



What we are already doing

Managing carbon in the Colindale station redevelopment

The redevelopment of Colindale Underground station in north London will deliver increased capacity and step-free access by 2024, and support new residential development on the current station site. We are integrating carbon management into all design work and decision making around the project, using the principles set out in the Publicly Available Specification for Carbon Management in Infrastructure, PAS 2080. Working closely with our suppliers Morgan Sindall, Atkins and Fourway, and using the Rail Safety and Standards Board's Rail Carbon Tool, we have continually developed the design for the new station building to reduce carbon use across the lifecycle of the new infrastructure. Improvements ranged from reducing the amount of materials we use to adapting the public lighting design to optimise energy consumption. TfL's project engineer for the scheme has been recognised as a Carbon Champion by the Institution of Civil Engineers.

Net Zero Infrastructure Industry Coalition

In 2019 we joined a coalition of prominent public and private infrastructure businesses and academic institutions that are committed to achieving net-zero carbon emissions. Our goal is to support the ambition of the UK to transform the way in which the infrastructure that forms the backbone of our economy contributes to good net-zero carbon, and makes the UK an international leader in net-zero carbon across the global infrastructure industry. The Net-Zero Infrastructure Industry Coalition will provide and demonstrate clear leadership as well as innovative thinking and know-how across the infrastructure industry to achieve our goal.

We are working to manage the carbon when redeveloping our stations

Adapting to the changing climate

Our ambitions

-  Understand, prepare and adapt for climate change, now and in the future on our services, infrastructure, staff, contractors and customers

How will this be reached?

- Understand TfL's exposure to the impact of climate change through a dedicated research programme, developing case studies of weather-related impacts, and improving how we collect data on performance and incidents
- Embed climate change adaptation into our processes, long-term planning and decision making
- Work with teams across TfL to raise awareness of climate change impacts and improve the way we reduce those risks
- Work with other infrastructure owners and transport organisations to share knowledge, understanding of interdependencies and risks, develop best practice and work together to help reduce risks

Our targets

- Conduct a climate risk assessment of our assets by the end of 2021
- Develop a baseline understanding of severe weather impacts on our assets and performance by the end of 2022
- Use this baseline and the Met Office's climate projections to predict the likely impact of future climate change on our network by 2023
- Apply climate projections consistently across the business by 2023, including in TfL's standards

How will this be monitored?

- Through project and programme business cases, scheme designs and other project management tools
- Data on performance, costs and incidents
- Benchmarking TfL's progress on adaptation against other organisations in the transport sector and beyond
- Reporting through the Adaptation Reporting Power created as part of the Climate Change Act (2008)



What we are already doing

Collaboration to improve climate change adaptation and resilience

We established and continue to chair the quarterly Transport Adaptation Steering Group, which brings together stakeholders (such as Network Rail, Highways England and Thames Water) and experts (such as the London Climate Change Partnership and Environment Agency) to understand how we can proactively address the issue of climate change adaptation in the transport sector.

London Underground Comprehensive Review of Flood Risk

The London Underground Comprehensive Review of Flood Risk project systematically reviewed any significant sources of flood risk, both natural and non-natural, to all of London Underground's vulnerable assets. The aim was to quantify the safety and business residual risks, and identify those assets most at risk of flooding, so that operational mitigation measures can be implemented and financial resources allocated more effectively.

After burst water mains, the most significant flooding threats are surface water flooding and river or tidal flooding. The latest results suggest a total residual risk value of £4.2m per year.

Better managing flooding risk is key to adapting to climate change

Case study

Embedding climate change adaptation measures at West Ham Bus Garage

At seven acres, the award-winning West Ham bus garage is one of the largest bus garages in Europe. It is also one of the most environmentally sustainable bus garages in the UK.

