996, describes invertebrate species occupying the estuarine zones of the Thames, of the stated 350 species, a 'minority' are able to survive the middle zone, with its fluctuations in salinity, [23] perhaps providing the optimal conditions for a successful colonisation of golden clam.

Table 3 - Local high profile non-native species and their impacts.

Accepted name	**Common name**	**Potential benefits**	**Negative impacts on native biodiversity**	**Detail**
Corbicula fluminea	Golden clam	Water filtration (increased clarity - increased light penetration), provision of substrate, potential bioindicator	Competition, bioaccumulation, alteration of water chemistry	Occupy habitat of native mussel species
Dikerogammarus haemobaphes	Demon' shrimp	-	Competition, predation	Out compete native species, predate invertebrate 'river-fly' populations
Eriocheir sinensis	Mitten crab	-	Damage to habitats, diseases, competition	Destabilise sediments, transmission of

				disease to native crustacea
Pacifastacus leniusculus	Signal crayfish	-	Damage to habitats, disruption to food web, diseases, competition,	Destabilise river banks increasing flood risk and silt load, displacement of species such as water vole, out compete native species, feed on native flora and fauna
Harmonia axyridis	Harlequin ladybird	-	Competition, disease, predation, disruption to food web	Out compete native species, over consume food supply, predate other species larval stage
Thaumetopoea processionea	Processionary oak moth	-	Damage to habitats (Quercus sp.), threat to human and animal health	Feed on leaves of oak trees, increase vulnerability to other pests and disease. Can cause extreme irritation and breathing difficulties.
Impatiens glandulifera	Himalayan balsam	-	Damage to habitats, ecosystem disruption, competition	Die back along river banks leaves bank vulnerable to erosion, its seeds disperse quickly and over take native species
Reynoutria japonica	Japanese knotweed	-	Competition	Spreads quickly through rhizomes and out competes native species
Heracleum mantegazzianum	Giant hogweed	-	Damage to habitats, competition, ecosystem disruption, threat to human health	Creates a monoculture, die back along river banks leaves bank vulnerable to erosion

Work Programmes

Through DEFRA's Green Recovery Challenge Fund, GDP has been able to record, survey and monitor the Lower Lea Valley, input into national biodiversity datasets and begin to inform conservation and restoration of the local area. This work was carried out with volunteers from the local community, schools, universities and businesses, and can be seen as an example of a whole-community approach to nature conservation, supporting individuals' investment and contribution to the local area.

We have described our main project areas below:

- Biodiversity monitoring
- Habitat creation
- Water quality monitoring
- Case Study: Bromley-By-Bow Gasworks

a. Biodiversity Monitoring

Though Cody Dock is not a large site, we work within the various gardens and raised planters to create a biodiverse, species-rich environment from the bottom up. The team ensures that habitat creation and monitoring occurs not only on our site but in the surrounding area, along the river path and within the industrial estate. Our study area encompasses around 1km^2 of the local vicinity (Fig. 1), which includes riparian, woodland, and industry-peripheral habitats. Cody Dock forms a stop along the Lea Valley Park green corridor, which connects the Lea Valley Park with the Olympic Park and follows the river all the way down to the Thames. This is an essential wildlife corridor for birds, fish and mammals alike, who use the river to traverse the dense urban landscape and reach oases like the Walthamstow Wetlands for breeding or roosting.

By focusing on different groups of fauna in each section below, we hope to outline the information we have, and the work we have already completed to help each one. This may include historical data, anecdotal data and data we have collected throughout the existence of Cody Dock, particularly in the last year. We have not mentioned several groups for which we have not had a particular focus so far, for example fish or aquatic plants, and we have not included ornamental plants from our gardens in our dataset or analyses.

i. Birds

Baseline

Prior to volunteer activity at Cody Dock, data for bird populations along the Lower Lea Valley was limited and undocumented. In 2017, GDP began recording the birds seen around the site by taking part in national citizen science events such as the RSPB Big Garden

Birdwatch, throughout which we identified around 30 species. We have now recorded 81 species of birds present within our study area surrounding Cody Dock, which includes the Memorial Woods, The River Lea, Three Mills and the old gasworks site at Bromley-by-Bow.

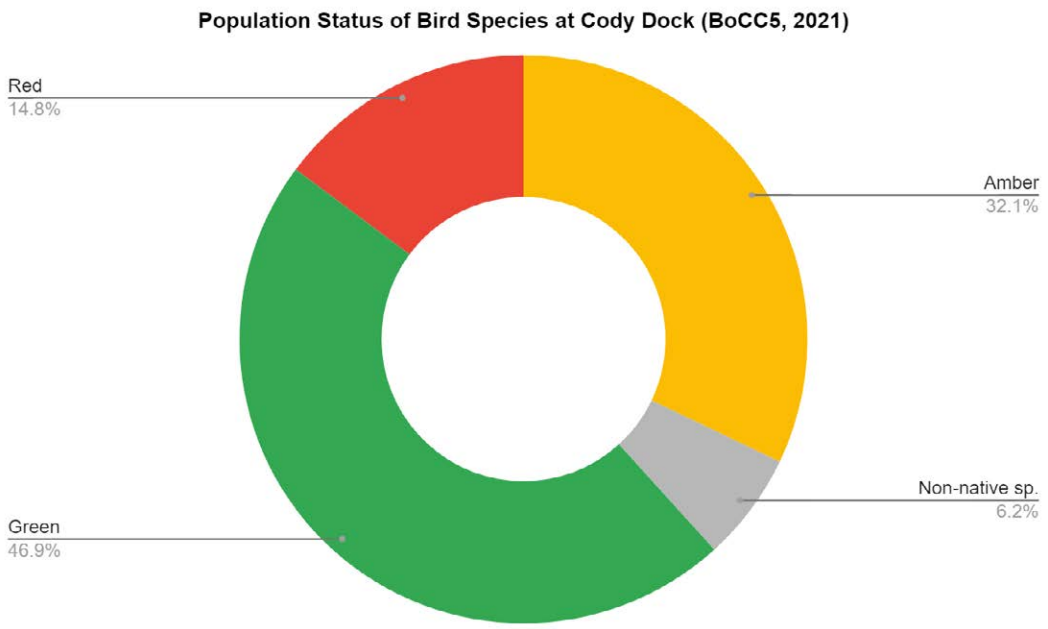


Figure 4 - Population status of all 81 bird species found within Cody Dock and in its surrounding areas between January 2018 and April 2022, full list available in Appendix 2.1. Population status according to BoCC5, 2021.

Our Work

In order to conserve the bird species within our local area, we are continuously monitoring populations, particularly along the River Lea. We contribute to national surveys in order to share our data as widely as possible. In addition to monitoring, we have created new habitats that will allow breeding birds to roost and places for migratory birds to feed by building nesting boxes and planting native vegetation. We involve volunteers in every stage of this programme, which has the added bonus of personal development via learning new skills such as identifying bird species, and technical skills like learning how to use new methodologies and equipment.

We carry out regular bird surveys in our study area in the following locations:

- Transect of the River Lea from Cody Dock to Bow Locks, occasionally to Three Mills
- Point Count Survey (PCS) of the Memorial Woods
- Point Count Survey (PCS) of Cody Dock site
- Transect of industrial estate from Cody Dock

In addition to our regular year-round surveys, we have applied the method of the following seasonal surveys:

- Breeding Bird Survey (BBS), BTO
- Big Garden Birdwatch (BGBW), RSPB

Regular monitoring allows us to track the variation in populations of birds present in the area throughout the year, and will eventually allow us to examine how it might be changing over time on a localised level. On a broader scale, all the data from these surveys are uploaded to BTO's BirdTrack open database, which is then pooled into the national database to inform research and keystone reports such as BoCC5.[24] These reports are key to informing our understanding of the conservation status of birds across the country, which will affect what mitigation measures we put in place.

Findings

As a habitat which has been assumed to be at best unimportant, and at worst actively harmful to wildlife, we have found that 46.9% of the bird species supported within our study area are threatened in some way. [24] 14.8% of the species recorded are red-listed, which means they have had a severe decline in the UK breeding population, or reduction in breeding or non-breeding range. These species that are categorised as 'amber' or 'red' in the BoCC5 must be prioritised for habitat protection and conservation work. This makes our work advocating for the protection of our locality all the more important, as brownfield sites along the banks of the Lea and throughout Newham and East London are being rapidly developed.

Four bird species found here have Species Action Plans as recommended by the UK Biodiversity Action Plan: Linnet, song thrush, reed bunting and spotted flycatcher. An additional three species are categorised as globally 'near threatened' on the IUCN RedList: northern lapwing, redwing and oystercatcher. Though not yet breeding in the area, the sight of threatened migratory birds such as redwing and spotted flycatcher indicates potential for future colonisation of suitable habitat here. 15 species that have been recorded within the survey area are London Priority Species, which means they have been chosen as priorities for conservation in London due to being threatened on a larger regional scale, or are particularly declining within Greater London, planning decisions must take these into account (see appendix 2.2). London Priority Species found within our study area include such notable species as; swift, black redstart, kingfisher and peregrine falcon.

Mute swan, *Cygnus olor* on the salt marsh at Channelsea.

ii. Bats

Baseline

Prior to 2021, the only information about the possible presence of bats in the vicinity came from the anecdotes of local residents, and the GDP Preliminary Ecology Assessment. The PEA only assessed the Cody Dock site itself, and recorded the presence of three species of bat, mentioned in the historic data section of baseline. We knew there was likely to be additional activity around the industrial estate, on the river and particularly in the wooded area in the Memorial Woods, which prompted us to use a multi-pronged method to find out more about them.

The plight of bats as a group was an important reason for us to attempt to collect more information about them. All bat species have been protected across the UK since 1981, however threats to their existence persist. Loss of natural habitat through construction and renovation have reduced the availability of roosts, as well as feeding grounds. Additionally, the widely known crash in the abundance of insect life across the globe has had a domino effect through the food web, including bats, which are solely insectivorous in the UK. [25,26] We now know that bats are also affected by urban light pollution, which fragments their roosting and foraging habitat, and affects their ability to feed during the night.[27] Artificial light can also delay emergence times for bat species which are light-avoidant, particularly *Myotis* species such as the Daubenton.[28] All London boroughs should have species action plans which are created in an effort to combat their decline.[29]

A 2008 survey by boat along the Thames and Lee Navigation showed light spillage onto the water greatly reduced bats use, while completely dark patches were highly diverse in bat life [30]. We want to ensure that the species that currently live and forage within the River Lea catchment will be able to thrive, throughout the development that is taking place across the area.

Our Work

We used both passive-acoustic detection and active surveying to identify bat activity in and around Cody Dock throughout 2021. By placing AudioMoth passive-acoustic detectors out within the survey area, we found the presence of multiple species of bats roosting and feeding on-site, along the river, and in the Memorial Park. Analysing audio recordings by narrowing the frequency band to those which are emitted by bats allowed us to identify the bat signatures and estimate the identity of the species for each type of call that was detected. This process was carried out using Kaleidoscopes Auto ID software, and was followed up by examination of ID hits, for verification.

We began a monthly general bat survey on the Cody Dock site in the summer of 2021, with guided novice volunteers gathering data on presence of different species from April to September. We ran a short training session at the beginning of each survey evening in order to provide background myth-busting information on bats and some context to improve volunteers' understanding about what they were doing and why it is important. Participating in this NBMP citizen-science survey is valuable as it allows trends to be modelled in bat populations over time. [31]

Volunteers on a sunset survey at the memorial park.

Findings

Over the course of the summer, we were able to detect the presence of six different bat species: common pipistrelle, soprano pipistrelle, nathusius' pipistrelle, brown long-eared bat, noctule and Daubenton's bat. Three major foraging hubs were identified: Cody Dock (dock and tree lines); South Crescent and Cody Road and the Memorial Park (Fig. 2). *P. pipistrellus, P. pygmeus and P. nathusii* were found to be the most common species at these sites. *P. auritus* were detected at 2 out of 3 of the sites and *N. nyactula* were recorded using passive acoustic monitoring, but not observed in a 'pass'. The habitats identified as foraging opportunities for bats included: Broad-leaved woodland plantation; well vegetated continuous scrub; standing water; reedbeds; gardens/parkland and rivers and streams. Of the sites that were found to have activity, the following habitats are identified; broadleaved woodland plantation, gardens and standing water. The most significant 'unused' site was the 'Lea River Park' which features 4 of the habitats determined as useful for foraging. Although more investigation is needed, almost no passes were detected during sunset surveys through 2021.

In addition to our surveys, we have built and installed 14 summer roost bat boxes around the industrial estate (Fig. 2). We are unable to ascertain whether they have been inhabited over the past year, as we cannot carry out roost surveys due to a lack of a bat-handling licence.

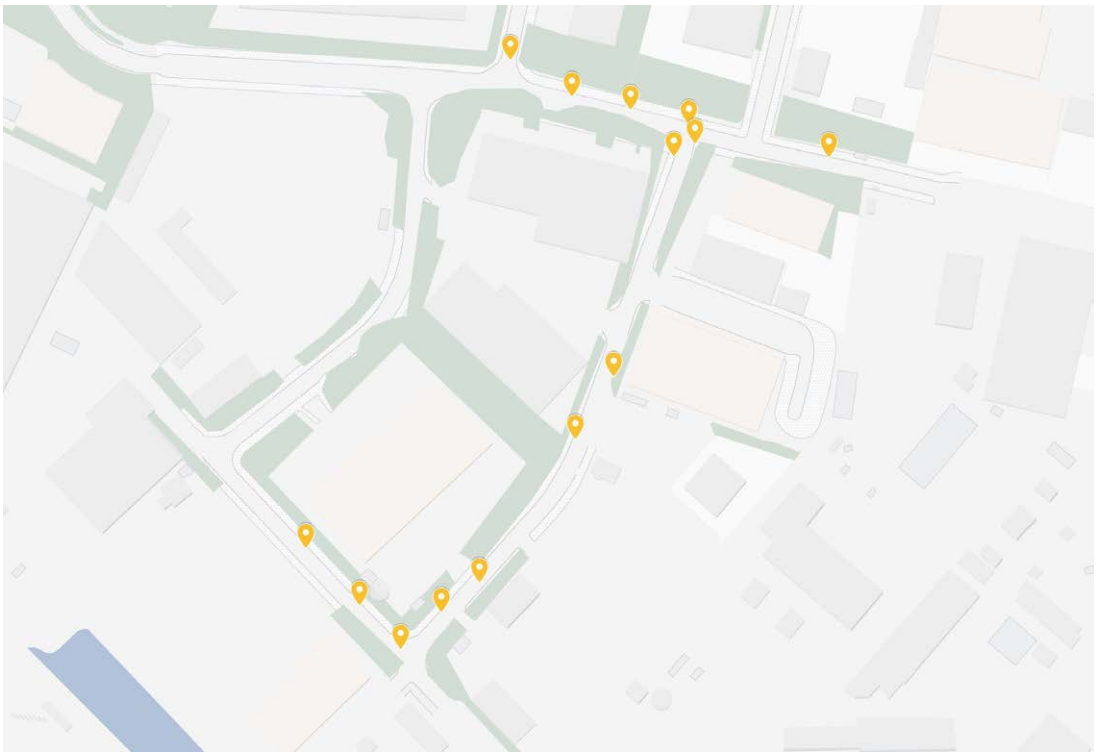


Figure 2 - Map of the Cody Dock study area. Pins indicate the location of 14 bat boxes installed on trees around the industrial estate. (Grid ref: TQ387819)

iii. Invertebrates

Baseline

Across the globe, there has been a massive reduction in abundance and species richness of insects and other invertebrate species. This is not only disastrous for the invertebrates themselves but for all life on the planet. Invertebrates are critical for the function of many ecosystem services such as pollination, pest control, decomposition and nutrient cycling. Without these services, life on earth would likely cease to exist. There has been some work towards valuing these services economically, in order to aid our comprehension of their importance. For example, the services of pollinators alone are valued at around USD 1 trillion globally. [32] Despite their indispensability, the UK has lost an estimated 58.5% of its flying insects in the last 16 years. [33] Identifying the invertebrate species that are present in the local area now and throughout the time Cody Dock exists is key to understanding the health of the rest of our ecosystems.

Invertebrates act as an excellent early warning indicator for poor water quality, where in programmes such as the Anglers' Riverfly Monitoring Initiative (ARMI), a selection of riverfly species are surveyed. These invertebrate species are much quicker to respond to changes in water quality than organisms further up the food chain that are traditionally known to indicate pollution events, such as mass fish death events. By assessing the numbers of these species of riverflies over time we can see when a pollution event has occurred that may not otherwise be detected, and alert the relevant authorities.

London has a high proportion of brownfield sites, which although often ex-industrial, are unique and relatively undisturbed habitats in which biodiversity including insects, can thrive. The rapid and continuous development of this land is reducing the available suitable habitats that have been used as a last foothold for insect populations in the urban sprawl. Though open mosaic habitat is a priority habitat and therefore protected by the NERC Act 2006 and UK BAP, these areas are often earmarked for development to prevent greenfield sites from being built on. Development presents challenges for biodiversity because of the likely loss of habitat, and also the effect of the new development on surrounding areas. The addition of artificial lighting has already been discussed in this report with regard to bats, however nocturnal insects such as moths are similarly negatively affected. High density housing increases the footfall to previously quiet areas, this has expected impacts on levels of noise and air pollution.

Despite these challenges, the London Boroughs of Tower Hamlets and Newham, neighbouring borough and home borough to Cody Dock respectively, are home to populations of two scarce species. Though of a restricted national distribution, the brown-banded carder bee has been recorded by citizen scientists in Tower Hamlets on multiple occasions, which has made them a borough priority species. Similarly, thought to be extinct in the UK for 75 years, the streaked bombardier beetle has now been found on a few brownfield sites in Newham and Tower Hamlets, prior to them being developed. After development of those sites, there is now only one known intact population of the streaked bombardier beetle, close to London City Airport in Newham.[34] This is a London priority

species. While working on ex-industrial and dormant industrial sites such as Cody Dock and the Bromley-by-Bow Gasworks, we remain on the lookout for populations of these species.

Sloe bug, *Dolycoris baccarum* found on plant during bug count survey.

Our Work

Similar to our bird monitoring, we have established regular monitoring of invertebrates throughout the summer months when they are most active. This involves carrying out general invertebrate surveys on established transects and sites which are the same as carried out for the bird surveys (Appendix 2.3, 2.4). We created and ran training sessions for the volunteers who wanted to participate in each survey respectively, to teach them the importance of collecting this data, and some ID tips for the species that occur in the vicinity.

