

BIODIVERSITY AND THE BUILT ENVIRONMENT:

IRISH CASE STUDIES

Authors:

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Supported by:



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- » **Eimear Fox**, Senior Landscape Architect at Transport Infrastructure Ireland
- » **Dr. Úna FitzPatrick**, Chief Scientific Officer at National Biodiversity Centre
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- » **Susan Vickers**, Head of Environmental Sustainability at Cluid Housing (*Chair*)
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- » **Cairn Homes**
- » **Clúid Housing**
- » **Cork County Council**
- » **Glenveagh**
- » **Heritage Council**
- » **Hibernia Real Estate Group**
- » **HSE**
- » **Irish Doctors for the Environment**
- » **Local Authority Water Programme**
- » **Monaghan County Council**
- » **Murray Associates**
- » **National Biodiversity Centre**
- » **Russell Environmental and Sustainability Services Limited**
- » **Scott Tallon Walker**
- » **Swift Conservation Ireland**
- » **Transport Ireland Infrastructure**
- » **Tuath Housing**

Construction and the built environment are deeply reliant on biodiversity and ecosystem services.

Nature provides our sector with the water and raw materials that we need to manufacture, construction materials and construct buildings. Trees and other plants contribute to improving air and water quality in our cities, preventing floods, and cooling our environment during heat waves. Many social and commercial benefits are also associated with the preservation of biodiversity in urban settings. For instance, vegetation cover and afternoon bird abundances are positively associated with a lower prevalence of depression, anxiety, and stress; and urban house value is boosted by proximity to public green space^a. Despite the reliance of our sector on biodiversity, **current spatial patterns of development and construction methods often negatively affect nature.**

The construction sector contributes to biodiversity loss through land-use changes, pollution, climate change, and the spread of invasive species^b.

These adverse effects occur on-site, through habitat destruction and fragmentation, and off-site, from the extraction and processing of construction materials.

However, integrating biodiversity into planning and development offers transformative opportunities to create healthier and more resilient communities.

But to make this vision a reality, we must embrace innovative and sustainable approaches in construction, moving beyond business-as-usual practices to address ecological challenges while delivering social and environmental gains^c.

About the Case Studies

These Case Studies showcase how **biodiversity and nature-based solutions** have been integrated into various building types and infrastructure projects. They aim to inspire building and construction professionals to protect biodiversity and incorporate nature-led features into their projects. They offer insights from the challenges and lessons learned by others from real-world projects.

The case studies are not designed to provide technical guidance for any specific category of building professional. They were **developed to create a common understanding across the industry of how biodiversity can be protected and enhanced in our built environment**, and of the benefits of doing so. The case studies **should not replace professional advice**. It is **best practice to have a suitably trained**

a Cox, D.T.C., Shanahan, D.F., Hudson, H.L., Plummer, K.E., Siriwardena, G.M., Fuller, R.A., Anderson, K., Hancock, S. and Gaston, K.J. (2017). [Doses of Neighborhood Nature: The Benefits for Mental Health of Living with Nature](#). *BioScience*, [online] 67(2), p.biw173

b Opoku, A. (2019). [Biodiversity and the built environment: Implications for the Sustainable Development Goals \(SDGs\)](#). *Resources, Conservation and Recycling*, 141(0921-3449), pp.1–7

c Although recent studies show that the majority of the impacts of the sector occur off-site – See [“Quantifying biodiversity footprints of Dutch economic sectors: A global supply-chain analysis”](#) and [“Exploring Nature Positive Buildings”](#), the embodied ecological impact of construction has been largely ignored to date

ecologist involved in all projects from an early stage. Additional case studies may be developed as required and will be published on the [Irish Green Building Council's website](#).

How to use this catalogue

Depending on your specific needs, you can use the provided keywords (Figure 1) to identify the case study most relevant to your project type or the information you require. It's important to note that some solutions — such as green roofs — may be more suitable in certain locations (e.g., densely populated urban areas) but might not be the most suitable approach in other places where more space is available.

Careful consideration of the local environment and project context, including cost, is crucial. It is best practice to use the Biodiversity Gain Hierarchy: **Avoid** – **Minimise** – **Protect & Enhance** – **Create** (Figure 2), when developing your project.