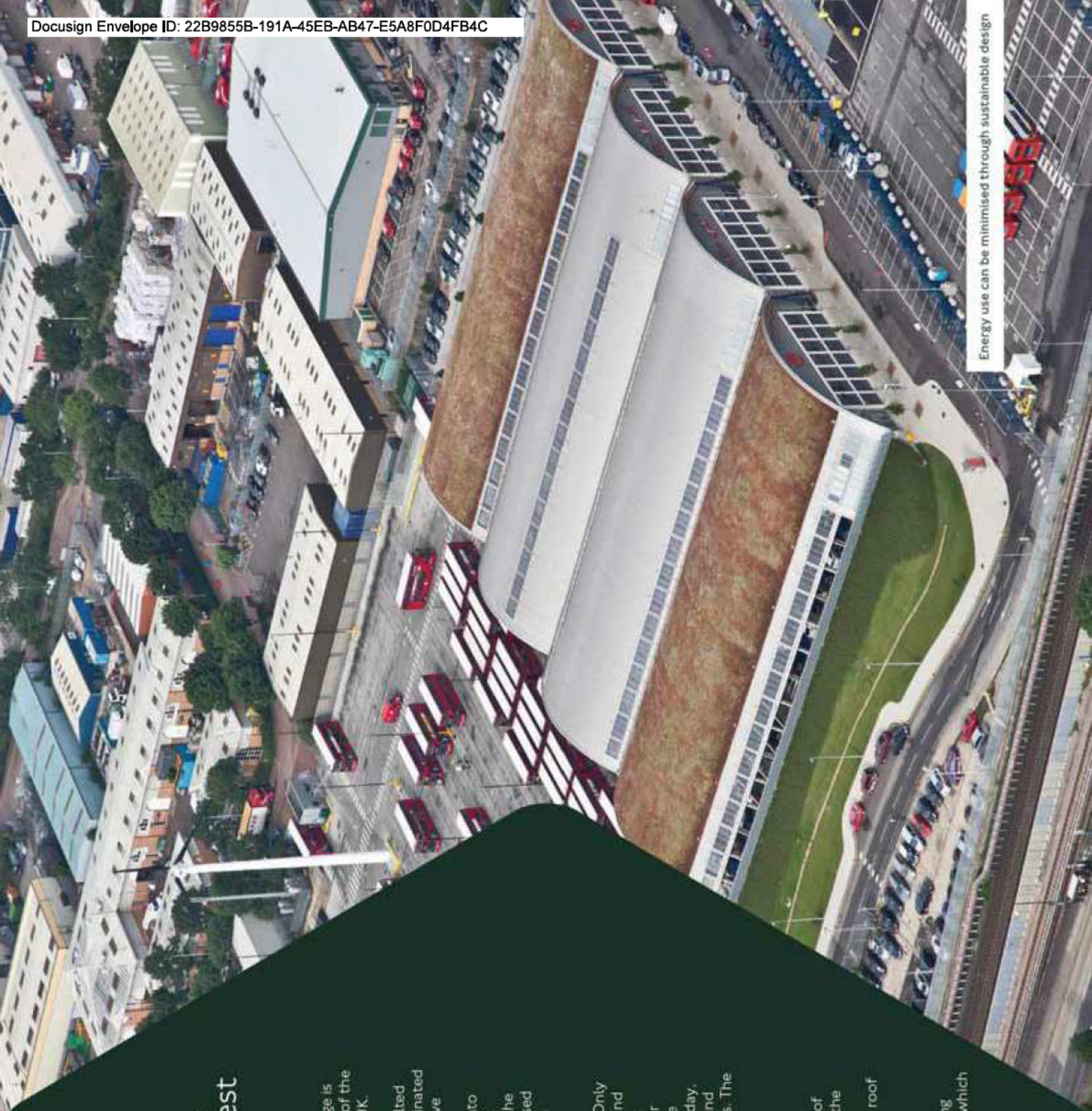
The garage has approximately 7,400sqm of barrel-vaulted roof-covered space. The two outer arches of the laminated timber roof (more than half of the total roof area) have been planted with a mat of sedum species. This acts like a sponge for rainwater, releasing it more slowly into the drainage system and so helping to reduce the risk of surface water flooding. Rainwater collected from the rest of the roof is stored in underground tanks and used to flush on-site toilets, helping to reduce pressure on water supplies.