In addition to general surveying, we run surveys to focus specifically on butterflies and dragonflies. Butterflies are tracked through the UK Butterfly Monitoring Scheme (UKBMS) 'pollard walks' and timed site visits; the locations are described in Appendix 2.3. The data we gather for this citizen science survey is sent to Butterfly Conservation, which contributes to reports such as the State of the UK's Butterflies 2015 report by the same organisation.[35] We run the British Dragonfly Survey to monitor the populations of odonata (dragonflies and damselflies) throughout our study area. This national survey is run by the British Dragonfly

Society, who produce annual reports based on their findings. We again follow one transect along the River Lea and carry out a timed site survey of Cody Dock itself (see Appendix 2.4).

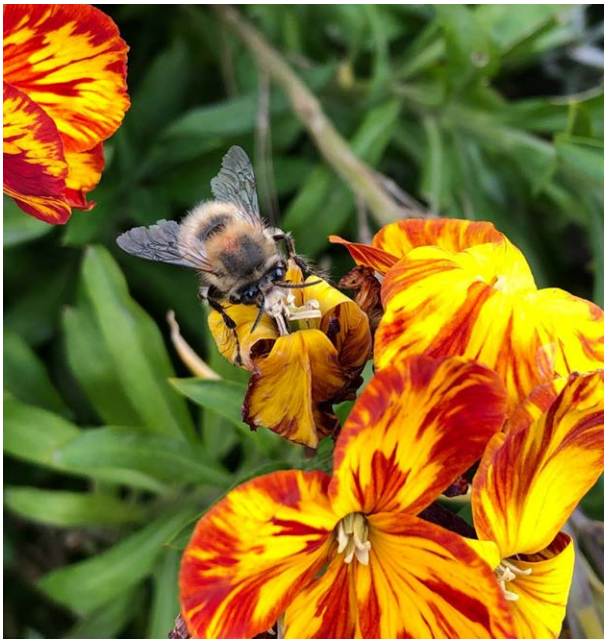
We designed our own primary survey of the intertidal mudflats of the Lea, as there was no information that we could find about invertebrates (or plants) that were present on the mud, save for some research from the Thames estuary from the 1990s. [36] Using our own canoes to access the mudflats, we took a number of volunteers to different locations along the river to take environmental readings, kick samples and mud samples (Appendix 2.5). Using a dichotomous key to identify species, we found a number of oligochaete species, bivalves and gammaridae shrimps. Notably, the invasive demon shrimp, *Dikerogammarus haemobaphes*, and golden clam, *Corbicula fluminea*, were both found - the latter being extensively distributed. A full list of the species we found can be found in Appendix 2.6.

Volunteers taking samples of salt marsh vegetation using quadrat.

In terms of habitat creation and maintenance, we have previously worked with volunteers to create a large bug hotel which is sited on Cody Road on our industrial estate. We work closely with the gardening volunteers at Cody Dock to plant wildflowers and other plants that will be attractive to pollinators. Our new builds all have a green roof in-built which is not only beneficial to the sustainability of the buildings themselves but provide a suitable habitat for open-mosaic species.

Findings

Invertebrate biomass is considered to be one of the main drivers of ecosystem processes. They form a large proportion of animal biodiversity and this makes them a difficult group to study and monitor. This is why focusing on recognisable and well studied groups is common practice in citizen science processes. Overall our surveys recorded 121 species of invertebrates within the study area and this is likely to be a tiny percentage of the community. The following targeted groups are more able to illustrate diversity and could indicate the value of the study area.




Left; hairy-footed flower bee, *Anthophora plumipes,* right; gatekeeper butterfly, *Pyronia tithonus* a London Priority Species.

Bees *Hymenoptera*

There are approximately 270 species of bee in the UK, many are hard to identify, however there are selected groups that are recognisable and with support can be monitored at a citizen science level. Furthermore bees receive a positive community reputation and we have found that people are keen to study them as they are aware of the importance of their role in our ecosystem. 19 species of bee were recorded within the study area this included the shrill carder bee which is decreasing globally and is part of the UK SAP. See Appendix 2.7 for species list.

Butterflies *Lepidoptera*

In the UK there are 60 species of butterfly, butterflies are a fairly easy group to monitor at a community level as they are easily identified and observed. We found that volunteers find that carrying out pollard walks is enjoyable as they are able to easily record the presence of

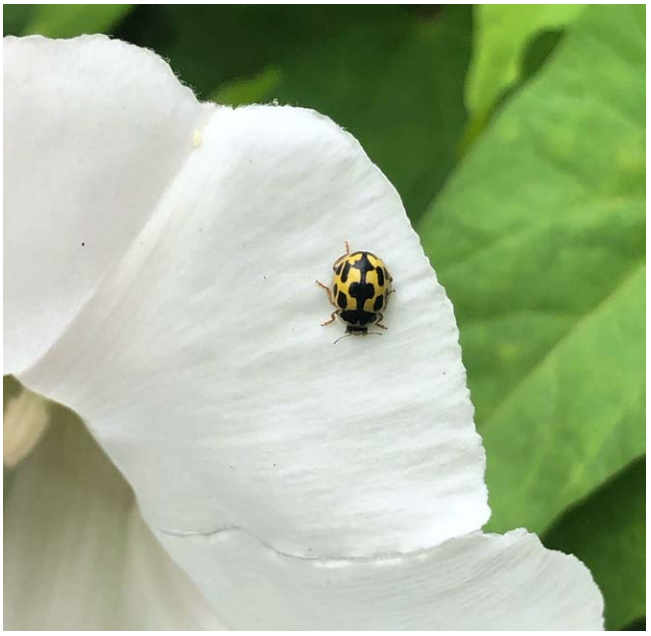
individuals and begin to differentiate between different species. Our surveys have recorded 20 species of butterfly including 3 species on the London Priority List and one species decreasing globally. See Appendix 2.8 for species list.

Dragonflies & Damselflies *Odonata*

The UK is home to 57 species of Odonata, 36 species of dragonfly and 21 species of damselfly. This group is a valuable indicator of quality and availability of water which their life cycles depend on. They are fascinating to study and are a great study focus when working with groups as they are good links between habitat type and use. Our work recorded 14 species within our study area, 7 species of damselfly and 7 species of dragonfly. All currently have a favourable status globally and are not listed within London Priority Species or UK BAP. 2 species are noted to be increasing globally; see Appendix 2.9 for species list.

Ladybirds *Coccinellidae*

There are 46 known resident species of ladybird in the UK. Their connection with gardens and different habitat types helps our volunteers identify and observe them. We recorded 6 native species within the study area and 1 non-native, invasive species, the harlequin *Harmonia axyridis.* This is significant because of the threats they pose to native species, through competition, success and predation. Our surveys noted that they were the most abundant species found, common throughout all habitat types observed. Further work will be carried out to understand and potentially mitigate this. See Appendix 2.10 for species list.



Left; southern hawker, *Aeshna cyanea,* Right; 14-spot ladybird, *Propylea quatuordecimpunctata.*

b. Water Quality Monitoring

Baseline

Nitrogen and phosphorus content in waterways are measured as they are harmful in high quantities, where they can trigger eutrophication (algal bloom and mass fish kill). Previous research by ZSL found that trends in phosphorus content of the Thames catchment is decreasing over time, including in the Lea.[2] This is because of the installation of phosphorus removing apparatus at sewage treatment plants across Greater London. On the Lea this was made particularly evident in 2012 when there was a sudden drop in phosphorus levels in the Lea after phosphorus removal was introduced at a local sewage treatment works. Nitrate levels are still rising across the Thames catchment, where the primary source is industrial and sewage effluent, though in the Lea they have begun to decrease since 2019.[37]

Our Work

Since 2019, we have used basic indicators to monitor the quality of water contained by the dock. The water in the dock comes from storm drains from roads and businesses around the industrial estate and surrounding areas. We mainly monitor two points within the dock, one being the dock outfall, which comes directly from the previously described surroundings, and one at the northern end of the dock next to the reedbed. The reedbed point is more of an indicator of how the sediment at the bottom of the dock has affected the water above it over time, as the dock only occasionally has an influx of water from the river, the majority consists of rainwater. The methods and equipment used can be found in appendix 1.9.

The five outcomes we were able to measure for have been nitrate and phosphate content, pH, conductivity and turbidity. These variables are described in the table below.

Table 4 - Measured variables, their primary sources and environmental impacts.

Measured Variable	**Primary Sources of Pollution in London**	**Environmental Impact**
Nitrate (mg/l)	Industrial, sewage effluent; urban runoff	Eutrophication, upland acidification
Phosphate (mg/l)	Sewage effluent, agriculture	Eutrophication
pH	CO_2	Mass mortality of aquatic life
Conductivity (µS/cm)	Higher temperatures, higher salinity, road run-off, STWs	Naturally variable, solubility of oxygen
Turbidity (mg/l)	Suspended matter: algal bloom, silt, sewage effluent, stormwater runoff	High levels affect aquatic life, ability to photosynthesise

Findings

By monitoring five environmental indicators in the dock over time, we have already noticed some patterns. Although no statistical analysis has been carried out, preliminary findings have indicated a decrease in nitrate and phosphate levels in the dock from March 2019 until October 2021 (Fig. 3). This pattern was recorded at both sampling sites, though was most noticeable at the reedbed site. This could be evidence of a reduction in pollution events over time.

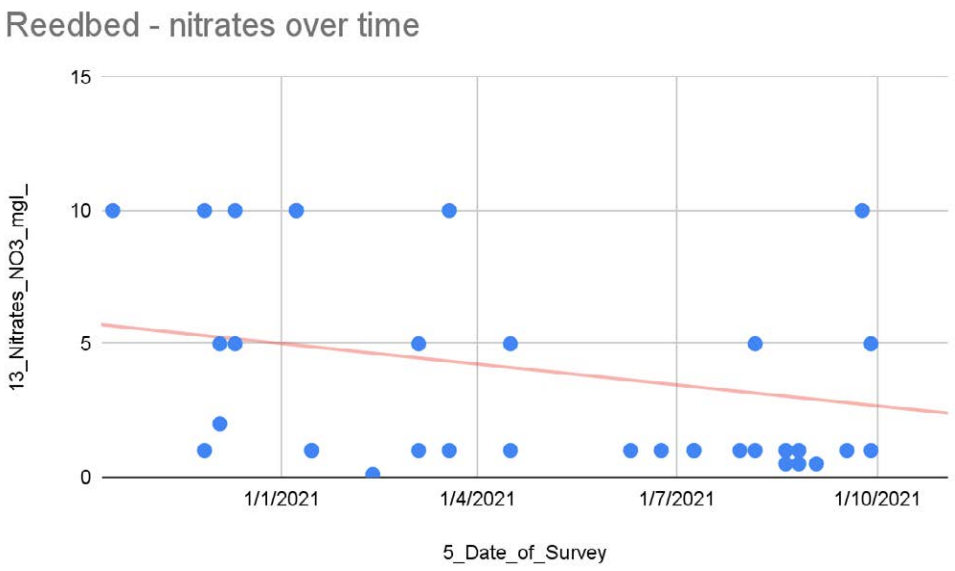


Figure 3a - change in nitrate content in dock water at the reedbed sampling site from 03/2019 to 10/2021. Red line shows the linear trendline for the data.

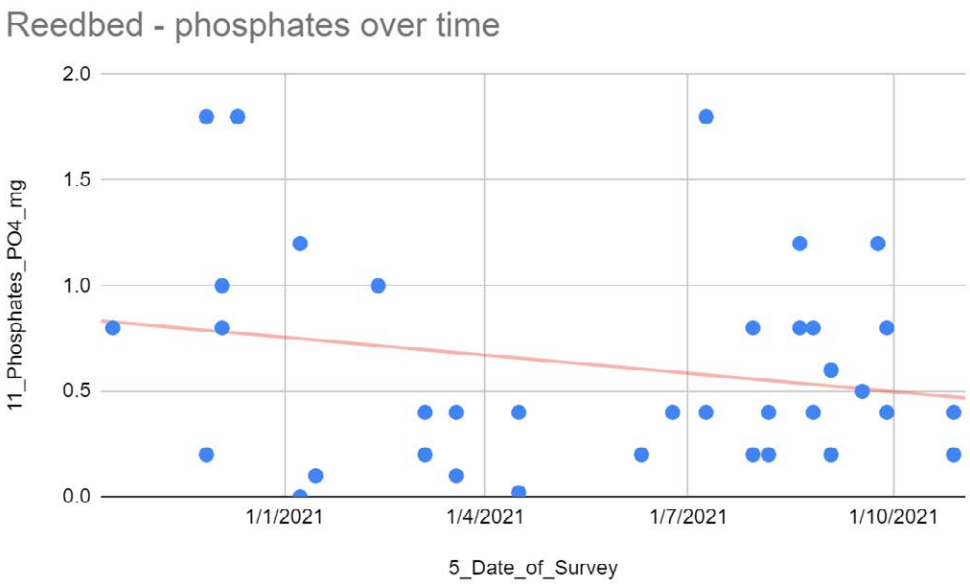


Figure 3b - change in phosphate content in dock water at the reedbed sampling site from 03/2019 to 10/2021. Red line shows the linear trendline for the data.

c. Habitat Creation and Restoration

Baseline

The restoration and creation of habitats around the study area were determined based on availability of habitat, natural history of the area and statutory and non statutory designated sites. As well as the need to address the need to improve local green spaces using planting and ecological design strategies.

Why do we need to improve blue and green spaces in Newham? Newham has 16% tree cover, the second lowest in London.[38] Newham 671ha of SINCs which covers 17.4% of the borough [39]. As an area with high levels of planned development these sites may face extreme pressures. Improving the quality of the surrounding environment through habitat creation and restoration may ease this process and ultimately improve the boroughs ecology.

Our aims:

- Increase native tree coverage
- Improve river's biological and physical habitat
- Improve water quality
- Introduce species-rich wildflower habitats

Our Work

i. Tree and hedge planting

Our aims:

- Increase habitat availability
- Support the reduction of the urban heat island effect
- Support local tree planting
- Improve species diversity and matrix by:
    - Reduce non-native cover
    - Wildlife considered planting

GDP planted 217 native trees within our study area, creating 30m of new hedging habitat around the industrial estate. Another 275 trees were distributed to the local authority, community groups, schools and individuals for them to plant. In total, 492 trees have been planted across Newham and the surrounding area. See below for the diversity of species and the number of each planted in total (Fig. 4), and their distribution throughout our local boroughs (Fig. 5).

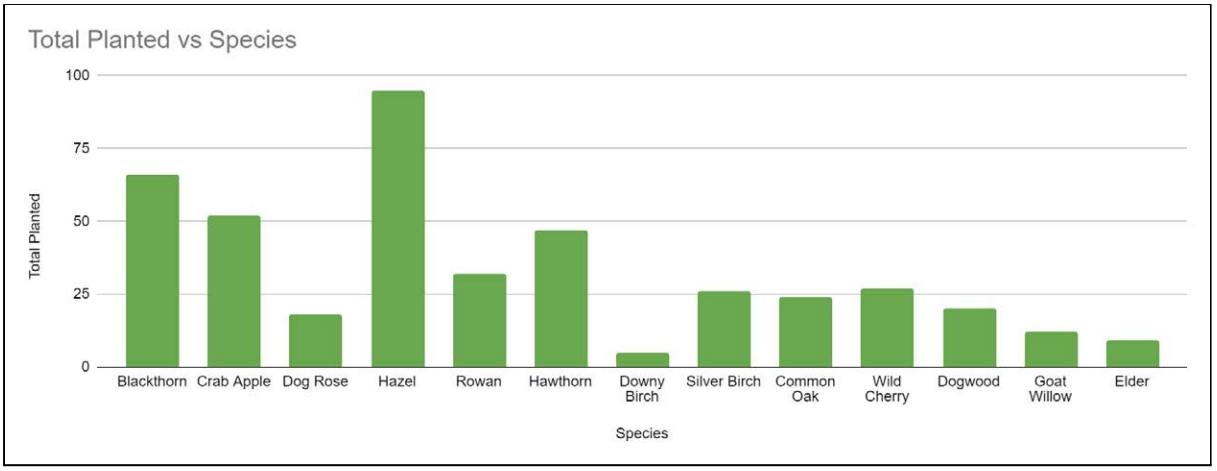


Figure 4 - quantity of trees of each species planted or donated by Cody Dock in 2021-22

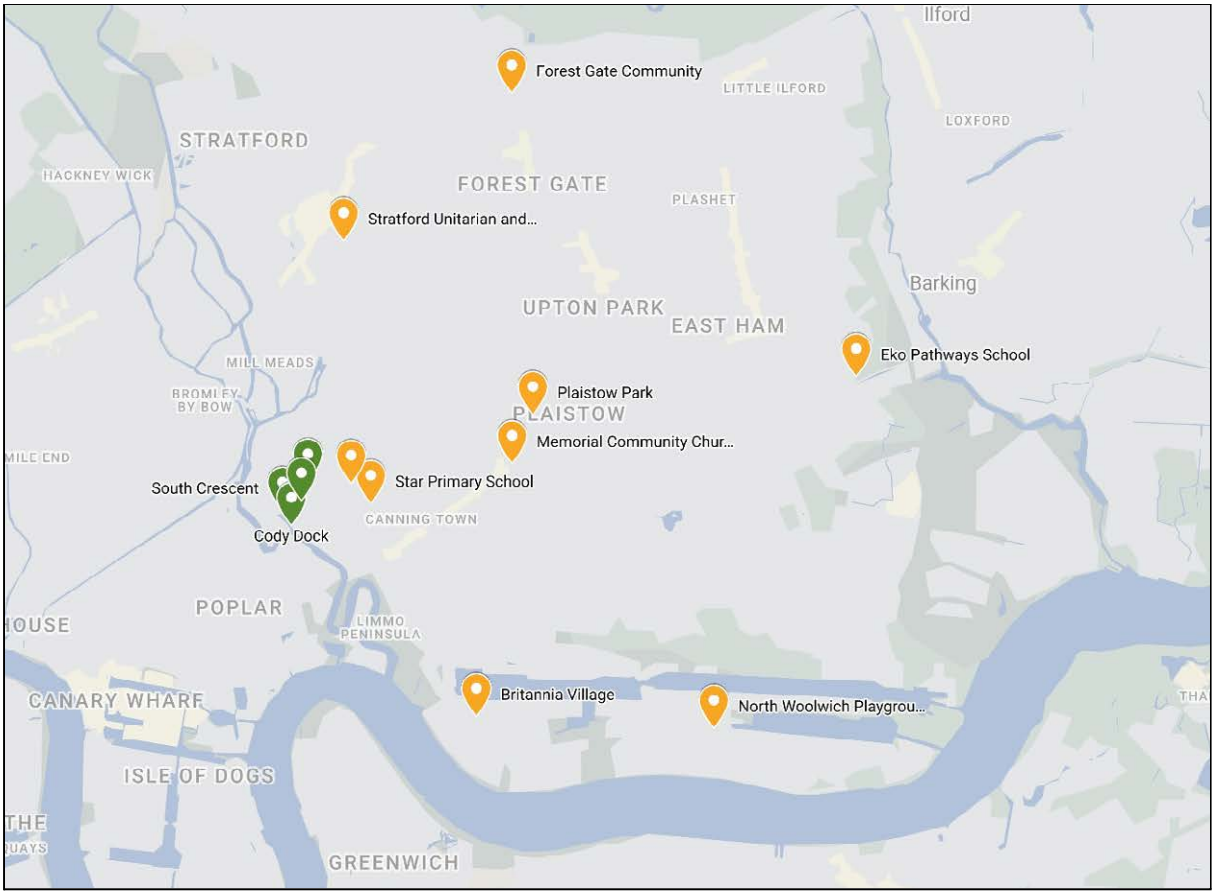


Figure 5 - yellow = donated trees to different venues, green = Cody Dock planted within the study area