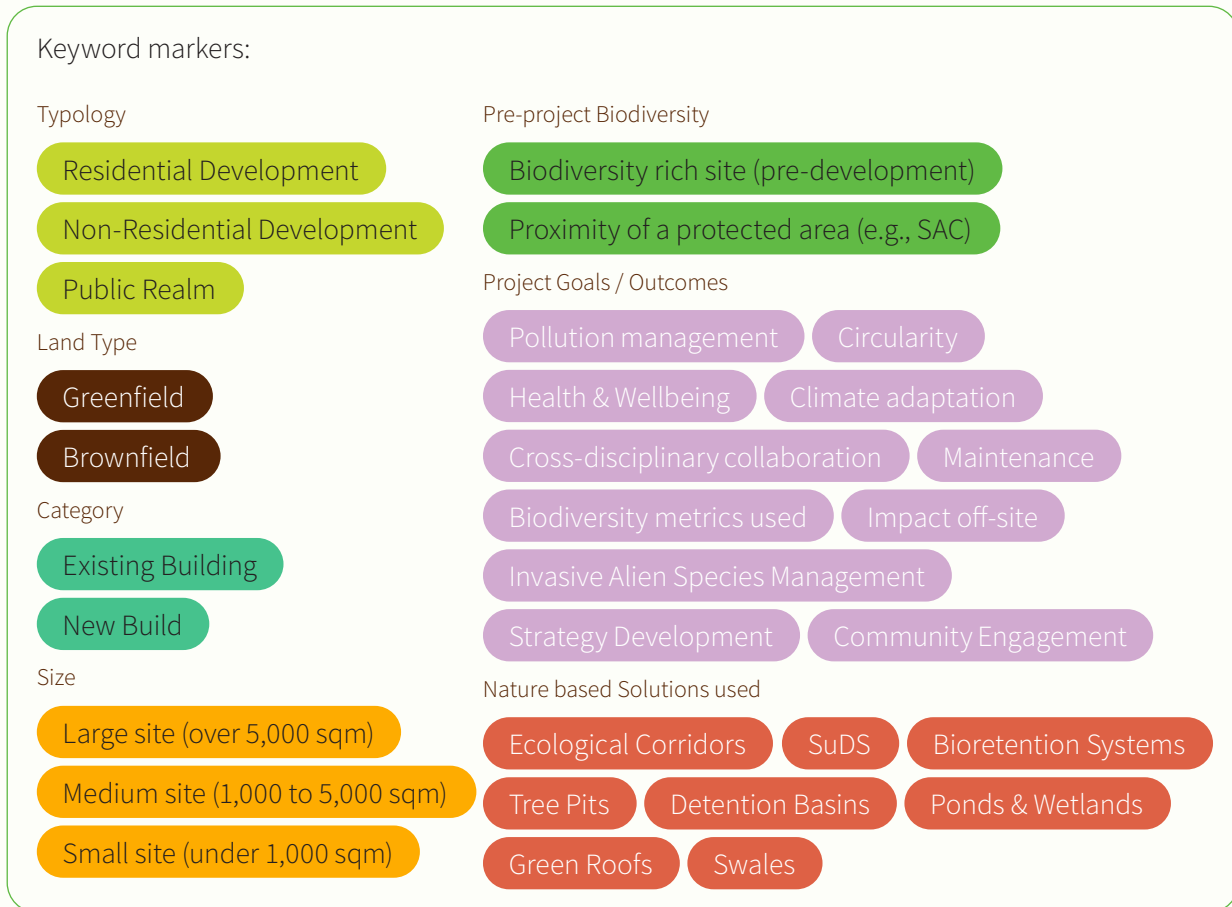


Figure 1: Keyword markers used to identify case studies

About the Biodiversity Gain Hierarchy

Similar to the well-known 'Waste Hierarchy', the **Biodiversity Gain Hierarchy** sets out a sequence of steps to follow when planning and implementing projects, aiming to protect and enhance biodiversity.

Steps:

» Step 1: Avoid

The first step in any strategy should be to avoid creating negative impacts from the outset. This involves careful site selection, thoughtful layout design, and, where necessary, timing construction activities to minimise disturbance. Avoidance is the most effective and reliable form of mitigation and must be given the highest priority. To enable this, biodiversity considerations need to be integrated from the earliest stages of project planning.

» Step 2: Minimise

When avoidance is not feasible, it is essential to minimise negative impacts on existing habitats. This can be achieved by adjusting the project design and strategy to reduce the duration, intensity, and extent of the impacts that cannot be completely avoided.

» Step 3: Protect & Enhance

Once impacts have been avoided and minimised, the next priority is to protect and enhance the quality of existing habitats.

» Step 4: Create

The final step is to explore opportunities for creating new habitats with greater ecological value, which can provide ecosystem services. This may involve more complex and costly approaches—such as the installation of green roofs.

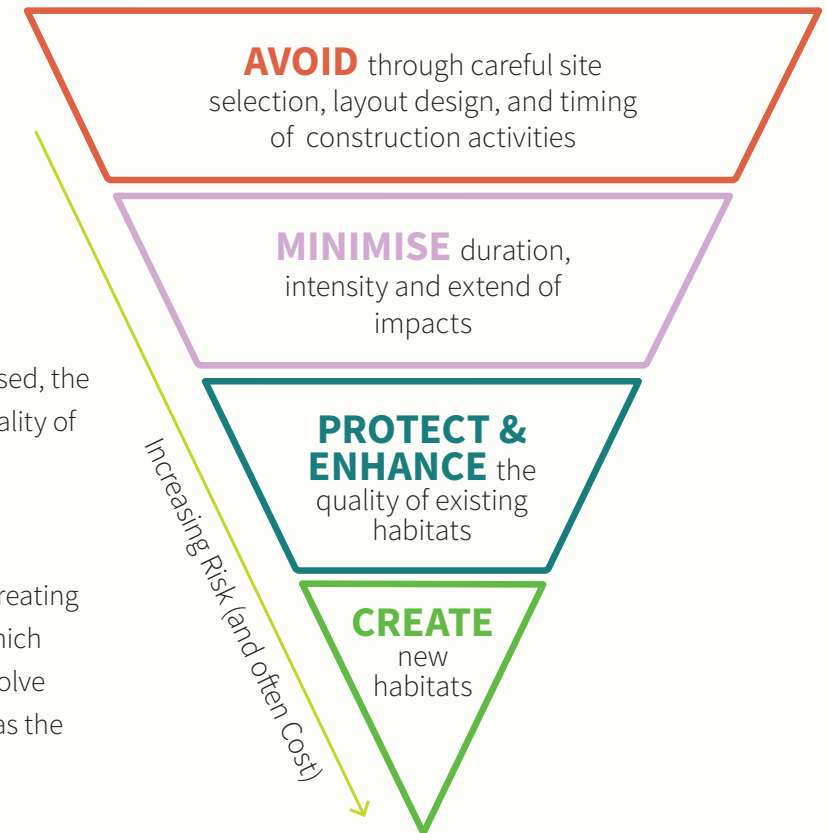


Figure 2: Biodiversity Gain Hierarchy



Peer Reviewed document, 2025 May

Development Near Protected Areas: Avoiding Biodiversity Loss

Authors: Marion Jammet and Irene Rondini

Construct Innovate RPO: Irish Green Building Council

Construct Innovate greatly values the work of the reviewers as their expert knowledge greatly contribute to the high standards of the Construct Innovate publications, therefore Construct Innovate would like to thank the reviewers for their participation.