The garage minimises energy use through its design. Only some of the rooms such as computer server rooms and training rooms are air conditioned. Other rooms have a ventilation system that is designed to draw in colder air overnight ready for their day-time occupation. The building's exposed concrete absorbs heat during the day, while the biomass boiler and micro Combined Heat and Power (CHP) units help reduce reliance on fossil fuels. The completed facility achieved an 'A' rated Energy Performance Certificate.

It is not just the garage that integrates climate change adaptation into its design. To help reduce the impacts of summer heat, all double deck buses in the fleet (with the exception of classic Routemasters) have air cooling. In addition, all single and double decks have white roofs, roof and engine insulation, tinted windows and opening windows.

Bus parking areas either side of the central engineering facility are designed to absorb noise from the depot which is located next to residential areas.

Energy use can be minimised through sustainable design





Air quality

Reduce emissions of harmful air pollutants from our activities

Air quality

Toxic air pollution remains a huge risk to the health of all Londoners. Progress has been made in reducing air pollution from road traffic in London through the introduction of the ULEZ in 2019 and strengthening of the Low Emission Zone standards in March 2021. However, there is still much to do for London to comply with legal limits for nitrogen dioxide (NO₂) and to meet the London Environment Strategy's ambition of reaching the World Health Organisation's recommended limits on particulate matter (PM_{2.5}).

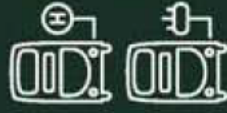
We will continue to play our part in delivering the Mayor's air quality programme, starting with the expansion of the ULEZ in October 2021. We will also continue to work with London's boroughs to deliver local improvements in air quality, and with taxi and private hire operators to reduce emissions from their fleets.

Reducing emissions from our own operations is a vital part of improving London's air quality. All 9,000 buses in our fleet now meet or exceed the cleanest Euro VI emissions standards, the same strict standards as the Mayor's ULEZ. The buses which we have retrofitted to meet the Euro VI standard emit up to 95 per cent less nitrogen oxide (NO_x) emissions and 80 per cent less particulate matter than before.

We want to move to a zero-emission support fleet and are working with our suppliers to convert their vehicles. As we transition our buildings towards zero carbon, we aim to reduce emissions of air pollutants as well. We are working hard to reduce emissions from the plant and equipment that we and our suppliers use in construction and maintenance of the network.

Our responsibility to improve air quality extends to our staff and customers on London Underground. While the concentration of particulate matter in the Tube network is below legal limits, there are still some areas of the network with high levels of dust. We have committed to working with academic partners to research the potential health impacts of the particulates found in the Tube network and publish the results. In the meantime, we are continuing to ensure the Tube is cleaned where it is most needed and explore innovative solutions to managing dust.

We continue to work with London's boroughs to deliver local improvements in air quality



ALL **9,000** buses in our fleet now meet or exceed the cleanest Euro VI emissions standards



Increasing active travel and reducing motor vehicles improves air quality

Improving air quality

Our ambitions

-  Help deliver London's air quality programme
-  Transition the fleets under our control to zero-emission
-  Reduce emissions of harmful air pollutants from our buildings and on the Tube network
-  Lead the way in the use of low- and zero-emission plant and equipment

How will this be reached?

- We will no longer procure new diesel or hybrid buses and will only procure new zero-emission buses
- Continue to work with taxi and private hire operators to support their conversion to zero emission capable vehicles
- Use performance management measures in our contracts to incentivise our suppliers to convert their vehicle fleets to zero emission
- Undertake detailed analysis of the health impacts of particulate matter on the Tube
- Trial innovative techniques to reduce particulate levels on the Tube
- Work with our suppliers to move towards zero emission Non-Road Mobile Machinery (NRM) across the network

Our targets

- Zero emission bus fleet by 2034 or earlier, with an ambition to achieve this by 2030
- All cars in our support fleet to be zero emission by 2025, and vans by 2030
- From 2025, new contracts will require freight and servicing vehicles under 3.5 tonnes travelling to TfL buildings to be zero emission
- Comply with the progressively tightening NRM Low Emission Zone standards for TfL developments and business as usual activities. This will lead to all NRM procured by us, or used by suppliers and subcontractors on our behalf, to be zero emission by 2040

How will this be monitored?