Species Choice

GDP focussed tree planting on creating good habitat throughout our study area. The core objectives were to provide suitable nesting sites, year round wildlife foraging and invertebrate food plants. The species chosen also can provide benefits to local people, offering urban foraging opportunities (table 1). Activities like foraging can support and

develop a community's connection to nature.[40] There is also evidence to suggest that regularly foraged habitats can increase biodiversity, as more edible plant species will attract consumers and predators.[40]

Table 5 - Species choice and their benefits to biodiversity and people

Latin name	**Common name**	**Benefit #1**	**Benefit #2**	**Benefit #3**
Prunus spinosa	**Blackthorn**	Early source of nectar	Dense protective wildlife habitat	Autumn/winter food source for birds (winter migrants)
Malvus sylvestris	**Crab apple**	Early source of nectar esp. bees	Early autumn food source for birds	Human foraging
Rosa canina	**Dog rose**	Source of nectar	Early autumn food source	Fast growing and dense protective wildlife habitat
Corylus avellana	**Hazel**	Early source of nectar	Food source for insects, birds and small mammals	Human foraging
Sorbus aucuparia	**Rowan**	Leaves eaten by number of moth caterpillars	Autumn food source for birds	Human foraging
Crataegus monogyna	**Hawthorn**	Supports a variety of insect species	Shelter for nesting birds	Human foraging
Betula pubescens	**Downy birch**	Quick growing	Light open canopy for wildflower habitats	Habitat for hole-nesting birds
Betula pendula	**Silver birch**	Quick growing	Light open canopy for wildflower habitats	Habitat for hole-nesting birds
Quercus robur	**Pedunculate oak**	Soft leaves that feed invertebrates	Important habitat for hole-nesting birds, bats	Mature species can support over 300 species
Prunus avium	**Wild cherry**	Early source of nectar esp. bees	Summer food source for birds and mammals	Human foraging
Cornus sanguinea	**Dogwood**	Source of nectar/berries for wildlife	Prefered by moths and butterflies	Autumn/winter colour
Salix caprea	**Goat willow**	Early source of nectar esp. bees	Good for caterpillars	Human foraging (crafts)
Sambucus nigra	**Elder**	Source of nectar and berries for wildlife	Human foraging	

ii. Intertidal and Wetland

Creation and improvement to intertidal and aquatic habitat zones has been identified as an important part of helping to increase biodiversity along the Tidal Lea.

Reedbeds are a dominant habitat type along the modified walls of the River Lea, and as the last remnant area of historic marsland are crucial sites for wildlife activity. Previous efforts to improve and expand this zone have been to a certain extent successful (riparian zone installed in 2014 by GDP, Thames21 and the Environment Agency), but further research and innovations are required to improve the success of these types of intervention. Natural accretion of sediments have also increased the habitat area along with 'shelly' material from bivalve species, building up the foreshore. These vegetated zones help improve the river's flow and the biological, chemical and physical indices of the water. It has been shown that a key way to improve urban waterways is to slow the flow of modified channels, reinstating natural hydromorphological cycles.[41]

The re-opening of Cody Dock the the river will expand the rivers flood defence and has offered GDP the opportunity to implement biodiversity design strategies.

Creation Of a New Reedbed

In preparation for the re-opening of the dock we have planted two new reedbeds. These reedbeds form a 'low-middle' and an upper marsh zone. The two zones are a permanently flooded and a partially flooded zone, aiming to recreate the natural succession of reed swamps[42]

Floating Island Habitat

GDP partnered with second year University of Westminster BA Hons Architecture students in 2021/22, commissioning them to design floating habitats for Cody Dock as part of their 'Urban Designs' module. A brief was provided to help them to consider the ecology of the habitats they were creating and the ecosystem services they should provide. This featured planting recommendations that would replicate vegetation communities of the riparian zone and support target species[43] The target outcomes for their designs were to support biodiversity net gain in the ongoing development of Cody Dock, and to improve water quality in the dock and catchment.

A bamboo raft design has been selected for commission which features well-considered wetland and reedbed planting (Fig. 6). The students' choice to use natural materials in the design of the structural elements and consideration of our core aims were a large factor in the reason it was chosen. The designs are now finalised and installation is due to take place May - June 2022.

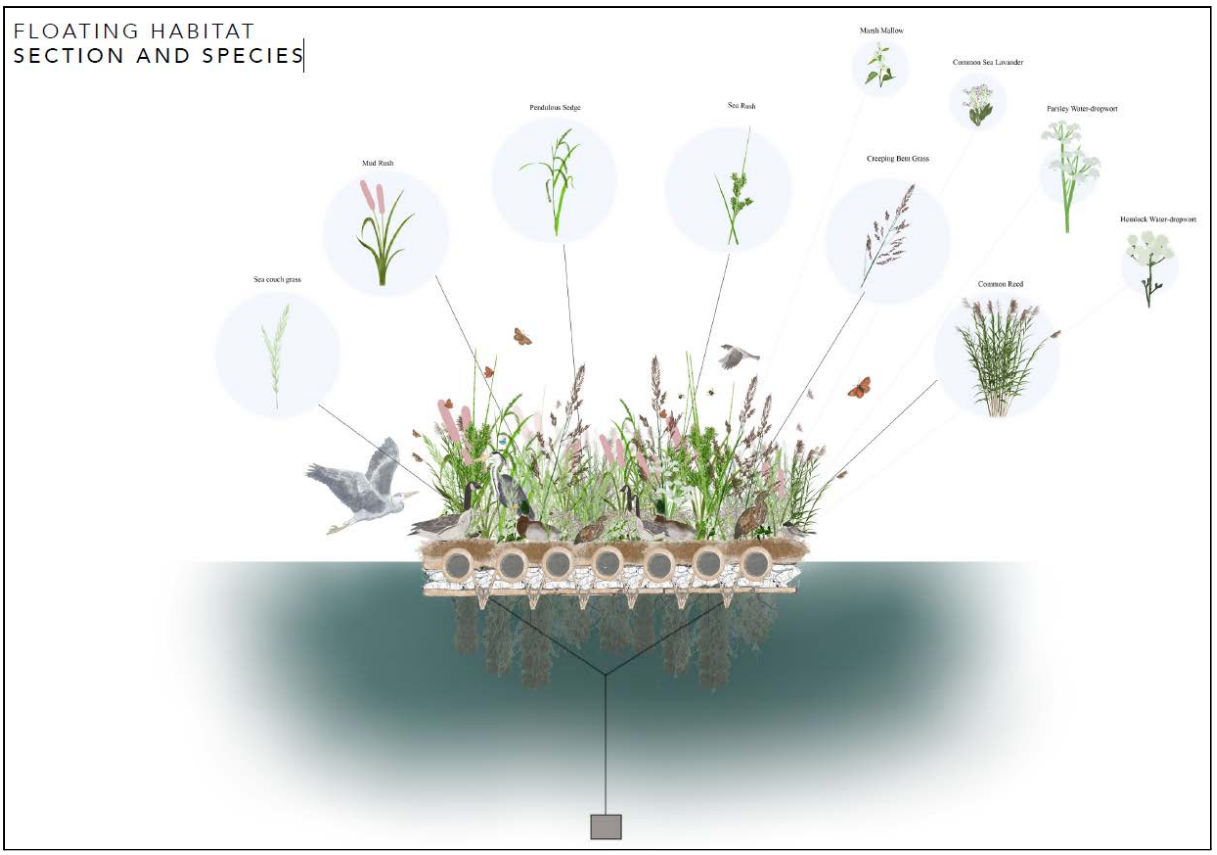


Figure 6 - Floating habitat design by Danya Khayal, Julie Krafft Bruland, Kristiana Valdmane and Natalia Konstantinidou; Year 2 BA Hons Architecture, University of Westminster [44]

iii. Wildflowers

Our Environment and Ecology team partnered with our Community Gardening Club and London in Bloom group to create and improve existing wildflower habitat and spring bulbs around the study area.

Our aims:

- Improve species communities
- Increase biodiversity

We focused on two key wildflower habitats, open grassland and shaded woodland. To improve our communal picnic area and now designated wildflower meadow, we carried out works in autumn of 2021 to reduce dominant species and reseed the lawn area using a species mix appendix 2.11. To improve the local woodland areas we focused on shaded sloped banks around the local area, reseeding these in late autumn with species mix see appendix 2.12.

Restoration and creation is crucial as these habitats are vulnerable and often lack protection. They are important for both biodiversity and the enjoyment of the community; attracting wildlife as some of the most species rich environments. The UK has lost 97% of its meadows since 1930 and if existing sites are not maintained regularly the wild plants that are found here could decline by a further 40% within a decade.[45] Disturbance is key to their

preservation as ‘early successional habitats’, so the regular use of our picnic, mowing regimes and targeted cutting are methods applied to manage the site.

Local student studying wildflower habitat at Cody Dock, with corn marigold, *Glebionis segetum,* a globally vulnerable species.

iv. Biodiverse Green Roofs

Biodiverse green roofs can be used to create replicas of disturbed and abandoned sites which feature open mosaic habitats that can support rare plant and invertebrate species.

Our aims:

- Replace locally lost open mosaic habitats
- Increase green infrastructure for its benefits such as carbon sequestration

668 m^2 of green roof have been installed on all of Cody Dock’s flat roofed studio units. The green roofs chosen from the supplier were selected for the environmental resilience of its sedum species and replication of open mosaic habitats. Features that define these habitats include nutrient poor soil, wildflower richness and presence of bare and loose substrate. [46] These and other features such as varying substrate depth, spoil and bare ground have been included, to replicate open mosaic habitats. These sites will be monitored and work will be carried out to ensure variation in features are maintained.

Biodiverse green roof on top of one of our studio containers with exposed substrate.

d. Engagement in Nature Education and Conservation

Engagement in nature conservation is a powerful tool to empower individuals, offering them new skills and ways to help improve the neighbourhood that they live in. Benefits to the volunteers themselves have been discussed in the parallel report 'Social Prescribing at Cody Dock'; [47] the primary focus of this section will be on the willingness of people to participate in nature conservation activities and the need to include all members of a community in biodiversity governance.

Engaging the local community in conservation work brings benefits to individuals' health and wellbeing, brings about the benefits that the project is working towards for biodiversity, and also has long term benefits to the conservation movement in the local area. Teaching people about the nature on their doorstep is often something that they haven't been exposed to before. The more people who are interested in and value their local species and habitats, the more likely they are to be prioritised for protection in planning decisions by policymakers. These decisions are historically made by a small sector of society, and it is our aim to increase participation in these decision-making processes. This is part of working towards a whole-society approach to biodiversity conservation.

Our aims:

- Encourage participation in nature conservation of local area
- Run accessible activities that everyone can participate in

- Facilitate the development of urban environmental ambassadors
- Develop community participation in biodiversity governance

Participation

Participation in GDP's Citizen Science and Environmental Conservation programme has exceeded the expectations of the project scope, with 1237 sessions completed, adding up to 3921 hours of volunteering. This work has included the participation of 259 corporate volunteers and 632 community volunteers, including 262 children from school and youth groups and 60 university students. See Fig. 7 for distribution of hours across project areas.

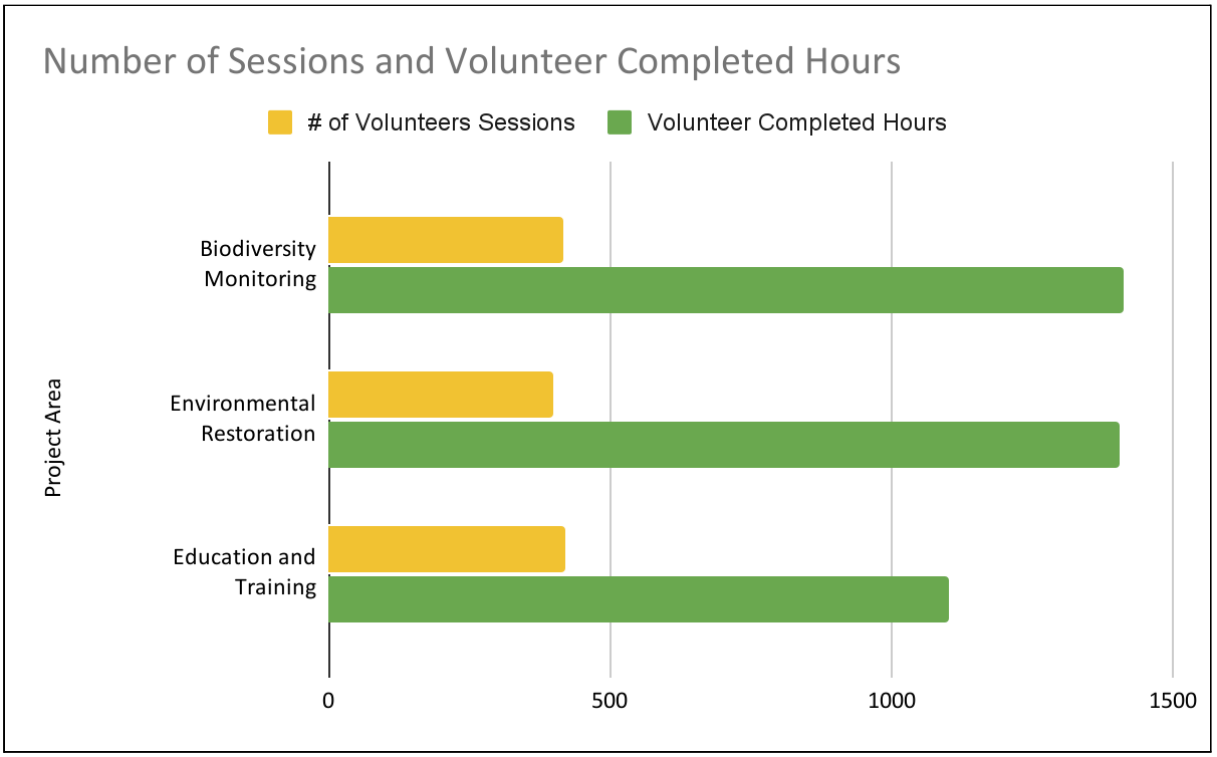


Figure 7 - Volunteer participation in the number of sessions and number of hours, within each CSEC project area.

Training and Development

The Environment and Ecology team developed and led 20 training sessions. These sessions included seminars on the biodiversity monitoring projects, activity training sessions, outdoor education workshops and volunteer development programmes such as internships, placements and the Duke of Edinburgh programme. Over 400 sessions were completed and accumulated to 1103 hours of trainee participation.These sessions were created to help build skills and knowledge within the community, to facilitate and encourage local environmental custodianship, and support further study and education, for people of all ages.

The students celebrate their collaboration and share their message around climate change and water conservation.

e. Case Study: Bromley-by-Bow Gasworks

To meet planning application requirements development proposals are required to submit a Landscape and Biodiversity Statement. This work should be included in their initial application and detail the surveys carried out. Findings should be shared with Greenspace information for Greater London (GiGL). As a response to the need for more involvement in biodiversity governance, GDP offered support as a key stakeholder with an existing knowledge of local biodiversity and the local area, and are contributing to the Landscape and Biodiversity strategy of the Bromley-by-Bow Gasworks.

Working with St William, Berkeley Homes GDP supported the beginning of an important programme of works to thoroughly identify and record biodiversity on site, a 21 acre post industrial brownfield site, bordered by the River Lea and Channelsea River. The scale and condition of the site has the potential to support a variety of critical species of national and metropolitan importance.

The pond at the bombed out gas tower at the Bromley-by-Bow Gasworks site ecological survey on 28/03/2022.

Our aims:

- Early spring full biodiversity survey
- Begin to determine a baseline of biodiversity presence and abundance
- Inform considered nature conservation
- Create target notes that must be considered in development plans

Work carried out

We carried out 5 baseline surveys:

- Bird Point Count Surveys
- Terrestrial Invertebrates & Other Wildlife
- Habitat Survey
- Passive Acoustic Detection
- Water Quality Monitoring

For methods see section see appendix 1.

Findings

Through the two site visits the team were able to do a thorough site survey following the methods described in appendix 1. Rudimental categories were assigned to habitats and locations identified (Fig. 8). The visits identified and recorded 91 species, 3 species listed on the UK BAP, including 2 species with specific SAPs; and 9 species on the London Priority Species list.

Classifying habitat types rationale:
Habitats were classified either through the JNCC Phase 1 groups or functionality and species presence.The site was divided into 5 major zones, with significant features that provided potential for species of interest:

1. Access driveway - woodland (plantation)
2. Open field - grassland (unimproved)
3. Marsh - reedbed
4. Spoil - aggregate (dry grassland)
5. Riverside SINC - woodland/continuous scrub

Areas of particular interest included the marsh in zone 3 and the spoil in zone 4, both presented viable habitat for reptiles and amphibians.