Reviewers:

Dr. Úna FitzPatrick, National Biodiversity Data Centre

Dr. Maryann Harris, Department of Housing, Local Government and Heritage

This Case Study is a part of 2023 Seed Fund Project:
BUILDING REGENERATIVE TOWNS & CITIES – CURATING HIGH-QUALITY CASE STUDIES TO BETTER PROTECT AND ENHANCE BIODIVERSITY IN IRELAND'S MOST COMMON BUILDING TYPOLOGIES AND INFRASTRUCTURE.

The main objective of this project is to mainstream biodiversity actions in the construction sector through the curation and dissemination of exemplar biodiversity case studies. The project will develop and curate high-quality, practical existing case studies on how to protect and enhance biodiversity in the most common building typologies and infrastructure found in Irish towns and cities. A minimum of 10 case studies will be developed as part of this project. "Development Near Protected Areas: Avoiding Biodiversity Loss" Case Study has been Peer Reviewed through Construct Innovate in May 2025.



DEVELOPMENT NEAR PROTECTED AREAS: AVOIDING BIODIVERSITY LOSS



About the Project

This case study explores the development of a **mental health hospital** that aims to **improve patients' health and wellbeing** by enhancing biodiversity within the building spaces while **protecting the surrounding natural areas**. The project involved expanding and managing the existing woodlands, creating new habitats, and implementing a sustainable drainage system (SuDS) to manage surface water runoff and restore a nearby wetland. These activities were driven by the proximity of a number of protected areas and the mandatory Natura Impact Assessment but also by the commitment of the team involved and local community engagement.

Figure 1-1: Sensory garden in the National Forensic Mental Health Service. Source: STW, 2021 (left)



“Hospitals should aim to become green pillars in their communities. By using the healing effect of nature and adopting a more holistic approach to healthcare, hospitals could lead the way within their communities toward a more sustainable future. A future that will not only benefit the patients but also the hospital staff and the wider community.”

Ola Løkken Nordrum
Irish Doctors for the Environment

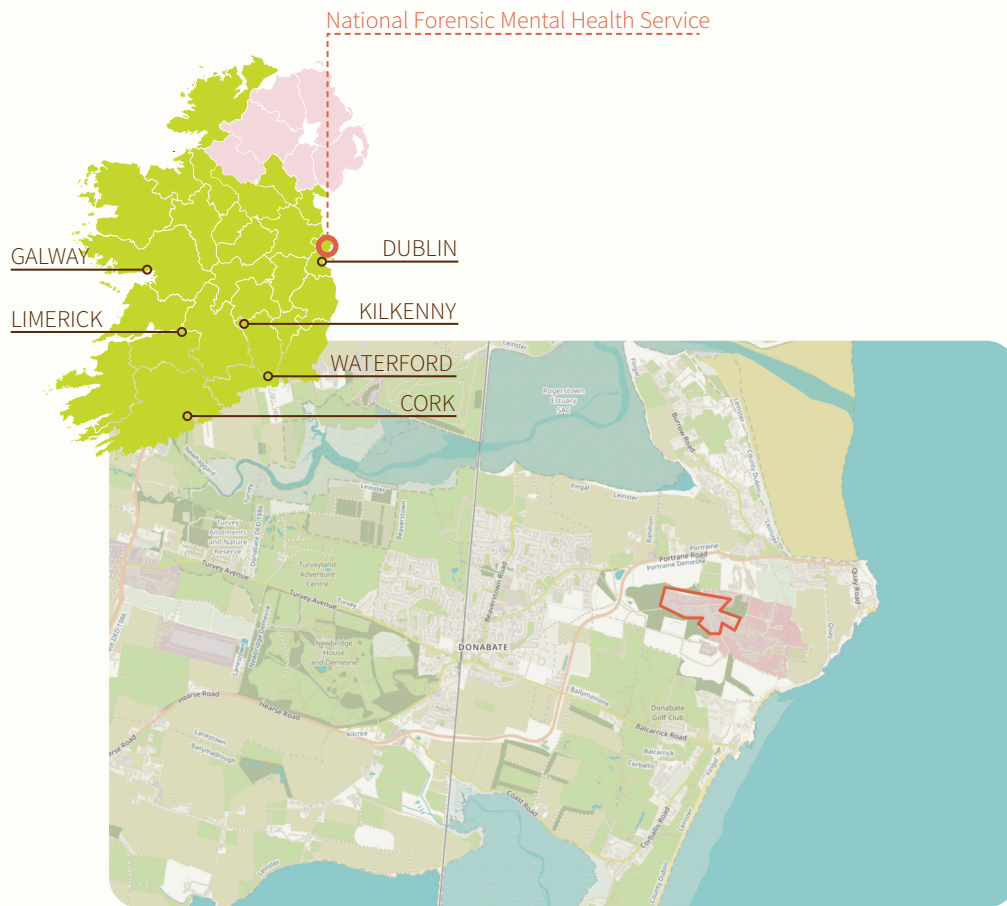


Figure 1-2: Location of the NFMHS in Portrane Demesne. Source: OpenStreetMap

Keywords:

- Non-Residential Development
- Greenfield
- Brownfield
- New Build
- Large site (over 5,000 sqm)
- Biodiversity rich site (pre-development)
- Proximity of a protected area (e.g., SAC)
- Pollution management
- Health & Wellbeing
- Climate adaptation
- Cross-disciplinary collaboration
- Invasive Alien Species Management
- Ecological Corridors
- SuDS
- Ponds & Wetlands

Location: National Forensic Mental Health Service (NFMHS), Portrane Demesne, Portrane, Co. Dublin, K36 FD79

Client: Health Service Executive Ireland (HSE)

Budget: A breakdown of the costs associated with biodiversity and SuDSs action was not available

Funding: Publicly funded

Start Date: 2014-2015 (Planning Permission)

Completion Date: 2021

Green Building Certificate: BREEAM - designed to Excellent (71.2%)

Ecologist Involvement?