- Track and report the makeup of our vehicle fleets and their emissions and that of our subcontracted services and suppliers
- Regular monitoring of particulate matter concentrations on the Tube
- NRM compliance is monitored by the GLA NRM register and will also be monitored by a specialist app, currently in development

What we are already doing

Reducing emissions from our buses

We already operate the largest zero emission bus fleet in western Europe, with more than 500 electric buses currently in operation, increasing to 800 by the end of March 2022, and 22 hydrogen fuel cell buses. We are committed to converting our 9,000-strong bus fleet to zero emission, and aim to have transitioned 10 per cent of the fleet by 2023. We have recently brought forward our target for a fully zero-emission fleet to 2034, with an ambition to achieve this by 2030.

Working with the GLA to develop the non-road mobile machinery compliance monitoring app

Exhaust fumes from non-road mobile machinery such as excavators and generators are a significant contributor to London's air pollution. Progressively stricter emission standards have been set. The current GLA NRMN Register monitors compliance with NRMN standards for development sites which can be identified by specific postcode. We are working with the GLA to develop an online portal to monitor compliance with NRMN standards across the GLA group and pilot this on TfL's highways maintenance contracts.

We are committed to converting our 9,000 strong bus fleet to zero emission



Green infrastructure

Protect, connect and enhance our green infrastructure including the biodiversity, habitats and ecosystem services on our estate

Green infrastructure

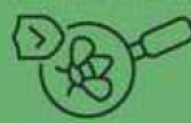
Our climate is in crisis and so is nature. The pressures on our natural environment continue to increase with more competition for space caused by increased demand for consumer goods, agriculture and accelerated urbanisation. Globally, more than a million species are on the verge of extinction, with an average of 60 per cent decline in animal populations since 1970. The latest (2019) State of Nature Report from a coalition of environmental organisations estimated that 15 per cent of the species assessed in the UK are at risk of extinction. London's wildlife is in decline, in line with the trends across the country.

Our network is home to several notable and protected species such as bats, water voles, stag beetles, great crested newts and badgers to name a few. It also includes designated sites such as Epping Forest, which is nationally and internationally recognised for its biodiversity. Our

networks also provide valuable green corridors for wildlife. We have 23,500 trees in our inventory with plane (Platanus) being the most dominant. These remove nearly 6.3 tonnes of airborne pollutants each year and store more than 6,700 tonnes of carbon. Beyond this, they divert an estimated 8,700 cubic metres of storm water run off away from the local sewer systems each year. Urban trees are vital to our city since they can help to improve air quality by reducing air temperature and by directly filtering pollutants. With 22.17 square kilometres of landholdings, including 1.65 square kilometres of roadside verges and 124 Sites of Importance for Nature Conservation (SINCs), covering 4.8 square kilometres (or 24 per cent) of our land*, we have a significant opportunity to protect and enhance the flora and fauna in the Capital.

We are committed to protecting our natural environment, connecting and enhancing green spaces across our estate. In the event of biodiversity loss, we provide new green infrastructure to deliver biodiversity net gain. We have a crucial role to play in ensuring that London's natural environment, habitats and species are protected. Improving green infrastructure on our networks makes these more attractive and has health benefits for our customers, particularly those walking, cycling and using public transport. It also increases resilience to extreme weather and climate change. Our investments, projects, and operations will protect, connect and enhance the biodiversity, habitats and ecosystem services in our estate. Our maintenance activities will balance the need to run safe services to the travelling public and delivering biodiversity benefits where possible.

97



species, with protected or priority status in London, recorded within 100m of the tramline, including four species of bats

* November 2018 data

Wildflowers are an important food source for pollinators like bees



Trees provide welcome shade for people walking on hot days

Our green infrastructure includes networks of green spaces, embankments, railway cuttings, grassland, woodland and sustainable drainage systems, and features street trees and green roofs.

Our work on green infrastructure contributes to a wide range of environmental and social benefits. By valuing our natural environment and prioritising green infrastructure as an asset and a solution, there are a number of opportunities for us as an organisation and London as a whole, including:

Climate resilience

Reducing the risk of flooding by slowing the rate and reducing the amount of rainwater entering the drainage system. Green infrastructure also provides shade and helps to cool the city as it radiates less heat back into the air compared to hard infrastructure, such as concrete and asphalt.