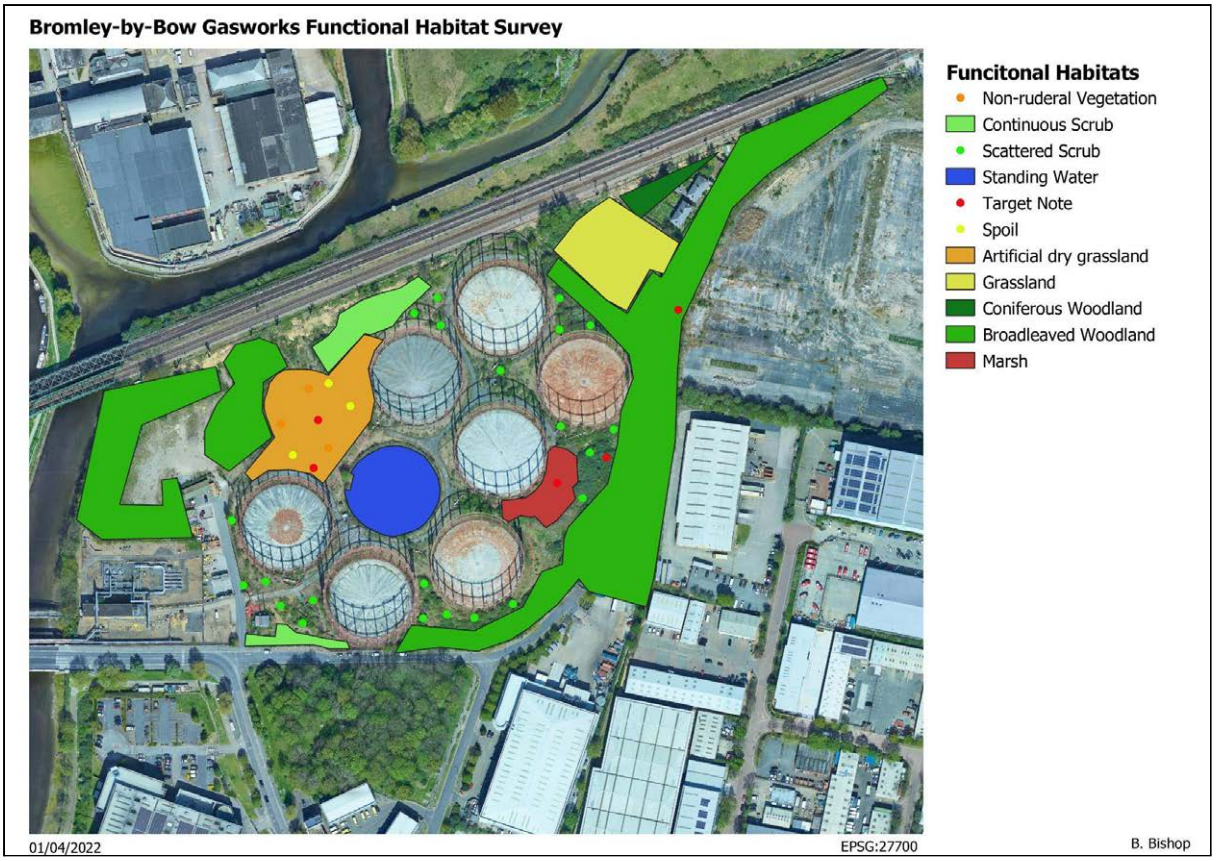


Figure 8 - Bromley-by-Bow functional habitat survey.

Table 6 - Dominant tree/shrub species recorded at Bromley-by-Bow Gasworks. Abundance categories are indicative of the proportion of the five zones they were present in.

Accepted name	**Common name**	**Abundance cat.**	**IUCN cat. (global)**	**Population trajectory**	**UK BAP**	**London Priority Species**
Acer psuedoplantus	Sycamore	4	LC	Unknown	NL	N

Aesculus hippocastanum	Horse chestnut	2	VU	Decreasing	NL	N
Betula pendula	Silver birch	4	LC	Stable	NL	N
Betula pubescencs	Downy birch	4	LC	Stable	NL	N
Buddleja sp.	Buddleja	5	-	-	NL	N
Cornus sanguinea	Dogwood	4	-	Not evaluated	NL	N
Corylus avellana	Hazel	3	LC	Stable	NL	N
Crataegus monogyna	Hawthorn	3	LC	Unknown	NL	N
Fraxinus excelsior	Ash	2	NT	Decreasing	NL	N
Poplus nigra 'Italica'	Lombardy poplar	1	DD	Unknown	NL	N
Populus alba	White poplar	1	LC	Decreasing	NL	N
Populus x	Hybrid poplar	1	-	-	NL	N
Rosa canina	Dog rose	3	LC	Unknown	NL	N
Rubus fructicosa	Blackberry	4	LC	Stable	NL	N
Salix caparea	Goat willow	5	LC	Stable	NL	N

Target notes:

Birds

- Early signs of breeding bird activity
- Red listed species records
- 28 species recorded

Mammals

- Bat species detected on passive acoustic device;
- *Pipistrellus pipistrellus* and *Pipistrellus nathusii*
- 5 samples of droppings recorded, including potential *Mustela* and *Cervidae*

Amphibians

- Smooth newt, *Lissotriton vulgaris* was identified
- 9 specimens were recorded at two sampling sites.

Reptiles

- An Individual common lizard, *Zootoca vivipara*
- Recorded amongst the tall 'non-ruderal' vegetation growing on spoil
- Conditions favourable for early seasonal sighting
- No more individuals were recorded.

Plants

- Bluebell, Hyancinthnoids non-scripta patches in woodland
- Tree protection order is being observed

- 3 species decreasing globally
- Dominant non-native species identified

Water

- Standing water body,
    - unknown depth,
    - Water quality index raised no concern
    - Signs of breeding birds, (little grebe)

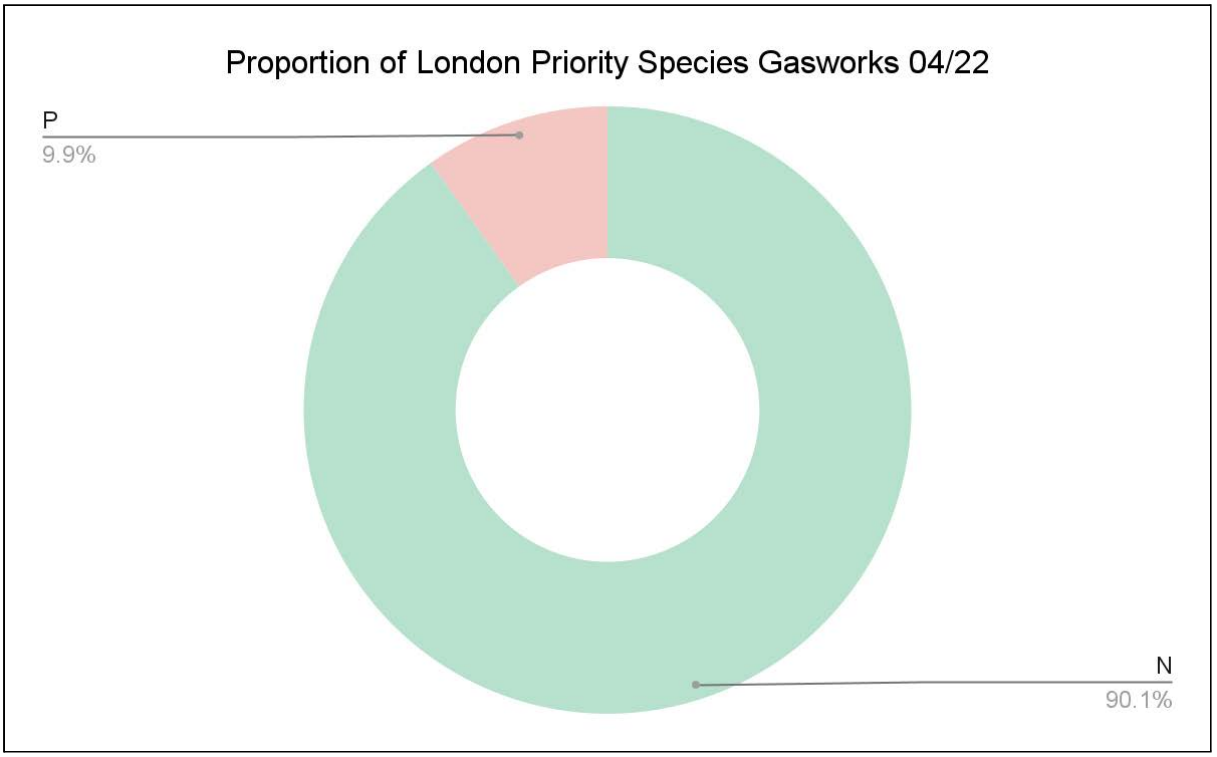


Fig. 11 - proportion of London Priority Species found during biodiversity survey of the Bromley-by-Bow Gasworks site.

Goals and Future Projects “what’s next for us”

As the land use around the local area transforms rapidly, there is a window of opportunity to make sure there is sufficient representation of biodiversity, to help inform development and more importantly conservation strategies. We aim to continue and grow our work, continue monitoring and increasing our engagement of the local population in this work.

a. Expanding our Environmental Programme

The Green Recovery Challenge Fund grant has allowed GDP and the local community to successfully inform biodiversity conservation for what was a previously under-represented area. This work must be continued and expanded to monitor and prevent further biodiversity loss. The fund has so far facilitated the purchase of much needed resources that have empowered and supported community level participation in the project. We were able to offer free and accessible training opportunities to volunteers who wanted to expand their skill set and get more involved in our monitoring programme. Participation in the DWP Kickstart Scheme allowed the Environment and Ecology programme to expand and provide a local person the opportunity to develop their skills and begin their career within the sector.

To set out a sustainable programme that can continue to contribute to biodiversity governance and local conservation, this programme requires a significant amount of support to ensure the resources and experience is available to generate future environmental stewardship in the local community. With the opening of GDP’s visitors centre, washblock and other facilities there is an opportunity to expand this provision. We will have more space to accommodate nature education, training and workshops, and along with the development of long term partnerships with other conservation organisations, the site is set to become a hub for this type of work. Community level contribution to nature conservation is a powerful tool and should be regarded as a mandatory mechanism within national biodiversity governance. Furthermore, long term financial investment in projects like Cody Dock’s Citizen Science and Environmental Conservation programme is necessary to continue the monitoring of sites along the Lower Lea Valley, ensuring biodiversity monitoring.

b. Championing Community Engagement

We aim to build upon our work with young people and help them find an environment to thrive and learn about protecting biodiversity. Cody Dock has always been a space to allow people to come together and experiment, test new ideas and approaches to improving their local area. As the project grows we will continue to: work with schools supporting the curriculum and providing out of the classroom learning experiences; develop our partnerships with Newham and other East London youth zones to provide work and practical experience; offer placements A-level and university students who want to explore and

research topics related to conservation and the environment; and continue to work with faculties of education to allow them to apply their learning in a real space.

GDP aims to apply inclusive approaches to ensure that this work engages all community members, and support the increased inclusion of underrepresented groups. We all have a right to access nature, and part of appreciating that is being able to join in the discussion and work that takes place at local, regional and national levels. Cody Dock is an example of a community space where all people have been given the opportunity to contribute to the conservation of their local environment, and help create a place in the city for people and nature.

Left; youth group from the Royal Docks Learning and Activity Centre on a nature trail along Cody Wilds. Right; creating artwork based on their learning and what they found.

c. Overall Goals

As GDP continues to record biodiversity within the study area, we will be able to locate and monitor the use of habitats to illustrate the importance of the study area and the tidal rivers ecology. As the ecological description of the study area expands GDP will be able to further implement responsive conservation strategies and aim to justify the designation of the route and its habitats. The tidal river corridor is part of a vital blue network connecting the estuary habitat with inland waterways and wetlands. Improvement to the river corridor will help improve provisions to increase biodiversity. The following interventions will be necessary to meet this such as; implementation of channel restoration, improvements to terrestrial habitats, and reduction in effluent and output from unregulated sources. Continued monitoring can help review and forward this process. This work will aim to meet GDP's aspiration of realising the Cody Wilds corridor as a linear park and SINC, for the community to help connect with wildlife and manage these spaces using sustainable and wildlife friendly methods.

Time Urgency

GDP will continue to work in a timely manner, with the understanding that there is a time critical window of opportunity to make sure a thorough record of biodiversity exists and is available to the public and relevant stakeholders. This does not mean working quickly, but working effectively to ensure that relevant monitoring projects are carried out, in time for new planning and development phases.

Celebrate the River

GDP hosts regular community events to celebrate the local areas rich human and ecological heritage. This also includes public exhibitions of work from people from across the local area. With the new facilities we will continue this effort and invite people in to learn more about what is going on in their local area, and ultimately expand our engagement.

Public Education

It is important to us to make sure that there is always an opportunity for people using Cody Dock and the Lea River Park to learn more about it, as discussed for a long time this area was not known locally. Display of educational materials around the site will improve the communication of our work and the ecological importance of the area, to anyone who stops by to read them, providing a passive learning experience.

d. Habitat Action Plans

Targeted goals for increasing the scope of this project and improving the quality of each habitat we work in are listed below:

i. River

1. Water quality

a. Creation of target contaminant levels for the Lea

GDP aspires to set up robust monitoring gauges that can be sampled regularly by volunteers, with the aim of determining levels of specific contaminants. We will compare our data with national and international standards of water quality in order to monitor the progress of our goals to improve water quality in the dock and the river. Recent purchase of more accurate laboratory water quality metres will measure salinity as well as the existing measured indicators - this will allow us to expand our monitoring programme to the River Lea as we will be able to account for the level of salinity in the water when measuring other variables. Previously, the brackish estuarine water prevented us from measuring nitrates and phosphates, as our indicators were only appropriate for freshwater.

b. Mapping known pollution point sources

Creation of a map which logs all known point and nonpoint sources of water pollution in the Lea and the dock, as well as potential new ones. This will help us to document and report pollution events to the relevant authorities if and when they occur. We may work with waterway and community watersports groups to record when these pollution incidents

happen. This could be an application of the ZSL and The Rivers Trust 'Outfall Safari' methodology.[48]

c. *Developing partnerships: Thames21, MoRPh*

Our water monitoring programme currently consists of chemical analysis of the water inside Cody Dock, but does not regularly monitor the river water quality. As the Lea is a tidal river, the water is brackish - meaning that following water testing standards created for freshwater or saltwater will not yield fully accurate results. There are other indicators of river health that are not covered by this of course, including any physical modifications and differences from the natural, historic structure; and biological features, such as the presence/absence of certain sensitive species like riverfly species.

Surveys originating from different organisations already exist to assess these different features of the river. MoRPh has been designed by the Modular River Survey Team to record the physical features including intertidal vegetation zones and anthropogenic modifications. The ARMI Riverfly Survey uses presence/absence and abundance data of riverfly species to indicate pollution events. Establishing partnerships between such organisations across the Lea/Thames catchment would enable the sharing of data and river knowledge and broaden the knowledge of the estuary. Combining the messages of each of these types of indicators would provide a more full and detailed understanding of the health of the river at any one time.

d. *Set up a standardised methodology for monitoring estuaries*

Monitoring the water quality of tidal river channels should allow for the point in the tide and resulting salt content to be taken into account. Having a standardised methodology to adhere to would not only be beneficial for us to monitor our own river, but allow for comparability from different points in the estuary, and between estuaries.

2. Habitat restoration

Our coastal and estuarine waters play a key role in the biogeochemical cycles that sequester and store carbon, known blue carbon.[49] Habitat restoration along intertidal rivers like the Lea can contribute towards the long term and large-scale efforts to restore these ecosystems, helping to sink carbon, and increase opportunities for biodiversity. These communities have been shown to accumulate 3 times more carbon per unit area than terrestrial soils,[49] therefore must be recognised for their value and targeted in these environments.

a. *Reedbeds*

Protecting and improving the quality and quantity of reedbed habitat: helping the reedbed to grow in size by encouraging sediment accretion, and improving its natural processes by digging channels to allow natural flooding and prevent the domination of terrestrial plants.

b. *Intertidal Zone*

Encouraging the accretion of silt and will also support the reestablishment of successional stages of the intertidal zones, i.e vegetated mudflats and low marsh zone. The creation of

vertical solutions along riverwalls to support the distribution of vegetation along the river. On our surveys we have noted an increased distribution of submerged vegetation, for example eelgrass *Zostera spp*, this is likely as a result of improving river quality. Monitoring and finding ways to expand their distribution; as well as providing education on this type of vegetation will be incorporated into future projects, especially in relation to its capacity to store blue carbon.

c. Riparian Zone

Installation of floating solutions to reintroduce the linear habitat of the riparian zone. To address the level of modification of the tidal Lower Lea, creation of vertical design opportunities and substrate interventions would be the most successful approach. With the aim of increasing plant diversity along the river wall and foreshore, replicating upper marsh plant diversity along the walls and the low marsh along the mudflats. Vertical planters should be simple such as timbers, or silt traps, these will allow the natural accretion of silt and establishment of plants. Along the foreshore, physical structures such as groynes will encourage the natural accretion of silt. Plant colonisation has already been noted along sections of mudflats, as has the gradual succession of species that indicate the vegetated zone of the mudflats. Creation of floating habitat islands on the river may offer marginal success, but would require maintenance and precision engineering to withstand tidal flow.

Reedbeds established along the river wall on the Cody Wilds trail.

ii. Woodland

1. Encourage Wild Hedging

We aim to encourage the reduced maintenance of existing hedging in favour of more wild, dense thickets, which will improve breeding bird habitat. We also want to encourage local sites to apply this method of relaxed maintenance of their linear tree lines, in favour of thick scrub. We will also offer support to schools to create these types of habitat where possible.

2. The Memorial Park

In partnership with local stakeholders we want to take on the improvements necessary to restore the memorial park. A neglected and unloved fly-tip zone, we have carried out various community clean-ups and are now ready to make the necessary improvements. Which are increasing the native species matrix, increasing access for the local residents and works and continuing our monitoring of species existing here to target their conservation.

3. Cody Road and South Crescent

Part of the public industrial estate within the study area, it has well established woodland plantation with species including willow, poplar, blackthorn, and elder, all of which provide valuable ecosystem functionality. This area is also a fly-tip zone and we aim to continue our work to reduce and prevent that. By raising its profile and continuing to draft in local works in the efforts to improve it. We have installed a variety of nesting, roosting and bug boxes and will monitor these, and include future designs into the landscaping of the space.

e. Species Action Plans

This section is a review of threatened species found within our study area, and an exploration of the potential for reintroduction of historically occurring species. Modification to increase habitat quality will be considered within the context of pre-existing landscape use and ongoing development of the area. We are constantly reviewing the national guidelines from BTO for threatened species and exploring how we can support their populations at Cody Dock, this is not an exhaustive list of species being considered.

i. Water Vole

Cody Dock's new reedbed and soft sloping bank offers potentially suitable habitat for the water vole, however the scale of the site is small and unlikely to be able to provide ample habitat or foraging opportunity for a healthy population of individuals. Upstream of Cody Dock, reedbeds have created a larger soft bank that offers a larger area of viable habitat that will be re-connected to the dock via the river within the next few years. As species are more common in saline waters near to reed fringed lagoons, the dock may offer a suitable spot for them to reestablish [50]. Water voles have been considered in the process of choosing what should be planted in the artificial floating habitats that will be installed in the dock this summer [51].

ii. Reptiles and Amphibians

Common lizards have been recorded at certain locations within the study area. Although the extent of urbanisation is likely to be too extreme for the establishment of new populations of reptiles, GDP aims to be considerate of potential common lizard colonisation in the future development of Cody Dock. The following objectives will therefore be considered and implemented where possible: connectivity of landscape level habitats; presence of hotspots and sunspots, and diverse vegetation structure i.e grassland, woodland and shrubland [52]. Additionally, GDP has observed the use of surrounding habitat fragments by smooth newt *Lissotritron vulgaris*, which may indicate the potential for the site to support other species. The future development of the site should incorporate new wetland features and appropriate terrestrial habitats.