Biodiversity Metric(s) used: However, the project ecologist, who was involved from day one, took a project-specific approach and produced a biodiversity management plan.

Key Stakeholders: The project involved local authority representatives (Fingal County Council's Biodiversity Officer and Parks Department). It also promoted group meetings with residents, sports clubs, and councillors to discuss the interventions, e.g. woodland footpaths

- Project Team:**
- » Ecologist: Faith Wilson Ecological Consultant
 - » Architect: Scott Tallon Walker Architects (STW)
 - » Landscape Consultant: Mitchell + Associates
 - » Bat Specialist: Tina Augnhey
 - » Arborist: Ciaran Keating
 - » Conservation Consultant: Carrig Building
 - » Structural & Civil Engineer: PUNCH Consulting Engineers
 - » Medical Consultant: Medical Architecture
 - » HSE Clerk of Works: Derek Redmond

- Links to legislation and policies:**
- » Habitats Directive (92/43/EEC)
 - » Water Framework Directive (2000/60/EC)
 - » Birds Directive (2009/147/EC)
 - » Wildlife Act (1976) and Wildlife Amendment Act (2000)
 - » National Biodiversity Action Plans 2017 - 2021 and 2021-2025

Biodiversity Status Pre-Project

The NFMHS Hospital construction includes **eight single-storey buildings** and **one 2-storey building**, as well as the provision of ancillary transformers and switchrooms, energy buildings, maintenance and engineering buildings and horticulture buildings, totalling approximately **25,324 square metres** of gross floorspace, and all associated site works, landscaping and lighting. The project also includes the demolition of five existing vacant structures.

In 2013, the project ecologist conducted a baseline ecological survey of the entire HSE landholding at Portrane Demesne (112 ha), the former site of St Ita's Hospital, a mental health facility that closed in 2011. The survey confirmed the use of the woodlands (mainly mixed broad leaf woodland, approximately 25.5 ha) and adjoining lands by a **variety of protected fauna**, including mammals such as **badgers and six bat species**, which were recorded foraging and commuting through the site.

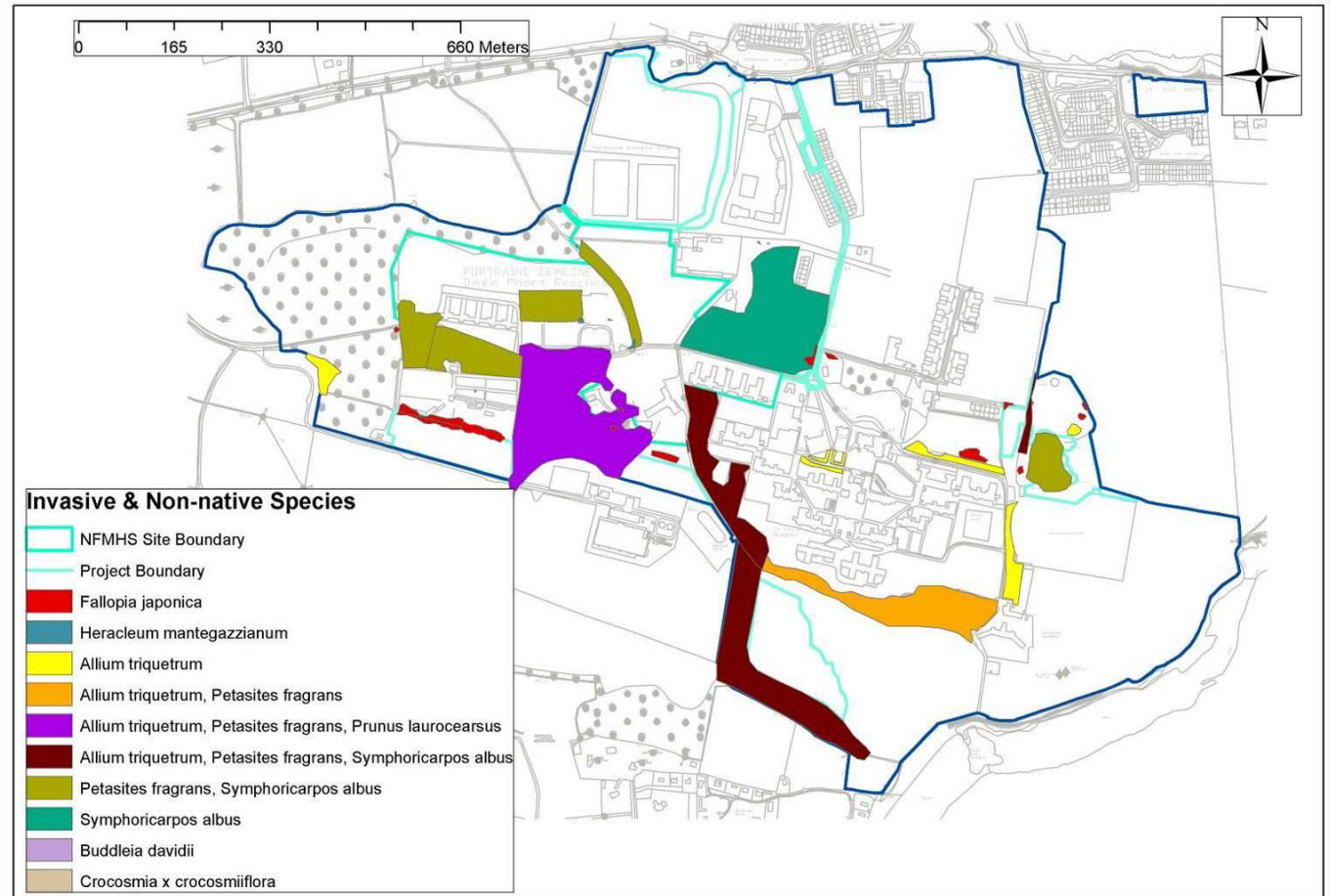
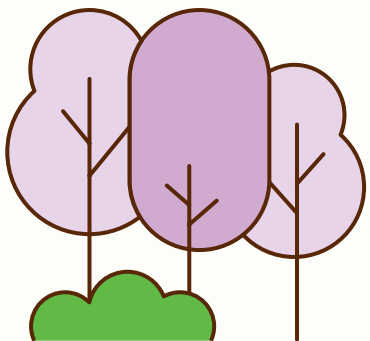
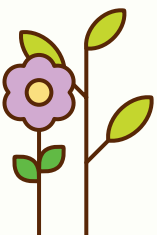