Improving health and wellbeing

By helping to cool the city, reduce the risk of flooding, provide shade, and improve air quality we are making London more attractive to live in and visit. Green infrastructure can also help make walking and cycling a more attractive method of travel.

Reducing exposure to poor air quality

In some locations, green infrastructure can act as an effective barrier to air pollutants, helping to reduce pedestrians' exposure to poor air quality.

Providing social benefits

Help connect and improve communities, and enhance natural environments for people living locally and visitors to enjoy.

Growing our economy

By making London a more liveable and climate-adapted city, green infrastructure can make London a more attractive place to live, work in and visit.

Cultural heritage and built environment

From Victorian London plane trees to public parks, green infrastructure is an important part of London's cultural heritage and built environment. Our transport networks connect and provide access to this heritage.

Connecting and enhancing habitats and biodiversity

As well as providing a range of benefits, green infrastructure provides valuable networks of habitats for wildlife and so can increase biodiversity, even in a changing climate.

Green infrastructure can make walking and cycling a more attractive way to travel



4,463

trees have been planted on our roads since 2016, including replacing those that had to be removed due to disease or for safety reasons

Benefits of green infrastructure

Implementation of robust green infrastructure and biodiversity policy will lead to:



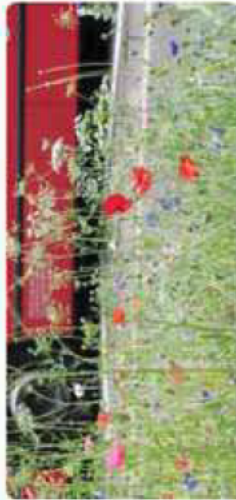
Customers

- + More attractive, safe, reliable and comfortable transport networks
- + Increased level of health and wellbeing, leading to improved quality of life



Boroughs

- + Collaborative working
- + Cleaner air, water and land
- + Enhanced local character



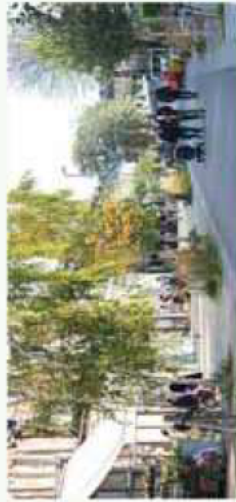
All Londoners

- + Cleaner air, water and land
- + Increased biodiversity
- + Provide access to green spaces
- + Making London a more attractive place to live, work and visit



Benefits to TfL

- + Improved relationship with all stakeholders
- + Cost savings (for example, through energy efficiency, reduced maintenance, etc.)
- + Energy efficiency
- + Risk reduction
- + Adaptation to climate change
- + Staff engagement
- + Enhanced reputation
- + Improved reliability
- + Increased customer footfall
- + Meeting mayoral objectives and legal requirements



Neighbours

- + Neighbours understand our need to maintain safety while working to improve biodiversity
- + Enhanced local character, and improved views and surroundings



Contractors

- + Improved understanding between contractors, leading to more efficient and innovative ways of working



Developers

- + Increased certainty for developers, leading to improved relationships
- + More marketable property developments

Making the most of green infrastructure

Our ambitions

-  Protect, connect and enhance our green infrastructure, including the biodiversity, habitats and ecosystem services on our estate

How will this be reached?

- Use a natural capital approach* to maximise the benefits of green infrastructure in our investments, projects, maintenance activities and strategic decision-making
- Deliver a net gain in biodiversity across our estate through our maintenance activities, project delivery and commercial development
- Contribute to the London Environment Strategy goals of a 10 per cent increase in tree canopy cover and London being more than 50 per cent green
- We aim to avoid, or where this is not achievable, minimise our impacts on SINCs, and actively manage these to improve biodiversity and ecosystem services
- Reduce the incidence of existing, and risk of new, invasive non-native species, such as Japanese knotweed and oak processionary moth, on our networks
- Improve the way we monitor and report on green infrastructure and biodiversity
- Work with teams across TfL to raise awareness of the benefits and importance of green infrastructure and biodiversity, and improve the way we consider these topics, for example, in our Management System