Smooth newt, *Lissotriton vulgaris* found during survey.

iii. Birds

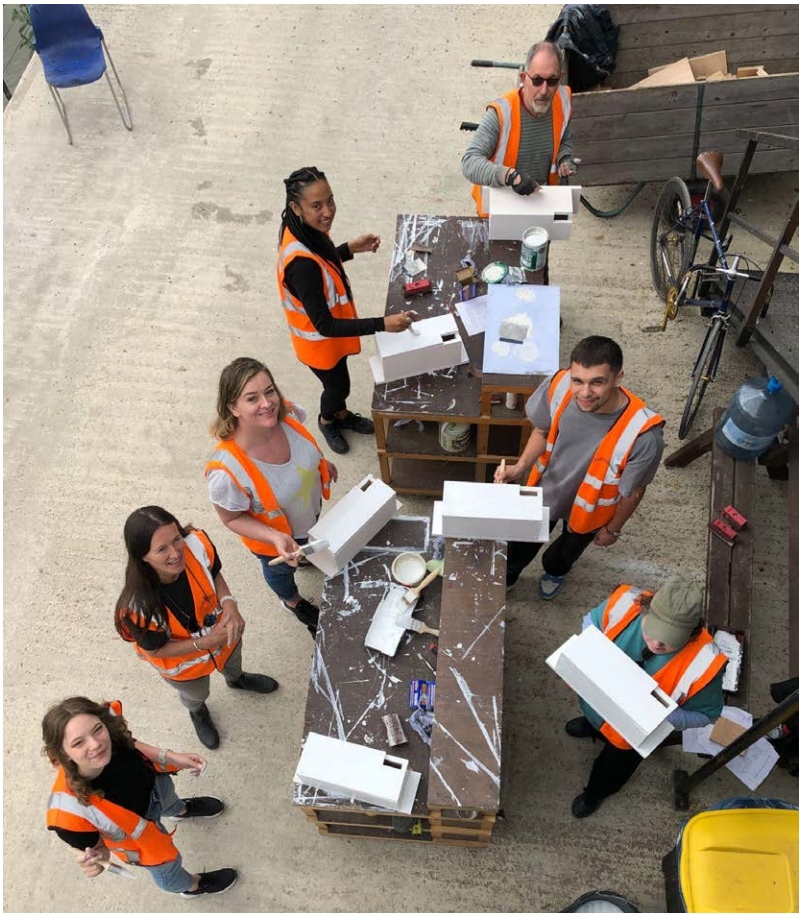
1. Oystercatcher, *Haematopus ostralegus*

Oystercatchers have been recorded within the study area, and are frequently sighted in the East India Dock Basin. As a globally 'near threatened' species with a decreasing population trajectory - and being amber listed in the UK, we aim to provide as much high quality foraging space as possible. Previously mentioned habitat interventions will increase the provision of suitable habitats, however the primary obstacle to the colonisation of this section

of the Lower Lea is the further improvements that need to be made to the health of the water in the river. We hope to change this by targeting outfalls which are frequent sources of sewage or industrial effluent.

2. Swift, *Apus apus*

The common swift, *Apus apus*, is one of our target species for the site, as there have been records of screaming parties of swifts in the vicinity, but no known nesting sites recorded so far [53]. Swifts have suffered a 58% population decline from 1995 to 2018, which is likely to be partially due to a loss of suitable nesting habitat [24]. As an area with a high level of building and re-development, this is further reducing any spaces swifts may have traditionally used to nest in. We will be doing our bit in supporting the recovery of this local swift population by building artificial swift nest boxes to place on our offices around the site. This activity could become a workshop that volunteers will be able to lead with local groups and schools on site, for the purpose of increasing availability of nest sites across Newham.



Volunteers making swift boxes for studio containers at Cody Dock.

iv. Invertebrates

We aim to grow the project and volunteers' experience and knowledge. Part of this work will be to expand and improve monitoring, continuing to provide opportunities for invertebrates. We want to integrate invertebrate habitats in future development of our site, similar to green roofs, creating microhabitats throughout the site. We think it will be important to expand to

more species specific surveys such as the Beewalk for the Bumblebee Conservation Trust, or grasshopper recording scheme (NBN Atlas), to help better inform targeted reporting schemes. Along with this we want to work with specialists to survey and monitor 'harder to record' groups, to improve our biodiversity database.

Species and groups of interest

London's priority butterflies and our ways to target them:

- Small Copper *Lycaena phlaeas* - Encourage stands of herbaceous plants such as ragwort and thistle [54].
- Large skipper *Ochlodes sylvanus* - Increase coverage of habitat (rough grassland/verges) and food plant s (cocksfoot).[55]
- Essex Skipper *Thymelicus lineola* - Increase coverage of habitats (rough grassland/verges) and caterpillar food plants (cock's foot, couch grass) [56]

Shrill carder bee *Bombus sylvarum*
One of the UK's rarest bumblebees. Recorded at Cody Dock, one of the isolated communities is found along the Thames Estuary.[57] We aim to support and increase its population through application of meadow management, with late cut areas, [58] and monitoring the success of green roof vegetation establishment.

Dragonflies and Damselflies (Odonata)
Creation of new wetland habitats onsite will be designed to support invertebrates that depend on water bodies for their life cycle. The focus will be on already observed species, benefiting from local freshwater sources gradually expanding to targeting priority species.

v. Bats

Building on our foundation of knowledge about local bats and bat-detecting methodologies from the past year, we now plan to expand our surveys to include the NBMP Waterways Survey on the River Lea. We are hoping to find hotspots for Daubenton's bats feeding along the river surface in the local area, as the river is relatively dark and undisturbed compared to other waterways further up and downstream, though this may not be the case as more residential developments are built on the river banks. By tracking bat activity throughout development, we will be able to assess the effect of the increase in footfall and use of artificial lighting along the riverway on the presence and activity of bats.

We plan to build a number of year-round suitable bat boxes to replace some of the ones that were installed previously. These new bat boxes will be suitable for roosting throughout the winter and for maternal roosts.

Surveys of bats within the Cody Dock study area show that they benefit from three primary feeding sites that are all subject to low levels of light pollution, but have some soft habitat features which screen and diffuse the sources of light. Unused sites need to be reviewed by lighting specialists, especially along the river path which should be a key 'commuting' route for bats. Fast flying species are more frequently recorded within the study area, possibly

capitalising on feeding opportunities provided by light sources. Buffer zones, directional lighting and screening with new habitat routes should be considered to delimit light to the necessary areas.

Conclusion

The Lower River Lea is transforming at a rapid pace and the work of GDP, its partners and local community is setting out to ensure that there is a place for nature and people. Cody Dock is now a destination for all to come and learn about ecology, the area's biodiversity and the rich heritage that has changed the river forever. We have a small window to ensure that this work is not lost and that biodiversity recovery continues. Collection of data, and involvement of all stakeholders by using a whole-society approach will ensure that everyone has the opportunity to access nature in the city.

Our findings have revealed and verified astonishing levels of biodiversity that would otherwise be disregarded and unmapped, significantly reducing the conservation value of the local area. It has shown the immense ecological value of small habitat patches and the linear connective strips that support biodiversity even in an urban environment. Rare and important habitats and species found within the study area show how these networks can be a vital connection between some of London's most important ecological assets. This part of the river should therefore be protected and prioritised in decision making processes. Without the GDP's voluntary and consistent contributions to ecological data, there would be almost no modern reference to biodiversity, critical species, breeding populations and habitats along the Lower Lea Valley.

Local post-industrial landscapes within the study area are refugia for priority species that struggle to exist within urban landscapes, such as the common lizard. We want to help species like this bounce back by improving ecological connectivity and design. Cities are places for ‘new’ ideas and solutions; implementation of biodiversity design strategies can reclaim opportunities for nature in the city. Restoring historic habitats can also be a meaningful way of connecting the existing community with a sense of place.

As we continue monitoring it is likely we will discover more species and find new ways to target conservation efforts. The way forward for GDP’s CSEC is to continue and expand local efforts to monitor biodiversity, by participating in a broader range of recording schemes. This includes working in partnership with other organisations to optimise this type of work, and contributing to developing methods like MoRPH, to help assess biodiversity and create more inclusive ways of mobilising volunteers. The continued involvement of young people will be vital in the future of our work and conservation of the local area. We want to encourage them to find their place and future here, developing their knowledge by providing a real time learning environment and place for them to invest time in. We want to nurture their ideas and take their perspectives into account when thinking about the future of the project.

The success of GDP’s Green Recovery Challenge proves that members of a local community are invested and willing to feed into the mechanisms of biodiversity conservation. People's respect for urban nature has been shown through the participation and passion of the community who volunteer with us at Cody Dock. It is crucial that projects of this size have the resources to sustain this type of work, as even small groups can have an immense impact.

Recommendations (Tool Kit for Stakeholders)

In this section, the environment programme and its findings help frame conservation focused recommendations that can be referred to by any authority, organisation or individual wanting to inform and improve outcomes for nature conservation, particularly within the context of urban landscapes and their development. Furthermore, this 'tool kit' is a reference point for any urban stakeholder interested in the restoration/conservation of undervalued ecological assets in a place like tidal River Lea and Cody Dock.

This approach has been followed in line with GDP's aims and aspirations of:

- Engaging local stakeholders including residents, community groups, businesses, local authorities and education faculties.
- Collecting and sharing ecological and environmental data to inform decision making
- Leading and facilitating nature education
- Implementing biodiversity design strategies

—

Recommendations are made based on our own learning and offer guidance. Further research should be done before implementing any of the suggestions made.

—

Recommendations are grouped into the following themes:

1. Habitats and Biodiversity Design
2. Environmental Monitoring
3. Policy

1. Habitats and Biodiversity Design

Implementation of innovative techniques and strategies can support the redistribution of species, along with providing crucial ecosystem services, such as water drainage and temperature management. Following the appropriate management practices will improve the value of these interventions and further support biodiversity gain.

1.1 Lighting for Wildlife

Light pollution is a major threat to habitat quality, with a significant impact on the activities of nocturnal species. A particular focus can be placed on bats, which are particularly vulnerable to the impacts of artificial lighting. In some places, bats have been found to completely avoid light areas in favour of new routes and other sites [59]. It is also known to increase predation, disturb roosts, and affect feeding behaviour [60].

The focus of this assessment is on the perceived impact of lighting on bats, though there will be an impact on many nocturnal species. After conducting preliminary surveys in the scope of GDP's biodiversity monitoring, the key factors that have determined the scope of our recommendations are:

- Locating foraging spots and activity buzzes
- Determining availability of habitat and any 'unused' sites
- Estimating species abundance
- Considering proximity of new and existing development to viable habitats

To successfully apply these recommendations it is important to carry out these preliminary steps to determine species presence, roost sites and habitat availability. Seek advice and support from local bat groups or nature conservation organisations, who may be able to carry out licensed bat surveys.

➔ **Avoid unnecessary lighting**

If possible, reduce any lighting of known bat roosts or foraging areas by new or existing infrastructure. If the complete absence of lighting in these areas is not possible due to safety concerns, some other options are listed below. Use of artificial lighting only when and where it is needed is key.

- Use of timers: timers can be used to limit light to be emitted only when it is needed. Security lighting can be set on short motion sensors.
- Use of a 'part-night lighting' scheme, turning certain outdoor lights off in 'off-peak' periods. This continues to provide opportunities for fast flying species like *Pipistrellus sp.* that benefit from insect light attraction [61]. This solution also results in reduced energy consumption and costs.

➔ **Screen known bat habitat**

Habitats should be considered in site configuration, to minimise light spill onto them. The creation of unlit 'dark zones' will protect bat habitat from fragmentation, allowing them to safely travel between their roosts and foraging grounds.

- Design the space to include features that will block light spillage. The location of buildings should be considered in order to minimise spill, set well back from key zones identified. Soft light-blocking features including the planting of native vegetation is recommended, including hedgerows and climbing plants. These features can be developed into a more connected network and form green corridors, contributing to the further conservation of biodiversity in the area.
- Creation of dark buffer zones can be used as a way to separate valuable habitats from lighting by forming a dark perimeter. These zones work by ensuring light levels do not exceed defined limits. Follow the BTC guidelines on limit zonation, and luminaire specifications to determine the needs of the site.
- Limiting light pollution from internal sources of light by using "good" internal lighting (see next section) can help reduce the impacts on the surroundings. Glazing

treatments such as tinting, retrofit films and smart glass are also available for windows. Other options include timered blinds.
- Use of downward direction light to retain darkness above

➔ **Use the appropriate type of lighting**

Luminaire specs vary and applying the right types of lighting for a wildlife friendly approach is key. Generally, warmer light has a lower impact on bats and nocturnal insects, with only a small compromise on energy efficiency if using LEDs. Species have been shown to have little or no response to red light as it most resembles 'dark'.[62]

Targets:
- Lighting should not contain UV elements;
- Use of LED with 'warm' light <2700K to reduce blue light

➔ **Create new habitat**

Offset methods can be considered in the development of a site that may intern reduce or compromise biodiversity. The creation of alternative spaces for species to re-route through for foraging is a good option. Consideration should always be given to how this connects to existing habitats.

1.2 Creation and Restoration of Intertidal and Riparian Zone Features

The UK has lost over 90% of its wetland habitats in the last 100 years, much of this to the development of new residential centres. Heavily modified urban rivers have replaced transitional inter-tidal wetland habitats with fortified flood defences, which severely limits the river's interaction with the terrestrial environment and thereby the services it can provide. Provision of habitats, absorption of surface runoff and reduction of river flow are all functions not performed by heavily modified river banks. Restoration of the river ecosystem functionality may require the implementation of innovative biodiversity design features. These design features should consider the natural history of the site, species presently occupying the site, and the surrounding infrastructure.

These actions are vital in urban settings to mitigate historic modifications of rivers in cities and the impact on biodiversity. All solutions will provide varied ecosystem functionality, allowing vegetation suitable to the type of river to thrive, providing habitats for wildlife.

➔ **Create reedbeds**

Build up of sediment along sections of a modified river, or in small outlets can create suitable substrate for the establishment of reedbeds. These can be defined as reed swamps (extensive cover) or reed fringes, marginal stretches that follow the waterway. As previously discussed reedbeds offer a variety of ecosystem services, including breeding habitat and improvements to water quality.The creation of new reedbeds can be done through the transplantation of plugs. While areas with reedbed in proximity to the intended work zone could benefit from substrate interventions to support the accretion of silt to encourage the spread of existing beds.

➔ **Install floating habitats**

Floating habitat solutions offer a retrofit solution to the modification of rivers and the infrastructure of manufactured blue habitats, i.e canals and docks. These solutions can be purchased directly from biodesign companies, or could be designed and constructed by students and community groups as a way to educate and engage people with their environment. Floating habitats can be considered anywhere there is limited fluctuation in water level and low flow rates. Permissions for installation are dependent on the regulatory body and frontage; as they are often seen as temporary there are unlikely to be any hard restrictions on their implementation. Modular islands with plantable coir rolls can be floated out and connected using phalanges to create islands suitable for local plants and wildlife.

Benefits

- Size, species and placement can be customised
- Responsive to needs of biodiversity and environment

Limitations

- Medium potential impact
- Requires artificial materials in solution [63]
- Requires constant water level

➔ **Recreate lost wetlands**

The recreation of wetland habitats along rivers is a well tested solution for the restoration of river catchments. These bodies are not placed along the visible river, and offer a sponge function to help manage river flow and stormwater run-off by restoring natural drainage conditions.[63] These sites could be wetland meadows, bioswales or marshes, which offer critical habitats for biodiversity, although in cities potential sites can be difficult to redesignate and determine. Creation of artificial features like bioswales utilise the principle features of wetlands in channel form, and help slow the flow of stormwater whilst filtering out pollutants.

➔ **Design vertical habitat opportunities**

Living riverwalls can support and improve biodiversity, especially in zones of the river subject to rapid flow and tidal fluctuations, where other modifications may not be suitable.[64] Installation of habitat creation structures along these linear margins can provide new opportunities for plants to flourish. Methods such as ‘gills’, gabions, silt traps and mesh, can be used to accrete silt and begin the formation of suitable substrates. Construction of bolt on planters is another option, these can be prefilled or naturally accreted. These features can be low cost, but have been shown to have a high impact. A study on the Deptford Creek shows that interventions along the river wall, with considerations of its conditions showed remarkable success over a 20 year period, from rapid colonisation, to well established fish population use of estuary edge features.[65]

➔ **Incorporate ‘Estuary Edges’ design techniques**

Following the ‘Estuary Edges’ approach is recommended when heavily modified rivers are adjacent to habitat features at risk, or present the opportunity to improve existing morphology [66]. Full set back can be applied where possible, which is when the flood defence is set back into the landscape and the land is returned to the estuary. Soft engineering can then be applied to the foreshore to help it restore. Creating vegetated terraces can help

establish saltmarsh plants, where set back is not an option. This is a hard engineering solution, requiring some of the channel to be redesignated for the solution.[66]

For further guidance follow the Thames Estuary Partnerships, Estuary Edges.

1.3 Management and Restoration of Species-Rich Wildflower Habitats

Wildflower habitats are critical at-risk habitats that support a high level of biodiversity, they are simple yet effective and should be included in all development and design strategies.

➔ **Apply 'No Mow May'**

Now a well–known national campaign, this practice has revealed how diverse lawns and verges are and has been shown to attract 10x more pollinators.[67] Reduction in the regularity of maintenance on lawns and verges is an effective way to increase overall diversity of a site. 'No Mow' does not mean not mowing at all, in reality it means leaving plants to grow a bit longer before the next cut. This approach can be applied spatially as well, using the 'mohican' technique: leaving longer patches in mowing throughout the spring and summer to allow a different assemblage of species to thrive. This type of mowing can even increase the productivity of flowers, if cut every four weeks.[67]

➔ **Sow wildflowers**

Creating meadow spaces on newly developed sites can be great ways to introduce or increase biodiversity. It is also an easy way to improve levels of biodiversity in existing grassy areas, although this is only recommended in urban areas. This can help restore plant species and habitats that have suffered declines and improve opportunities for wildlife that depend upon them for food or habitat, such as pollinators and ground-nesting birds.[68] They also create attractive landscapes which can be enjoyed by all.

➔ **Create 'B-lines'**

These are insect friendly highways which allow invertebrates to traverse our rural and urban areas. You can find out where these are by visiting the Buglife website.[69] A contribution to this network would be invaluable; creating insect corridors will increase the distribution of our invertebrate life and have a positive impact on biodiversity.[69] In addition, the insect-friendly highways built are typically low maintenance habitats, such as wildflower verges.