Figure 1-3: The main locations of invasive and non-native species at St Ita's Hospital.
Source: Wilson, 2014



The land where the facility was developed, including woodlands, was not designated for any nature conservation purposes, but some **Natura 2000 sites - Special Areas of Conservation (SAC)** and **Special Protection Areas (SPA)** and a **Proposed Natural Heritage Area (pNHA)^a** - adjoin the Demesne. In addition, the **woodland habitats** are identified in **Fingal County Council Development Plan 2011-2017 as Nature Development Areas**, locations where nature conservation can be combined with existing activities such as farming, forestry, quarrying and recreation and therefore are also protected.

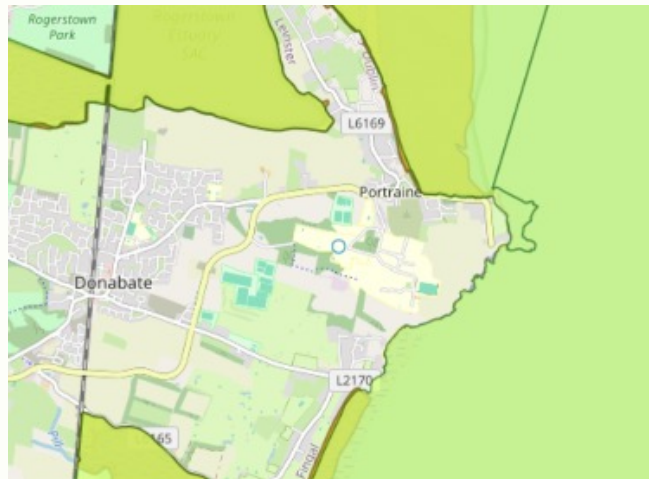


Figure 1-4: SAC and SPA (green) present in the proximity of the site
Source: EPA map, 2025



Figure 1-5: Aerial photograph of the site, after completion, showing neighbouring woodland and agricultural land

From an ecological perspective, the main driver for the project was to **create new habitats and enhance existing habitats** within the hospital grounds and wider demesne site, whilst protecting the designated sites and protected areas in close proximity. An **invasive and non-native plant species survey** was also conducted in 2013. It confirmed the presence of three invasive species^b (Figure 1-3): **Japanese knotweed, Giant hogweed, and Three-cornered leek** (see right, exploring why these plants present safety risk).

^a Portraine Shore pNHA (Site Code: 001215), Rogerstown Estuary SAC (Site Code: 000208), Rogerstown Estuary SPA (Site Code: 004015), Rogerstown Estuary pNHA (Site Code: 000208)

^b [First Schedule list of IAS of national Concern in the European Union \(Invasive Alien Species\) Regulations 2024](#) (S.I. No. 374 of 2024)

Japanese Knotweed (*Fallopia japonica*) spreads rapidly and forms dense thickets that outcompete native vegetation, reducing biodiversity. Its extensive root system can damage buildings, roads, and flood defences, making it a significant threat to infrastructure.



Japanese Knotweed, source: GBNNSS

Giant Hogweed (*Heracleum mantegazzianum*) is known for its toxic sap, which can cause severe burns and blisters upon contact with skin. Giant Hogweed also outcompetes native plants by forming large, dense stands. This reduces biodiversity and increases soil erosion along riverbanks.

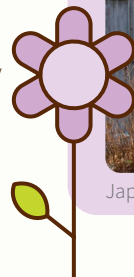


Giant Hogweed, source: GBNNSS

Three-Cornered Leek (*Allium triquetrum*) is an invasive plant spreads quickly and dominates waste ground, roadsides, and field margins, outcompeting native flora. Its ability to rapidly colonise areas makes it a threat to local biodiversity.



Three-Cornered Leek, source: RPS Group PLC



Project Intervention

The HSE subsequently commissioned a **Biodiversity Management Plan** for the entire Demesne. The strategy was facilitated by the amount of land owned by the HSE in the area, giving them space to enhance biodiversity. As part of its strategy, the HSE has implemented a **range of biodiversity measures** inside the Hospital site and the surrounding demesne site (Figure 1-7).

During the construction phase, one key strategy was the **removal and control of invasive species**. The protocol prioritised preventing their further spread and included a **long-term monitoring and management plan** to ensure these species do not re-establish. Security requirements led to the loss of significant tree numbers within the site, potentially impacting protected fauna and overall biodiversity. The plan mandates annual biodiversity monitoring for the first five years, followed by assessments in years ten, fifteen and twenty by the project ecologist.