* An approach to policy and decision making that considers and quantifies the value of the natural environment for people and the economy

** Schemes subject to the Town and Country Planning Act and Nationally Significant Infrastructure Projects

Our targets

- Develop a natural capital account for our estate by mid-2022 and regularly update it
- Meet, and where possible exceed, the London Plan's Urban Greening Factor requirements for relevant developments
- Develop a TFL Biodiversity Net Gain strategy to set out our approach towards biodiversity offsetting by end-2022 and aim to achieve 10 per cent biodiversity net gain on applicable schemes**
- Increase the number of trees on our roads by one per cent per year between 2016 and 2025
- Evaluate and expand (where possible) the use of alternative, herbicide-free methods of invasive species management
- Aim for a 10 per cent increase in TFL-wide tree canopy cover by 2050
- Identify and contribute to the Mayor's Transport Strategy target of 50,000 square metres draining through Sustainable Drainage System (SuDS) every year on London's roads
- Publish a green infrastructure technical strategy
- Expand and evaluate our wildflower verges trial by the end of 2022
- Evaluate the success of our green bus shelter roofs by the end-of 2021, to better understand their potential to support enhanced greening across London where it is most needed

How will this be monitored?

- By regularly updating our natural capital account and biodiversity baseline
- Reporting on the Mayor's Transport Strategy target progress to the Board
- Report on estate-wide biodiversity losses and gains every five years, through the biodiversity baseline



What we are already doing

Wildflower verge trials on our roads

We are trialling a reduced mowing regime on our roadside verges to encourage a more diverse habitat and increase wildlife. In 2019, we changed the maintenance regime in trial areas from up to eight annual cuts with clippings left behind, to annual cuts with the removal of all clippings. The regular removal of grass clippings reduces soil nutrients and results in a lower height and amount of grass, increasing the number and diversity of other wildflowers and plants. Left uncut, many of the verges produced flowers in the first year of the trial. We are continuing to cut and collect on all the sites we have been trialling so far, including in Redbridge and Hillingdon. Further new sites have been identified for an expanded trial. This new management method has the potential to save money for maintenance in the long run.

The regular removal of grass clippings reduces soil nutrients and increases wildflower diversity

Natural capital accounting

We are aiming to incorporate natural capital into asset strategy and project life cycle decision-making. The aim is to improve business performance, reduce business risk and deliver better environmental outcomes on schemes, for the benefit of Londoners and the UK as a whole. This aligns with existing commitments under the Mayor's Transport Strategy, London Environment Strategy. It will build on and support the work already under way to identify and reduce greenhouse gas emissions and tackle air pollution. We have identified that information on natural capital is relevant across our project development, maintenance activities and day-to-day operations, with some specific processes being identified as key entry points. We are one of only a few transport authorities globally to consider how to adopt a natural capital approach for its own operations at corporate level, not just in relation to site-based projects.

We are trialling a reduced mowing regime to encourage more diverse habitats

Biodiversity baseline

Working with nature and delivering ecological enhancements through relevant schemes has always been important to us. In 2017 we launched the TfL biodiversity baseline, a tool for tracking losses and gains in biodiversity delivered through the schemes we undertake. The biodiversity baseline is an innovative and effective GIS map of our operational networks that combines the Department for Environment, Food and Rural Affairs' (Defra's) biodiversity net gain metric with a variety of data sources to calculate the biodiversity value (units) of our land. These additional data sources include:

- Up-to-date ecology surveys
- Data from London's environmental records centre, Greenspace Information for Greater London (GiGL)
- Free Government data
- Aerial imagery

In 2019 we expanded the baseline to cover our entire estate, using high-resolution commercial imagery provided by the GLA. We have now used the baseline to identify opportunity areas for future biodiversity enhancements, for example, through offsetting our biodiversity impacts. Sitting alongside the baseline, we launched our biodiversity toolkit, a user-friendly tool to assess how different designs will affect biodiversity, supporting project leaders to make interventions earlier in the design process to benefit biodiversity at the end of the scheme. The data from the toolkit will be submitted to GiGL and used to help update the baseline every five years, enabling us to robustly report against progress towards our goal to deliver biodiversity net gain by 10 per cent on applicable schemes.