1.4 Improving Woodland Habitats

➔ **Nurture wild hedging**

Planting wild hedgerows increases connectivity for wildlife around and between different habitats in your site. They provide shelter for nesting and excellent foraging opportunities. Native shrubs and trees mixed with climbing plants increases the provision of these planted habitats even further. Hedging also has previously discussed benefits to creating 'dark zones' for nocturnal wildlife. Any planned hedge maintenance should be considerate of nesting seasons for birds.

➔ **Increase native tree coverage**

The right tree in the right place can provide a multitude of benefits to the local environment and ecology. Within urban developments, tree coverage can help reduce the impact of the heat island effect, help manage surface water and provide habitat for wildlife.[70] Despite this, it is important to consider whether or not a tree is needed. If planting into a pre-existing habitat, the local biodiversity officer should be consulted in case the habitat is protected and species composition should not be altered.

If a site is being redeveloped then tree planting schemes should be considered in terms of length of impact, best use of space and existing ecology. Quick growing species can provide short term impact quickly, versus slow, larger growing species that may be planted like pedunculate oak, *Quercus robur*, which when mature, offer immense value to biodiversity. The best use of available space should be considered when choosing the size and species to be planted. Some of the most successful approaches in spatially-limited urban environments can be to think small, and aim to achieve a denser planting scheme that will provide habitat for wildlife. An understanding of the area's ecology can help determine other reasons for choosing a planting scheme or an assemblage of species. For example you may choose species based on local habitats, if you are adjacent to a river or wish to recreate or restore a type of woodland. Alternatively you may try and restore an at risk species that is suffering local declines, such as the black poplar *Populus nigra*.

1.5 Constructing Homes For Wildlife

Wildlife homes are a fairly common and easy to implement solution to habitat loss. Many gardens, parks and open green spaces feature bird boxes, bug hotels and bat boxes and soft features like ponds. Implementation of them in design strategies and building with wildlife in mind is a great way to make space for wildlife. Our cities should be a home for people and wildlife. As discussed in 1.2 - 1.4 the viability of habitats is crucial for the range and distribution of wildlife in our cities.

➔ **Build for bats**

Bats are frequent users of artificial structures like old buildings and attics, and over time have become dependent on these due increasing loss of their natural habitat. Renovations and new-builds are now replacing these adopted habitats, which is accelerating the loss of bat habitat.

In new buildings spaces and access points should be designed into new buildings, with consideration given for species-specific habitat requirements relevant to your site.[71] Siting location is important, and guidance should be followed, eg. Bat Conservation Trust.[72]

Other design features that support bats include, habitat walls/bug hotels, green roofs and walls, dry stone walls, rain gardens and swales.

➔ **Build bug hotels and hibernacula**

Encouraging invertebrates is key if you want to have a healthy ecosystem. Constructing artificial habitats is one way to do this. These habitats can be intricately designed features or simple piles and tunnels to introduce some heterogeneity into the landscape.

The core features of these installations are:

- Dead and decaying material (ie. no need to remove and dispose of fallen branches)
- Holes, tunnels and sheltered space
- Variation of these features (i.e different materials used across the site)
- Create refugia for species that might require shelter or hibernation sites

Hibernacula can benefit mammals, reptiles and amphibians which hibernate through the winter months. The location of these features can increase their beneficial impact, being sited close to a body of freshwater, dense scrub or south facing mounds of substrate and vegetation that can provide suitable basking opportunities.[73]

1.6 Replication of Open Mosaic Habitats

➔ **Install biodiverse green roofs**

Flat roofs can be utilised as a feature of biodiversity design through conversion into a green roof system. These can replicate open mosaic habitats if they incorporate a variety of features.[46] The Buglife guidance on Biodiverse Green Roofs outlines the key features that are needed to achieve this and the optimal structural components needed to meet the requirements of the different types of green roof which all offer benefits to an extent.[46]

1.7 Other considerations

➔ **Remove harmful non-native plant species**

Non-native invasive species are organisms that have been introduced to the local ecosystem either purposefully or accidentally, and have spread rapidly and become harmful. Examples of these in our local area include Himalayan balsam, giant hogweed, harlequin ladybirds, golden clam and demon shrimp. The principal harm caused by invasive species tends to be the outcompeting or predation of native species by the non-native, generally more environmentally tolerant species.

Non-native plant species such as Himalayan balsam can be safely removed to allow native species to spread, without compromising the ecosystem services they may have provided. Non-sessile organisms such as the golden clam and demon shrimp are more difficult to eradicate from an ecosystem as open as an estuary, and some silver lining ecosystem services may discourage people from doing so. For example, the golden clam filters pollutants from river water much more quickly than the native species, or reedbeds that line the river.

2. Environmental Monitoring

2.1 Water Quality Monitoring

Monitoring the chemical qualities and pollution content of water on the river is crucial to the long-term protection of the biodiversity it supports. Any spikes in pollution indicators can be swiftly investigated and a solution found before too much harm is done to the ecosystem. Toxins build up within the food chain through a process known as 'bioaccumulation' which means even small oil spills or outfalls have an effect in the long term. This highlights the importance of the resolution of any pollution events, regardless of the size.

➔ **Set up regular visual checks on the river**

Set up a process to recognise, record and inform the Environment Agency or other relevant authorities in the case of visible pollution, such as an oil slick, strong smells or mass fish death. Train employees or volunteers on the recognition of these events, who to contact and how to contact them in the case of a pollution event. In our experience, the public are often concerned about the health of our waterway, so having an official pathway for them to follow to contribute to keeping the waterway safe would be beneficial for all involved.

➔ **Monitor key chemical indicators**

Monitoring equipment can be obtained for relatively small amounts of money, depending on the number of indicators you would like to monitor. Some key indicators to consider are nitrates (NO_3), phosphates (PO_4), pH and dissolved oxygen (DO). Guidance can be found to carry this out yourself, or you can employ an environmental consultant.

2.2 Biodiversity Monitoring

To create accurate conservation targets for a site or local area, regular monitoring is needed in order to establish the biodiversity presence. Increases in connection to nature and interest in local green and blue spaces can be utilised as a tool to engage communities in supporting the monitoring of ecosystem health through 'citizen science' initiatives. Support for community level biodiversity monitoring and nature conservation activities from local authorities and landscape developers should become standard practice as these groups can offer regularity of data collection as well as a personal connection to the area.

Tools for Community Groups, Conservation Organisations and Individuals

➔ **Find a baseline**

A baseline is the starting point for any long term monitoring and conservation of biodiversity. This could be the first period of surveys carried out, or it could be gathered from pre-existing data that is accessed via open source platforms.

➔ **Set up regular monitoring**

Regular frequencies of biodiversity monitoring is important to illustrate the presence and variation of species composition through different times of year. It is best to be reasonable; if weekly is likely to be too much of a time commitment, perhaps monthly monitoring may be more feasible. Identify sites of interest and set these as the focus for monitoring. These can be defined by habitat types, activity or even a location where development is due to take place.

➔ **Make connections**

Forming partnerships is key to the success and sustainability of any monitoring programme. Connections can be made with local people, community groups, conservation bodies and data collection agencies. Following pre-existing methods means your data will be comparable with other sites, and they will be able to support you in the case of any species identification queries.

➔ **Share your findings**

Making your data accessible by contributing it to national databases vastly increases its value by allowing it to be included in decision making and governance. Information can be disseminated in a variety of ways but the key is to share it! Share it with your local authority, developers or contractors and other groups that may be interested in knowing more about local biodiversity.

Advice for Authorities, Businesses and Developers

Support and partnership with local community members and group is key to rallying a greater sense of environmental stewardship

➔ **Support local conservation organisations and groups**

Established local conservation groups can provide valuable information about a local area's environment and biodiversity. They are often the first to show concern when landscape development may impact the quality of the local environment and have a detrimental impact on biodiversity. Offering support for their project in the form of resource provisions eg. facilities, equipment or financial support can foster goodwill with the local community and allow you to learn much more about how you can effectively work for the environment. These groups can offer input which should be valued and matched with financial support that could allow them to continue their vital work. These groups should be included from the earliest planning stages to maximise the value and effectiveness of their contributions.

➔ **Consult local communities**

Consultation and understanding local communities is key to gaining local support. This should not be used as a way to investigate the level of their resistance, but as a method to better inform the planning decision process. Forums are commonplace in planning discussions, however it might improve outcomes to have focus led discussions on biodiversity design or conservation objectives for example, and invite these to be led by community stakeholders. Seek to actively include all kinds of stakeholders in the planning and development process, particularly where their personal access to nature is concerned.

➔ **Fund conservation activities and projects**

Consider funding new or existing conservation projects within your local area. This could be recommended by a local consultant, i.e to create or restore a historically-occurring habitat type, or make a contribution towards a local, regional or national effort. This can be seen as an extension of the Biodiversity Net Gain method, and could include supporting local tree planting efforts by providing space for planting, funding restoration projects or providing bird boxes for groups and schools. This focus is less based on the groups carrying out the work and more on biodiversity conservation target setting.

3. Policy-level recommendations:

Transformative biodiversity governance is needed, specifically in cities to address the ecological crisis and realise the urban opportunity to integrate their communities, developments and existing biodiversity into a method which meets the goals of the Global Biodiversity Framework.

3.1 Collaborative Strategies

➔ **Create resilient ecological networks**

Ensure connectivity to your site from surrounding sites of conservation value for wildlife. Pragmatic strategies, considering any opportunity for responsible, sustainable and valuable ecological network design, could be the way forward in developing a successful approach for redevelopment of cities. As well as responding to the current ecological status of a locality or region, consider a site's historic value, its natural history, range and climate.

> *'The independent review of England's wildlife sites and ecological networks concluded that England's collection of wildlife areas (both legally protected areas and others) does not currently represent a coherent and resilient ecological network capable of responding to the challenges of climate change and other pressures. The review concluded that establishing such a network would effectively conserve biodiversity and ecosystem services, delivering many benefits to people, while also making efficient use of scarce land and resources.'* [74]
>
> - *Biodiversity 2020: A strategy for England's wildlife and ecosystem services, DEFRA*

➔ **Connect with other land-owners**

There are over 3000 public open spaces in London, mainly owned and managed by local authorities who designate their own conservation and green infrastructure strategies [75]. Each borough should have their individual biodiversity action plans (BAP), as well as adhering to London and UK BAPs. Policy *G1* of the London plan highlights the responsibility to devise collaborative strategies for protection and improvement of green infrastructure, identification of their assets, present and potential function.[75] Consultation and discussion across local authority borders should be routine when assessing development plans and considering the

protection and creation of nature spaces to ensure that ecological connectivity is prioritised. This will improve the health of biodiversity across the region.

➔ **Support regular biodiversity monitoring**

The way forward to address data deficiency is to recognise the significance of regular monitoring efforts[76]. National efforts to monitor biodiversity have been successful, and many targeted efforts have been established on a local scale, where initiative and knowledge exists. Local authorities, as an extension of their BAP, should review the value of existing habitats and biodiversity, establishing a strategy to implement continuous monitoring and reporting. Where these activities are already happening, local authorities should seek to support them, and where there is a gap seek support from local groups/conservation bodies.

➔ **Value disused spaces**

As our understanding of brownfield sites expands, targeting species related to these sites should be included in delivering conservation strategies, even when these species have not yet been recorded.

> *'Direct relationships have been established between increased area of brownfield sites and biodiversity gain, with evidence showing that grid squares containing [brownfield] sites having higher species richness than local ones without [brownfield] sites.'* [77]
>
> - MacGregor et al. (2022)

These are sites that are likely to be up for redevelopment, as well as offering value for nature conservation, they are new opportunities to expand local access to open space. Create spaces for people and nature, and use the unique characteristics of brownfields to do this.

> '*Existing policies and measures for the urban governance of biodiversity have been built on an evidence base that stresses the critical impact of in-situ urbanisation dynamics in driving land conversion and putting critical areas of biodiversity at risk. In response, efforts have been directed to creating local Biodiversity Action Plans that recognise areas of biodiversity value and seek to use the regulatory and planning capacities of municipal authorities to manage and enhance biodiversity protection.'* [76]
>
> - Realising the Urban Opportunity: Cities and Post-2020 Biodiversity Governance, Harriet Bulkely, Marcel Kok, Linjun Xie (2021).

This approach channels urban growth into areas without recognised nature conservation value, but there should be an effort to recognise the natural history and *potential* of these sites to provide this value.[76]

3.2 Whole-Society-Approach

To best recognise and make use of the contribution that cities and urban nature provide to achieving national and international biodiversity framework targets, a whole-of-society approach is recommended. Inclusion of non-state urban actors is vital; businesses, charities,

community groups and residents should all be involved in the process. This would mean engagement at all stages, for example it is often local residents and community organisations that can provide anecdotal evidence of species presence/absence, and it is often these groups that are most affected by new developments and change of land-use in their locality. For this aspiration of an inclusive approach toward biodiversity governance to take place, resources need to be made available to enable people's participation.

➔ **Utilise community organisations**

Part of the optimisation of biodiversity governance is utilising 'non-state' actors in the decision making processes. Community spaces like Cody Dock, privately owned land, neighbourhoods and small organisations should be seen as networks for this collaborative process. They often function outside of the boundaries set by local authorities, work with beneficiaries outside of their immediate area, and are places which people go to in order to be involved in something significant. These members already contribute to the decision making process by voluntarily collecting data, taking part in community led conservation strategies and being involved in the improvements to their local communities. Their contribution should be formally recognised.

➔ **Understand how people connect with their local nature spaces**

Cities are diverse places with many different communities and cultures coexisting, each with different perspectives and connections to their natural environment. These different types of knowledge and cultural understanding should be incorporated and celebrated. We need widespread support from all sectors of society in order for large-scale positive change to occur, a "whole-of-society" approach to biodiversity governance.[76] Authorities and conservation bodies should find ways to engage with and understand ways that their beneficiaries connect with their environment. With the aim of encouraging increased participation of underrepresented and marginalised communities in this type of work.

➔ **Create spaces for people and nature**

As a population hub, London is an opportunity to create and maintain the connections between people and nature which are required for action to be taken to conserve biodiversity on a society-wide scale.[76] Places that invite people to engage with, learn about and benefit from nature in cities are therefore important. Proximity to and quality of this green space, will increase levels of engagement to the benefit of society as a whole.

3.3 Final Considerations

Working with all members of the community is the only way forward for successful reforms in managing nature conservation in our cities. Utilise community hubs and places where people go to find things to be part of, these places are vital to community networks. Consider how nature is represented culturally and what it means to all people.

Appendix

Appendix 1

Summary of methodologies used in programme of works:

1. Bird Point Count Survey
2. Sunset Survey (bats)
3. Pollard Walk (butterflies)
4. Dragonfly Recording
5. Marine and Aquatic Sampling
6. Terrestrial Invertebrates and Other Wildlife
7. Habitat Survey
8. Passive Acoustic Detection
9. Water Quality Monitoring

<u>1.1 Bird Point Count Survey</u>
In partnership with the the British Trust of Ornithology for BirdTrack

Aims:
- Determine species presence and abundance
- Target note critical species

Methods:
1. Observe activity from selected points
2. Identify and record species and counts

<u>1.2 Sunset Survey</u>
In partnership with the Bat Conservation Trust for the UKBMP

Aims
- Monitor presence/absence of bat species

Methods:
1. Allocate point or transect
2. Spend 1 hour looking and listening for bats
3. Complete form

<u>1.3 Pollard Walk</u>
In partnership with Butterfly Conservation for the UKBMS

Aims
- Establish baseline
- Determine any indicator species

Methods

1. Weekly surveys between April and September
2. Follow set transect route
3. Record species within 5m band
4. Record site features, i.e habitat type
5. Note weather conditions

1.4 Dragonfly Recording

In partnership with the British Dragonfly Society for the BDS

Aims:

- Determine presence/absence of species
- Note any specific activity

Methods:

1. Monthly surveys between May and September
2. Visit point count site or follow transect route
3. Record species and activity at site/along route

1.5 Marine & Aquatic Sampling

Uploaded to iRecord for NBN Atlas

Aims:

- Determine presence and abundance of marine/brackish/freshwater species
- Determine overall health of water body
- Target note critical species

Methods:

1. Separate recording area into zones based on type of waterbody, adjacent land use and flow
2. If applicable separate sampling into substrate zones
3. Remove 2 foreshore substrate samples approx 5 cm
4. Take 30 kick sample
5. If applicable 'Dip' and sweep zone
6. Collect sample in tray containing water from sample site
7. Retrieve water sample from sample zones for chemical and physical analysis
8. Identify and record biodiversity
9. Target note sensitive species
10. Take photos of all specimens observed

1.6 Terrestrial Invertebrates & Other Wildlife

Uploaded to iRecord for NBN Atlas

Aims:

- Determine presence and abundance of terrestrial wildlife

- Target note critical species

Method: Bug Count Survey/BioBlitz

1. Separate environment into the following habitat categories
    a. Soft, earth and leaf litter
    b. Plants
    c. Human and hard surfaces
2. Follow out timed checks (15 or 30 minutes) of each area and sample in a fair and logical manner
3. Tally invertebrates in groups listed
4. Identify species using guides and record on general recording sheet
5. Target note sensitive species
6. Take note of other species and signs present
7. Where possible take photos of all specimens observed

<u>1.7 Habitat Survey</u>

Aims:

- Identify and record habitat types
- Identify and record plant species

Methods: Phase 1 Survey

1. Designate zones on site map
2. Spend 45 minutes observing features and identifying plants
3. Determine habitat types and coverage
4. Shade on map following key
5. Fill in species code index
6. Fill in management and target notes

<u>1.8 Passive Acoustic Detection</u>
Uploaded to iRecord for NBN Atlas

Aims:

- Detect nocturnal activity on site
- Detect species calls and communications

Method: AudioMoth

1. Check SD cards and batteries
2. Programme sensor to HIGH range
3. Record .55 of every minute between sunrise and sunset

Method: TrailCam

1. Programme sensor to record photos at 16mp
2. Set photo count to 2
3. Set lag time to 5 sec

1.9 Water Quality Monitoring

Aims:

- Assess health and monitor water quality at set locations

Method: Sample collection

1. Retrieve samples logging time of each
2. Note any external factors of interest, i.e outfall letting out, major works happening adjacent to sample site
3. Record weather conditions and rainfall from last 48hr

Method: Sample analysis

1. Temperature C
2. Using apparatus, probe or reagent follow instructions and sample
    a. pH (JBL Aquatest)
    b. PO4 (JBL Aquatest)
    c. NO3 (JBL Aquatest)
    d. Conductivity (CamLab Hi-range Conductivity Meter)
    e. Turbidity TDS (Palintest Turbidity Tube 26 inch)
3. Upload record
4. Follow procedure for reporting pollution incidents with Environment Agency if necessary