Figure 1-6: Mammal gate and nesting sites. Source: STW, 2013

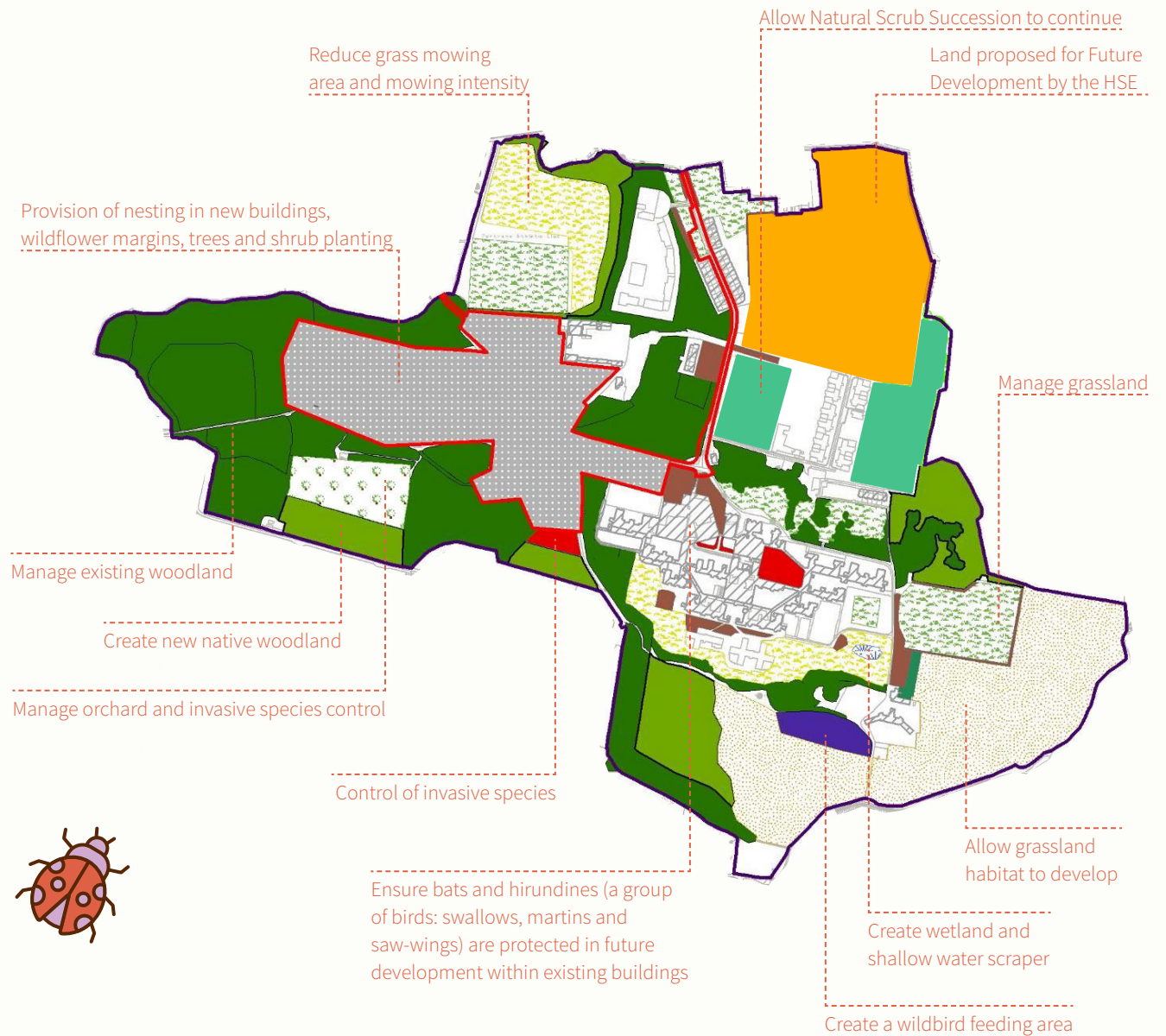
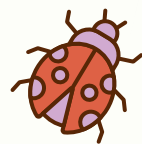


Figure 1-7: A visual representation of the Biodiversity Management Plan for Portrane Demesne. Source: Edited from Wilson, 2014

Inside the Hospital Site:

- » Implementation of **mammal gates** (Figure 1-6) in the secure perimeter fence to ensure connectivity between different areas and **integrated nesting sites in the buildings for bats, swifts, swallows, sparrows, and starlings**
- » The project included extensive shrub and perennial planting, a diverse selection of semi-mature trees, a sensory garden, and a **flower meadow** (Figure 1-8) around the security fences, creating a transition zone from woodland to the built environment and serving as a vital wildlife corridor. Native plants with varied flowering periods were incorporated to provide food and shelter for wildlife in line with the [All-Ireland Pollinator Plan](#)



Figure 1-8: Flower meadow in the NFMHS. Source: STW, 2021

Outside the Hospital Site:

- » The project involved the **enhancement, strategic expansion, and management of existing woodlands, with over 15,000 native trees planted**, bringing the woodland to 33.34ha (Figure 1-9). This afforestation effort serves as a natural carbon sink, supporting climate mitigation while enhancing connectivity between natural areas. Additionally, bat and bird boxes were installed to further support local biodiversity
- » **Bioretention SuDS habitats and additional habitats** were created:
 - » A coastal grassland, (approximately 13.2ha) which replaced an area of low ecological complexity
 - » A wader scrape, a shallow pond was created serving as new habitat, offering food and refuge for a diverse range of wetland wildlife, whilst providing a SuDS for surface water runoff (Figure 1-13)
 - » A wetland, restored by capturing stormwater and directing the runoff to an existing wetland area, improving flood control and enhancing water retention capacity, as well as providing a sustainable solution for surface water management (see right).