In 2017, we launched the TfL biodiversity baseline to track changes in biodiversity delivered through our schemes

By establishing a biodiversity baseline, we can track changes more easily

Case study

Improved drainage systems on our network

Working closely with the Environment Agency, we have installed a SuDs on a case study site at Upminster Bridge, to assess how effective green infrastructure-based SuDs interventions could be in buffering the effects of extreme rainfall events on London Underground infrastructure.

In addition to this innovative approach, multifunctionality incorporated into the design of the system ensured that a range of additional ecosystem service benefits were supported through the initiative. These included protecting Environment Agency waterways, low-carbon construction through the use of recycled construction waste materials and supporting biodiversity through habitat features incorporated into the SuDS design.

The brownfield area has been transformed using the power substation demolition material and spare attenuation crates from works that were part of the 2012 London Summer Olympic and Paralympic Games.



Sustainable resources

Support a low-carbon
circular economy

Sustainable resources

The Mayor has set an ambition for London to become a zero-waste city. We are committed to supporting this, developing and embedding circular economy principles in how we operate. This means we will:

- Reduce waste at source, minimising the waste produced in the first place
- Extract value from materials by reuse and recycling
- Increase the purchase of products made from recycled materials

We aim to divert all waste from landfill and, where we are cannot reuse or recycle, it will be sent to modern incinerators which generate electricity from burning waste, capturing and reducing harmful pollutants during the process.

To reduce waste, action needs to be taken early on. We embed principles to reduce waste in projects' early planning and design stages. The largest generator of waste by weight and volume are our major construction projects, by far. We require all our major projects above a certain threshold to achieve sustainability awards levels such as CEEQUAL (Civil Engineering Environmental Quality Assessment and Awards Scheme) and BREEM (Building Research Establishment Environmental Assessment Method) that require reducing waste through the design process and highly responsible waste management.

Excavated soil from major tunnelling projects can be put to beneficial use more easily than other waste, and we achieve very high reuse and recycling for these waste streams. Capturing the value in some other areas of wastes can be much more challenging.

TfL waste in 2020/21



Recycling helps London to become a zero waste city faster

Increased and more efficient use of sustainable resources

Our ambitions

- ➕ Use resources and materials sustainably
- ➕ Consider materials' carbon cost throughout its life cycle
- ➕ Support London's goal of being a zero-waste city

How will this be reached?

- Deliver our ambitions within the GLA Group Responsible Procurement Implementation Plan 2021-24
- Collaborate with the Relondon partnership to broker innovative solutions through engagement with Tier 1 suppliers and contractors, and SMEs including the development and delivery of trials
- Continue to deliver and build on initiatives such as our Safe & Sustainable by Design projects and engineering programme
- Embed circular economy guidance in procurement
- Identify opportunities in our standards and specifications to incorporate more recycled content of materials and recyclable materials
- Continue to implement customer waste recycling trials in stations
- Work with station tenants to reduce waste and implement food recycling trials
- Continue roll-out of food waste recycling from our staff canteens and establish a food waste baseline. Work with catering contractors to reduce food waste in line with the Mayor's targets to halve food waste by 2050
- Support reduction in plastic waste programmes, including continuing the roll-out of water refill points across the TfL network and reducing the use of single use plastics throughout our operations
- Develop new circular economy benchmarks and targets

Our targets

- Divert from Landfill 100 per cent of non-hazardous construction, demolition and excavation waste by 2030
- Recycle 65 per cent of our commercial and industrial waste by 2030
- Ensure 100 per cent of our commercial staff complete the Circular Procurement eLearning Module by April 2023, 50 per cent by April 2022

How will this be monitored?

- Continue to collate and report on our waste and recycling performance
- Use the Management System to monitor the completion of the Responsible Procurement Checklist
- Monitor the implementation of circular procurement through the Responsible Procurement Implementation Plan progress reporting