Appendix 2

2.1 Local Land Designations

2.11 London BAP Habitats:

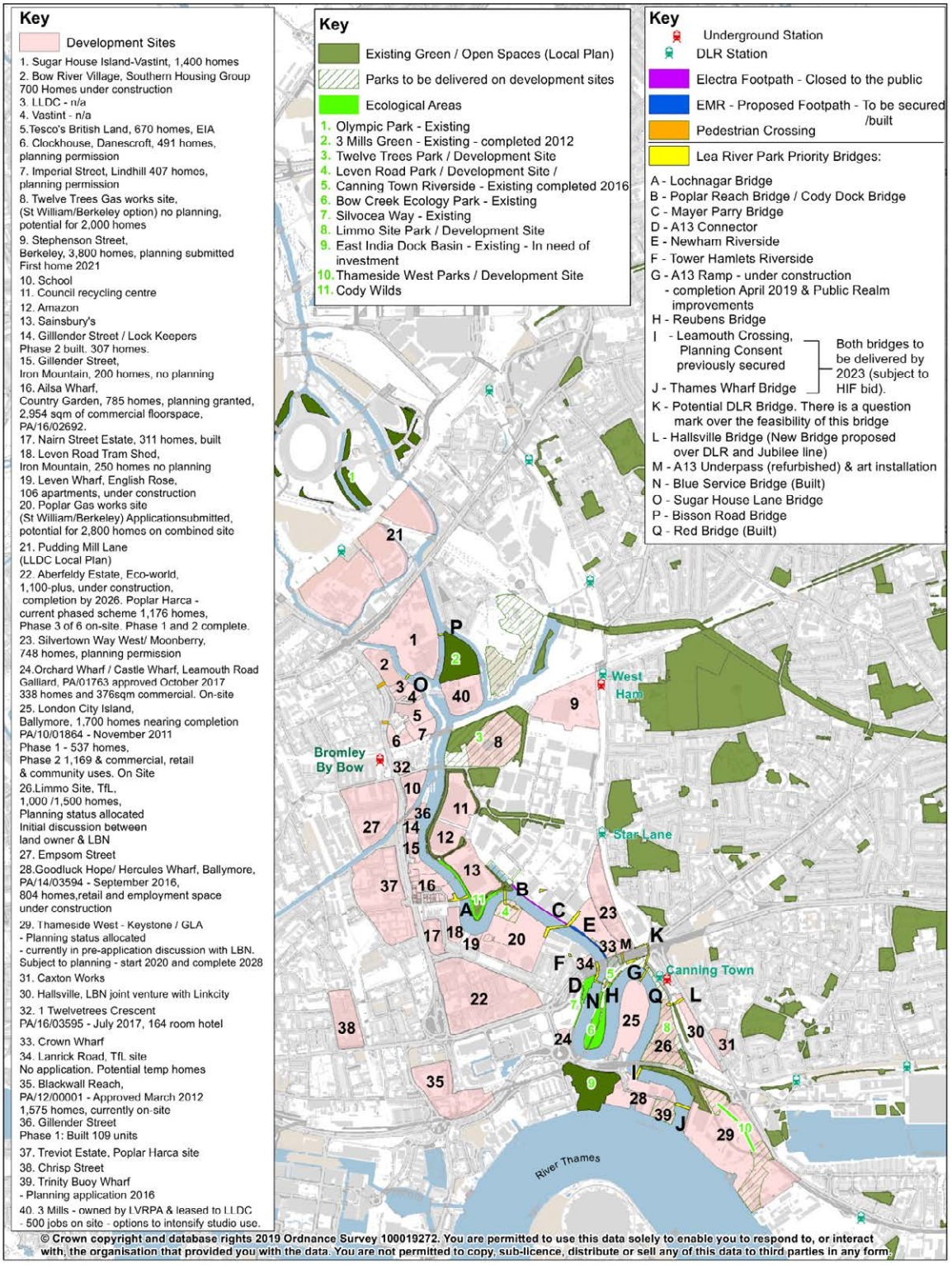
Under the London Biodiversity Action Plan the following key habitats have been identified within the proximity of the work carried out as part of GDP's GRCF:

- Tidal Thames
- Rivers & streams
- Reedbeds
- Woodland
- Parks and urban green spaces
- Wasteland

Other important habitats

- Built structures (biodiversity design)[78]

2.12 Lea River Park Development Plan



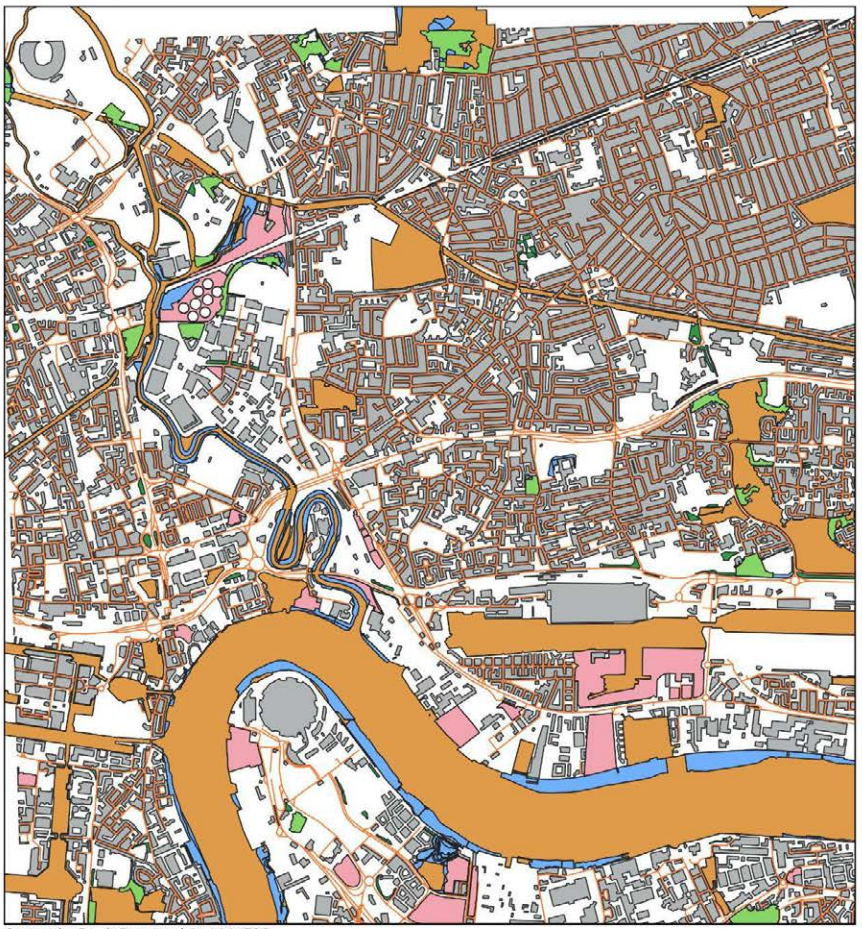
Newham London

Site Plan

Lea River Park Development Sites, Proposed Bridges, Crossings, and Priority Projects - January 2019

Date:	05/02/2019
Scale:	1:17,000
Drawn By:	BL

2.13 Non-Statutory Designations



SiteName	Grade	ReleaseDt
Mudchute Farm and Park	M	July 2021
Fun Forest	L	July 2021
Eastmoor Street Park	BII	July 2021
Greenwich Ecology Park and Southern Park	BI	July 2021
Maryon Park, Gilbert's Pit and Maryon Wilson Park	BI	July 2021
Cameron Community Garden	L	July 2021
East India Dock Basin	BI	July 2021
Saffron Avenue Pond	BII	July 2021
Robin Hood Gardens	L	July 2021
Thames Barrier Park	BII	July 2021
Newham Way Footpath	L	July 2021
Thames Wharf	BI	July 2021
Bow Creek Ecology Park	BI	July 2021
Beckton District Park and Newham City Farm	BI	July 2021
Railside Land in Newham	BII	July 2021
Plashet Park	L	July 2021
Priory Park	L	July 2021
Central Park	L	July 2021
Pylon Walk	L	July 2021
Royal Docks	BI	July 2021
Lyle Park	L	July 2021
Star Park	L	July 2021
East London Cemetery	BII	July 2021
All Saints Churchyard, West Ham	L	July 2021
Bromley-by-Bow War Memorial Wood	BI	July 2021
West Ham Park	L	July 2021
Transco Rough	BII	July 2021
Bow Back Rivers	BI	July 2021
River Thames and tidal tributaries	M	July 2021
Lea Valley	M	July 2021
The Greenway and Old Ford Nature Reserve	BI	July 2021
London's Canals	M	July 2021
Blackwall Basin	BII	July 2021
Millwall and West India Docks	BII	July 2021
Poplar Dock	BII	July 2021

Designations
- Forestry Inventory
- Priority Habitat Inventory England
- Open Mosaic Habitat
- SINCs

Mapping
- Buildings
- Woodland
- Roads

Gasworks Dock Partnership 1141523

Benjamin Bishop

2.14 Newham Protected Green Spaces

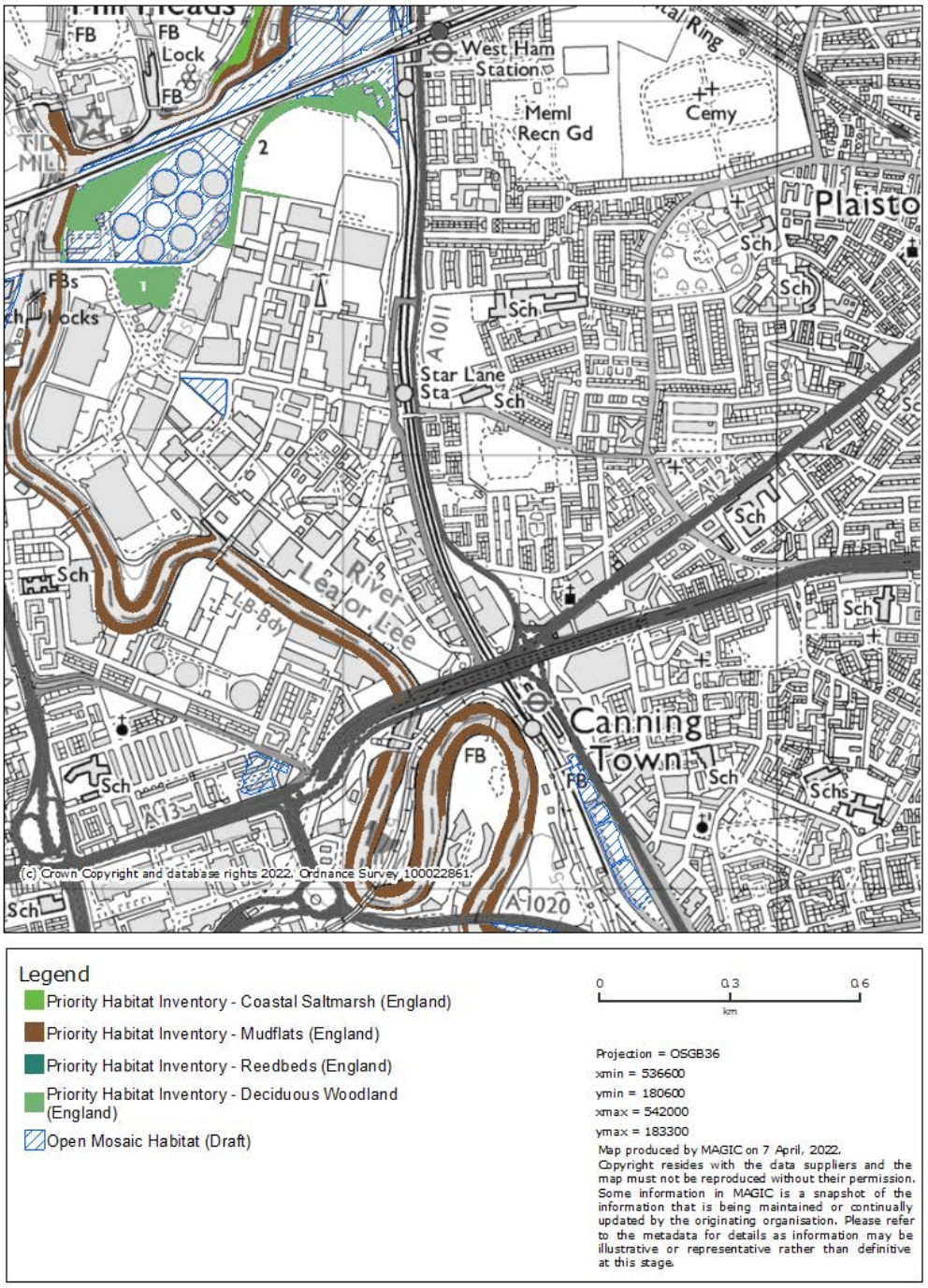
Sites listed as protected greenspace within the Newham Local Plan. These sites are within the boundaries of GDP's stewardship as part of the GRCF.

Plan code	Name	Area (ha)	Classification	Access	Designation	Location
GS206	Memorial Woods	1.17	Amenity / Woodland Small Open Space	Public Access	**SINC**	Custom House & Canning Town E3 3JQ
GS358	Lea River Park	3.19	Cody Road & Leaway TBC	Public Access	**NA**	Custom House & Canning Town E3 3JH
GS355	Sensory Garden	0.08	Pocket Park	Public Access	**NA**	Custom House &

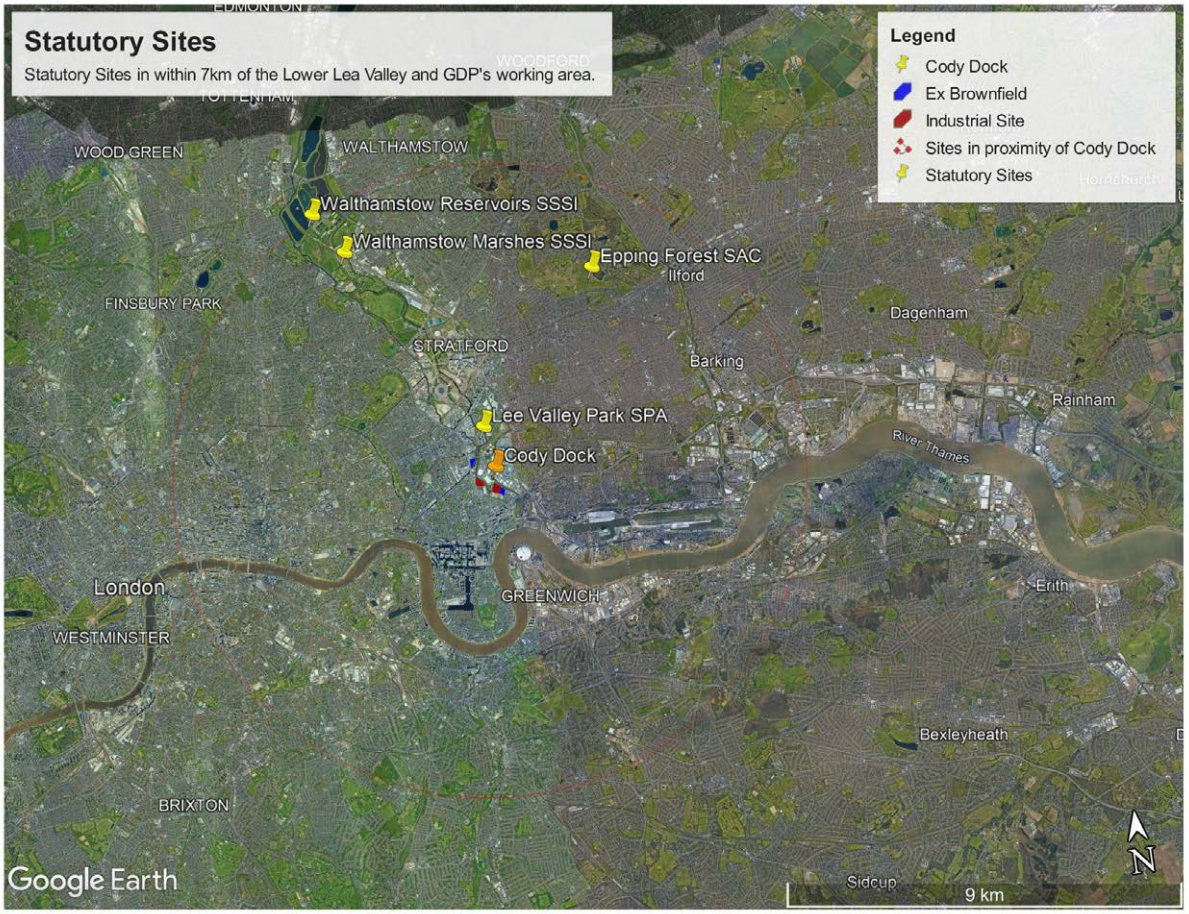
						Canning E16 4TL
GS254	Reedbeds on the Lea	0.48	Waterway No Designation	No Public Access	**SINC**	Custom House & Canning Town E14 0LA
GS300	Bow Ecology Park	1.43	Park Small Open space	Public Access	**SINC, LVRPA** *(Lee Valley Regional Park Authority)*	Custom House & Canning Town E14 0JG
GS158	Channelsea Saltmarsh	0.52	Waterway No Designation	No Public Access	**SINC**	Stratford & West Ham E15 3NY

2.15 Lower Lea Valley Priority Habitat Inventory

These sites are of high nature conservation value and have to be considered within the planning and development processes in London. This map shows the habitats of 'principal importance' which are deemed to be the most threatened, requiring conservation action.