Resources

Swifts: [Building Nest Boxes into Cement Block, Brick, and Externally Insulated Walls](#) (2021)

Bats: [Creating Roosts and Bat Boxes](#) (n.d)



Wetland Area for Birds:

In the original proposal, the engineering company had planned to install an underground attenuation tank. However, **the Project Ecologist suggested an alternative approach:** diverting the water to a nearby wetland that had been drained over the years due to the development of pitches and housing, and now required additional water. The engineering company was open to this idea and conducted further research on the total volume of water to be discharged. After thorough analysis, it was agreed that the water would be redirected to the wetland. This solution demonstrated strong collaboration and teamwork between all members of the team. This also made financial sense since this measure saved around €100,000 as well as providing a sustainable solution for surface water management.



Wetland, source: IGBC

Biodiversity Status Post-Project

The project enhanced natural habitats by **preserving native woodlands and with the creation of habitats such as wetlands, coastal grassland etc. all of which are vital for wildlife**. In addition the landscaped areas within the hospital grounds provided new habitats for species.

These efforts supported existing species and attracted new ones, enriching ecological diversity. Five years of bird monitoring showed substantial positive impacts on biodiversity. The findings emphasise the importance of ongoing monitoring and adaptive management.

A Biodiversity Management Plan was developed to preserve the woodlands, support native species, manage non-native species, and control invasive ones.

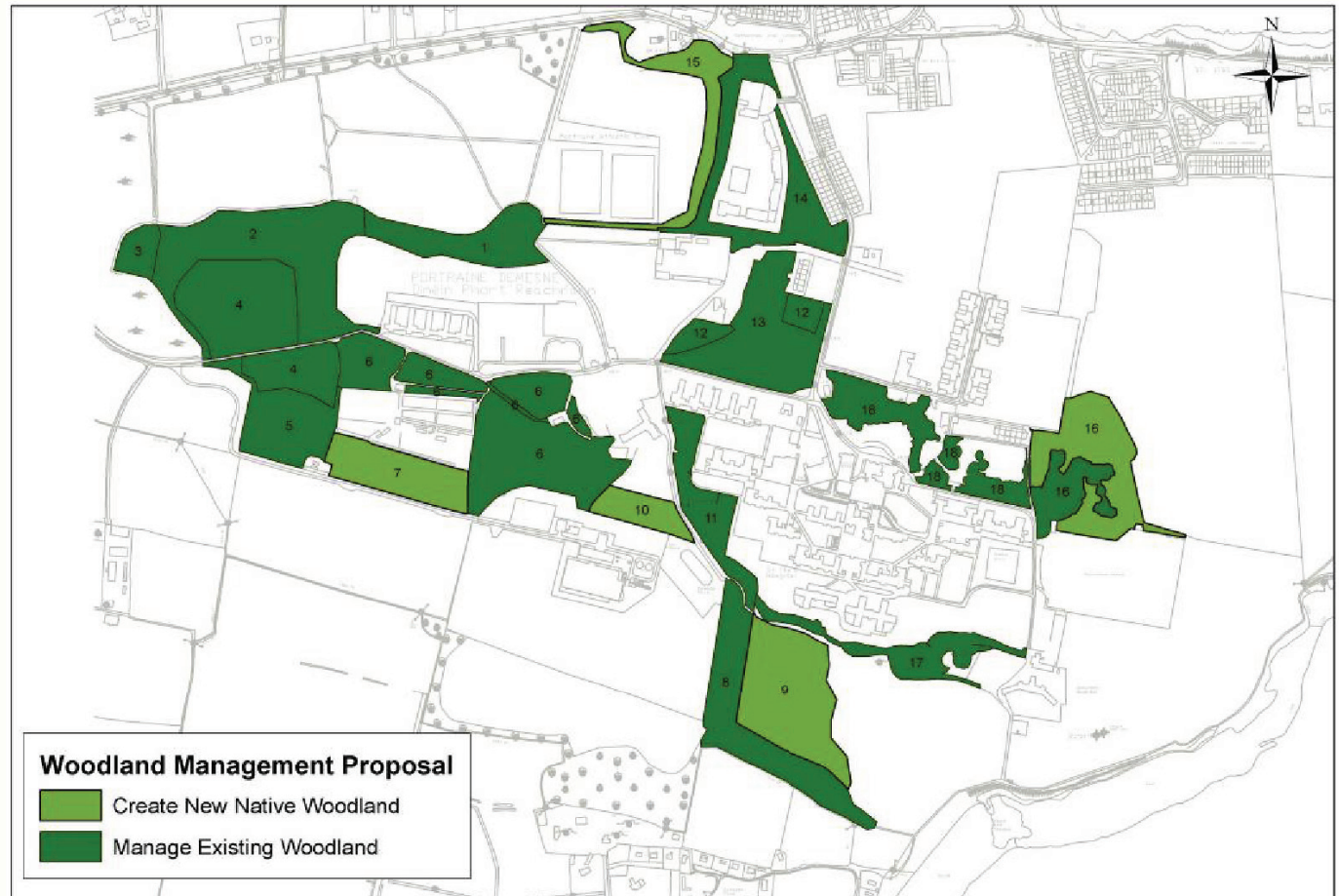
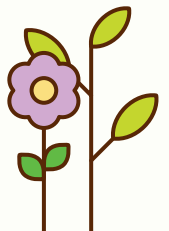
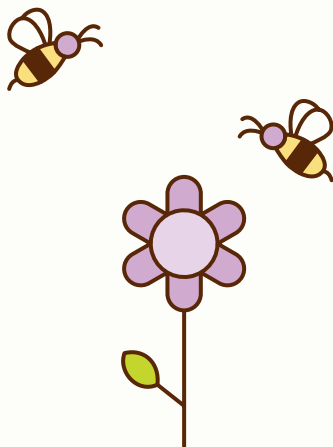


Figure 1-9: Woodland management plan for conservation of existing habitats and management post-delivery. Source: Wilson, 2014



Co-Benefits

Health & Wellbeing of patients and community

The project's landscaping was carefully planned to include recreational and therapeutic spaces, such as a **sensory garden** (Figure 1-10) - a favourable environment for patient recovery. Research shows a strong positive correlation between exposure to green spaces and health promotion, especially improved mental well-being, making urban greening a valuable public health strategy^a.