2.16 Statutory Site Designations Within 7km of Cody Dock



2.2 Full Bird Species List with BoCC5 Conservation Status (2021)

Status	Accepted Name	Common Name
Red	*Linaria cannabina*	Common linnet
	Sturnus vulgaris	Common starling
	Cuculus canorus	Cuckoo
	Chloris chloris	European greenfinch
	Larus argentatus	Herring Gull
	Passer domesticus	House Sparrow
	Poecile palustris	Marsh Tit
	Turdus viscivorus	Mistle Thrush

	Vanellus vanellus	Northern lapwing
	Charadrius hiaticula	Common ringed plover
	Muscicapa striata	Spotted Flycatcher
	Apus apus	Swift
Amber	*Phoenicurus ochruros*	Black Redstart
	Chroicocephalus ridibundus	Black-headed Gull
	Larus canus	Common Gull
	Gallinula chloropus	Common moorhen
	Actitis hypoleucos	Common Sandpiper
	Sterna hirundo	Common Tern
	Columba palumbus	Common wood pigeon
	Prunella modularis	Dunnock
	Falco tinnunculus	Eurasian kestrel
	Accipiter nisus	Eurasian sparrowhawk
	Troglodytes troglodytes	Eurasian wren
	Mareca strepera	Gadwall
	Larus marinus	Great Black-backed Gull
	Motacilla cinerea	Grey Wagtail
	Larus fuscus	Lesser Black-backed Gull
	Anas platyrhynchos	Mallard
	Haematopus ostralegus	Oystercatcher
	Tringa totanus	Redshank
	Turdus iliacus	Redwing
	Emberiza schoeniclus	Reed bunting
	Acrocephalus schoenobaenus	Sedge warbler
	Tadorna tadorna	Shelduck
	Turdus philomelos	Song thrush
	Anas crecca	Teal
	Arenaria interpres	Turnstone
	Phylloscopus trochilus	Willow warbler
Green	*Sylvia atricapilla*	Blackcap

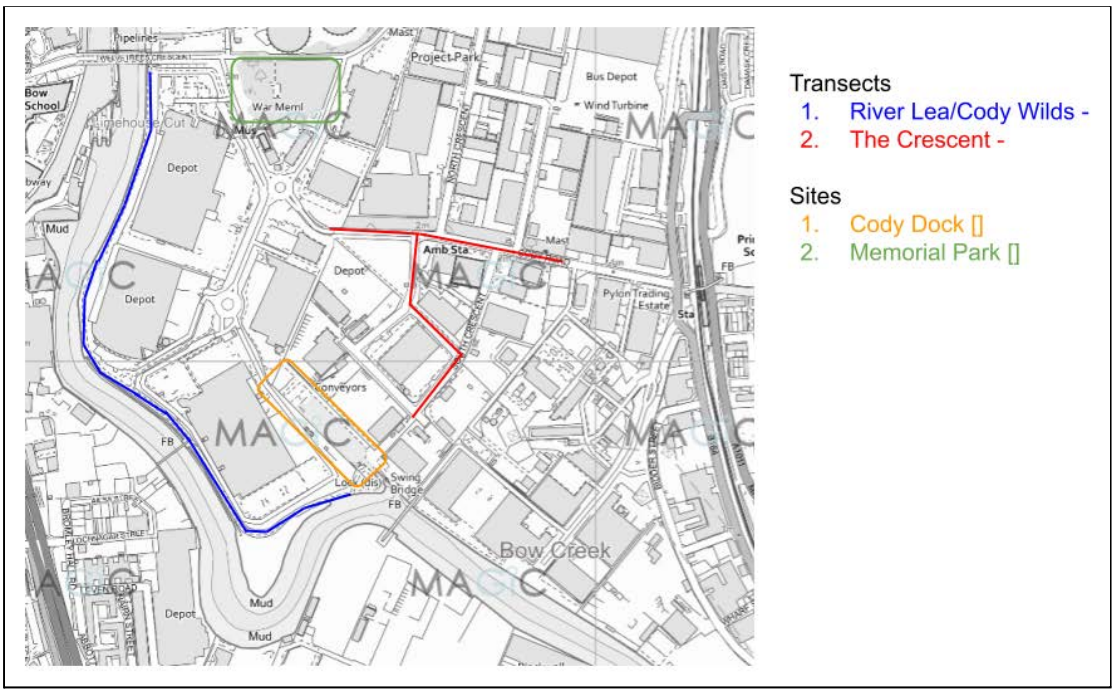
	Fringilla montifringilla	Brambling
	Buteo buteo	Buzzard
	Corvus corone	Carrion Crow
	Cettia cetti	Cetti's Warbler
	Fringilla coelebs	Chaffinch
	Periparus ater	Coal Tit
	Streptopelia decaocto	Collared Dove
	Turdus merula	Common blackbird
	Phylloscopus collybita	Common chiffchaff
	Fulica atra	Coot
	Phalacrocorax carbo	Cormorant
	Cyanistes caeruleus	Eurasian blue tit
	Garrulus glandarius	Eurasian jay
	Pica pica	Eurasian magpie
	Carduelis carduelis	European goldfinch
	Erithacus rubecula	European robin
	Columba livia	Feral Pigeon
	Sylvia borin	Garden Warbler
	Regulus regulus	Goldcrest
	Podiceps cristatus	Great Crested Grebe
	Dendrocopos major	Great Spotted Woodpecker
	Parus major	Great Tit
	Picus viridis	Green woodpecker
	Ardea cinerea	Grey Heron
	Alcedo atthis	Kingfisher
	Curruca curruca	Lesser whitethroat
	Egretta garzetta	Little Egret
	Tachybaptus ruficollis	Little grebe
	Aegithalos caudatus	Long-tailed Tit
	Cygnus olor	Mute Swan
	Falco peregrinus	Peregrine falcon

	Motacilla alba	Pied/White Wagtail
	Acrocephalus scirpaceus	Reed Warbler
	Riparia riparia	Sand Martin
	Certhia familiaris	Treecreeper
	Aythya fuligula	Tufted Duck
	Rallus aquaticus	Water Rail
Non-native species	*Cygnus atratus*	Black swan
	Branta canadensis	Canada Goose
	Alopochen aegyptiaca	Egyptian Goose
	Aix galericulata	Mandarin Duck
	Psittacula krameri	Ring-necked Parakeet

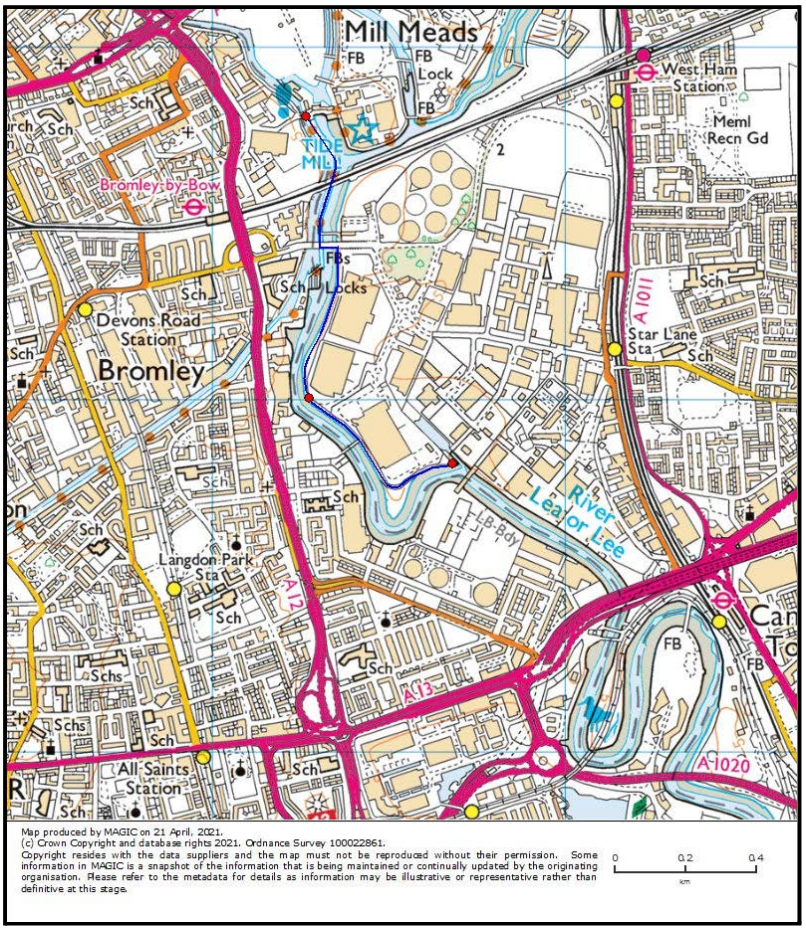
2.2 Bird species present in and around Cody Dock which are London Priority Species

Accepted Name	**Common Name**
Phoenicurus ochruros	Black Redstart
Linaria cannabina	Common linnet
Actitis hypoleucos	Common Sandpiper
Sturnus vulgaris	Common starling
Prunella modularis	Dunnock
Mareca strepera	Gadwall
Passer domesticus	House Sparrow
Alcedo atthis	Kingfisher
Larus fuscus	Lesser Black-backed Gull
Curruca curruca	Lesser whitethroat
Vanellus vanellus	Northern lapwing
Falco peregrinus	Peregrine falcon
Charadrius hiaticulata	Common ringed plover
Riparia riparia	Sand Martin
Tadorna tadorna	Shelduck
Turdus philomelos	Song thrush
Muscicapa striata	Spotted Flycatcher
Apus apus	Swift

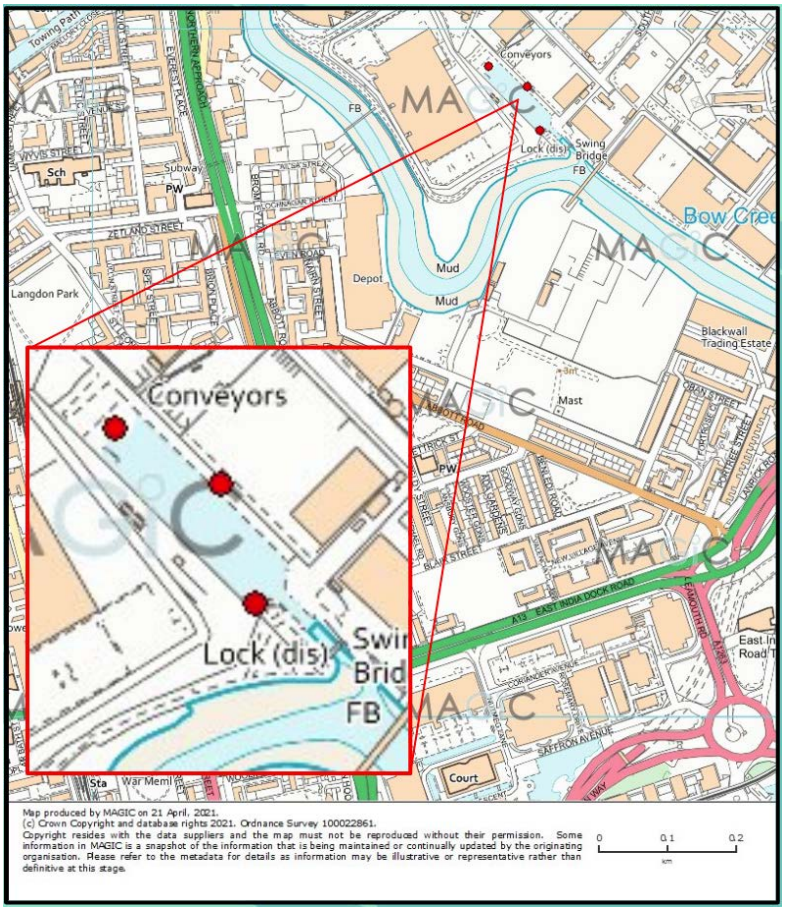
2.3. Location of UK Butterfly Monitoring Survey (UKBMS) survey transects and sites



2.4 Location of British Dragonfly Survey (BDS) transect (a) and site (b)



(a)

(b) 

2.5 Location of sample sites for the intertidal survey

Transect and Zone					
1		**2**		**3**	
1.1	**1.2**	**2.1**	**2.2**	**3.1**	**3.2**
TQ 38300 82222	TQ 38312 81924	TQ 38459 81774	TQ 38580 81716	TQ 39123 81343	TQ 38997 81583

2.6 Full list of invertebrate species found during intertidal survey of the River Lea 29/04/21 - 14/05/21. Invasive species marked with an asterisk.

Common name	**Scientific family (if known)**
Freshwater shrimp	Gammaridae
Demon shrimp*	Gammaridae
Freshwater hoglouse	Asellidae
Sludge worm	Tubificidae

Mayfly spp.	Baetidae
Mayfly spp.	Caenidae
Midge	Chironomidae
Damselfly spp.	
Golden clam*	Cyrenidae
Pea clam	Sphaeriidae
Water beetle larvae	
Water flea	Daphniidae
Pond snail	Lymnaeidae

2.7 Bee species records and status

Accepted name	Common name	IUCN cat. (global)	Population trajectory	UK BAP	London Priority Species
Lasius niger	Small Black Ant	-	-	NL	N
Andrena cineraria	Ashy Mining Bee	LC	unknown	NL	N
Andrena fulva	Tawny Mining Bee	DD	unknown	NL	N
Andrena haemorrhoa	Orange-tailed Mining Bee	LC	unknown	NL	N
Anthidium manicatum	Wool Carder Bee	LC	unknown	NL	N
Anthophora plumipes	Hairy-footed Flower Bee	LC	unknown	NL	N
Bombus hortorum	Small Garden Bumblebee	LC	stable	NL	N
Bombus hypnorum	Tree Bumblebee	LC	increasing	NL	N
Bombus lapidarius	Red-tailed Bumblebee	LC	increasing	NL	N
Bombus lucorum	White-tailed Bumblebee	LC	stable	NL	N
Bombus pascuorum	Common Carder Bee	LC	increasing	NL	N
Bombus pratorum	Early Bumblebee	LC	increasing	NL	N
Bombus rupestris	Red-tailed Cuckoo Bee	LC	unknown	NL	N
Bombus sylvarum	Shrill Carder Bee	LC	decreasing	SAP	N
Bombus sylvestris	Forest Cuckoo Bee	LC	stable	NL	N
Bombus terrestris	Buff-tailed Bumblebee	LC	increasing	NL	N

Coelioxys inermis	Shiny-vented Sharp-tail Bee	LC	unknown	NL	N
Lasioglossum calceatum	Common Furrow Bee	LC	unknown	NL	N
Osmia bicornis	Red mason bee	LC	unknown	NL	N
Osmia caerulescens	Blue Mason Bee	LC	unknown	NL	N

2.8 Butterfly Species Records and Status

Accepted name	Common name	IUCN cat. (global)	Population trajectory	UK BAP	London Priority Species
Aglais io	Peacock	LC	stable	NL	N
Aglais urticae	Small Tortoiseshell	LC	stable	NL	N
Anthocharis cardamines	Orange-tip	LC	stable	NL	N
Aricia agestis	Brown Argus	LC	stable	NL	N
Callophrys rubi	Green Hairstreak	LC	stable	NL	N
Celastrina argiolus	Holly Blue	LC	stable	NL	N
Gonepteryx rhamni	Brimstone	LC	stable	NL	N
Lycaena phlaeas	Small Copper	LC	Stable	NL	P
Maniola jurtina	Meadow Brown	LC	stable	NL	N
Ochlodes sylvanus	Large skipper	LC	stable	NL	P
Pararge aegeria	Speckled Wood	LC	stable	NL	N
Pieris brassicae	Large White	LC	stable	NL	N
Pieris napi	Green-veined White	LC	stable	NL	N
Pieris rapae	Small White	LC	stable	NL	N
Polygonia c-album	Comma	LC	stable	NL	N
Polyommatus icarus	Common Blue	LC	stable	NL	N
Pyronia tithonus	Gatekeeper	LC	decreasing	NL	N
Thymelicus lineola	Essex Skipper	LC	stable	NL	P
Vanessa atalanta	Red Admiral	LC	unknown	NL	N
Vanessa cardui	Painted Lady	LC	stable	NL	N

2.9 Odonata Species Records and Status

Accepted name	Common name	IUCN cat. (global)	Population trajectory	UK BAP	London Priority Species
Calopteryx splendens	Banded Demoiselle	LC	stable	NL	N

Chalcolestes viridis	Willow Emerald Damselfly	LC	stable	NL	N
Coenagrion pulchellum	Variable damselfly	LC	Stable	NL	N
Enallagma cyathigerum	Common Blue Damselfly	LC	stable	NL	N
Erythromma najas	red-eyed damselfy	LC	Stable	NL	N
Ischnura elegans	Blue-tailed Damselfly	LC	stable	NL	N
Pyrrhosoma nymphula	Large red damselfly	LC	Stable	NL	N
Aeshna cyanea	Southern Hawker	LC	increasing	NL	N
Aeshna grandis	Brown Hawker	LC	unknown	NL	N
Aeshna juncea	Common Hawker	LC	stable	NL	N
Aeshna mixta	Migrant Hawker	LC	increasing	NL	N
Anax imperator	Emperor Dragonfly	LC	stable	NL	N
Orthertrum cancellatum	Black-tailed skimmer	LC	stable	NL	N
Sympetrum striolatum	Common Darter	LC	unknown	NL	N

2.10 Ladybird Species Records and Status

Accepted name	**Common name**	**IUCN cat. (global)**	**Population trajectory**	**UK BAP**	**London Priority Species**
Adalia bipunctata	2-spot Ladybird	-	-	NL	N
Adalia decempunctata	10-spot Ladybird	-	-	NL	N
Calvia quattuordecimguttata	Cream-spot Ladybird	-	-	NL	N
Coccinella septempunctata	7-spot Ladybird	-	-	NL	N
Harmonia axyridis	Harlequin ladybird	-	-	NL	N
Propylea quattuordecimpunctata	14-spot Ladybird	-	-	NL	N
Psyllobora vigintiduopunctata	22-spot Ladybird	-	-	NL	N

2.11 Meadow Wildflower Species planted around study area

Latin name	**Common name**
Trifolium repens	White clover
Agrostemma githago	Corncockle
Papaver rhoeas	Corn poppy
Silene dioica	Red campion
Centaurea cyanus	Cornflower
Leucanthemum vulgaris	Oxeye daisy
Anthemis arvensis	Corn chamomile
Trifolium pratense	Red clover
Platago lanceolata	Ribwort plantain
Sanguisorba minor	Salad burnet
Lotus corniculatus	Bird's-foot trefoil
Rhinathus minor	Yellow rattle
Achillea millefolium	Yarrow
Vicia sativa	Common vetch
Festuca rubra rubra	Creeping red fescue
Festuca rubra commutata	Chewing red fescue
Festuca rubra litoralis	Slender creeping red fescue
Poa pratensis	Smooth meadow grass
Agrostis capillaris	Common bent grass
Grassland specific	
Festuca rubra rubra	Creeping red fescue
Lolium perenne	Perennial ryegrass
Festuca rubea litoralis	Slender creeping red fescue
Poa	Smooth meadow grass
Agrostis capillaris	Common bent grass
Trifolium repens	White clover

2.12 Shaded Wildflower Species Mix

Latin name	**Common name**
Silene dioica	Red campion
Daucus carota	Wild carrot
Borago officnalis	Borage
Agrimonia eupatorium	Common agrimony
Anthriscus sylvestris	Cow parsley
Galium mollugo	Hedge bedstraw
Sanguisorba minor	Salad burnet
Festuca arundinacea	Tall fescue
Hyacinthoides non scripta	Bluebell
Cynosurus cristatus	Crested dogs-tail
Festuca rubea litoralis	Slender creeping red fescue
Geum urbanum	Wood avens
Poa nemoralis	Wood meadow grass
Festuca rubra rubra	Creeping red fescue
Iris pseudacorus	Yellow flag iris
Alliara petiolata	Garlic mustard
Agrostemma githago	Corncockle
Stelllaria holostea	Greater stitchwort
Oenothera biennis	Evening primrose
Digitalis purpurea	Foxglove

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