Although patients cannot directly access these wider demesne site, the buildings were designed to take advantage of the natural areas, with **rooms oriented to the surrounding woodland** to provide a visual connection to nature.

Research shows that hospital patients have windows with a view of nature recovering faster^b. In addition, exposure to nature during an acute hospital admission has been shown to positively impact psychological outcomes such as anxiety, depression, pain perception, and overall patient satisfaction.

a Nordrum et al., 2022; Joschko et al., 2023; Yañez et al., 2023

b Ulrich, 1984

c Guidolin et al., 2024

These benefits are more pronounced with longer durations of exposure and deeper levels of immersion in natural environments^c. The public areas outside the hospital have been equipped with pedestrian signage (Figure 1-11) to explain interventions on the natural surrounding areas.



Figure 1-10: Sensory gardens

Project Highlights

Cross-sectoral cooperation

The project nurtured collaboration among building professionals, public health experts, environmental conservation professionals, and the local community. Key to this collaboration was the **early involvement of the project ecologist**, who collaborated closely with designers and construction teams, and the strong commitment of the client to biodiversity enhancement, supported by Fingal County Council’s Biodiversity Officers and Parks Department.

The HSE also organised several **working group meetings with local residents, sports clubs, and councillors**. The woodland footpaths and information stands came out of those meetings.

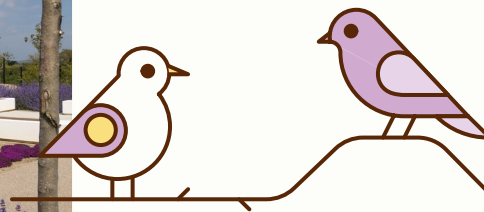


Figure 1-11: Recreational public area outside the hospital with pedestrian signage (left) and sensory garden inside the facility (right). STW, 2021

Going the Extra Miles

Due to its proximity to **Nature 2000 sites**, the project has undergone a **Natura Impact Assessment**. This was carried out to **assess and mitigate potential impacts on the Natura 2000 sites**. Some of the biodiversity features were part of the mitigation required for building on the site. Some solutions, however, went beyond legal requirements, driven by the team’s commitment to enhancing biodiversity.

- » Restoring the wetlands by diverting surface water was implemented as part of the design process, thanks to the involvement of ecologists (see Wetland Areas for Birds, page 1:6)
- » Public access to woodlands was not mandated but emerged from community engagement



- » Use of pollinator-friendly plants for internal landscaping was a decision made by the design team
- » A wildlife rescue plan implemented during construction, which ensured the safe relocation of wildlife.



“I took the initiative to implement a wildlife rescue plan during construction because I deeply care about all creatures and wanted to ensure the continued wellbeing of local fauna.”

Derek Redmond,
Clerk of Works, HSE



Figure 1-12: Tadpoles (left) and an eel (right) rescued by Derek during construction at the NFMHS site. Source: Derek Redmond and Jennie Quigley, photos taken 2017-2021

Project Challenges

- » **Preserving cultural and natural heritage**, requires careful attention during planning and construction.
- » **Supervising and upskilling contractors in biodiversity practices**. Contractors required training and close supervision to ensure they understood and followed strict protocols, including the proper management of reused soil.
- » **Coordinating site grading and soil movement**. Addressing differences in site levels demanded a strategic relocation and grading of soil across areas to ensure soil quality for planting.
- » **Addressing design restrictions in a high-security environment**. The mental health facility required unique design solutions to meet stringent security needs while maintaining functionality and aesthetics.



Figure 1-13: Grassland (left) and Wader Scrape (right). HSE, 2024

Lessons Learnt

- » **Assessing and protecting existing ecosystems**. Prioritising the assessment, conservation, and connectivity of existing natural areas and ecosystems in new developments—such as local woodlands and meadows—provides a practical approach to enhancing the ecological value of an area. This strategy reduces the need for entirely new solutions.
- » **Early involvement of ecologists**. Engaging an ecologist from the kick-off of a project is essential to ensure that biodiversity considerations inform all stages of development. Ecologists can suggest solutions that might not otherwise be identified by other professionals in the team.
- » **Championing Biodiversity**. Similarly, involving individuals with a passion for nature and a commitment to wildlife conservation can be highly beneficial, particularly when mandatory biodiversity requirements are absent, as well as a client willing to listen and implement their solutions.



Figure 1-14: Sensory gardens and new tree planting

References

- » [Bat Conservation Ireland. Creating Roots – Bat Boxes](#). (n.d.) [Accessed 10 March 2025]
- » [Huxley L. Building Nest Boxes into Cement Block, Brick, and Externally Insulated Walls](#). 2021
- » [Nordrum O, Waters I, Kirk A. 2022. The Benefits of Nature for Health and Wellbeing. Irish Medical Journal](#)
- » [Nordrum O, Waters I, Kirk A. 2022. The Benefits of Nature for Health and Wellbeing](#). Irish Medical Journal
- » Wilson F. Biodiversity Management Plan. 2014
- » St. Ita's Demesne, Portrane, Co. Dublin Biodiversity Management Plan
- » Ulrich, R. (1984). [View through a Window May Influence Recovery from Surgery](#). Science, [online] 224(4647), pp.420–421
- » Guidolin, Keegan, et al. [The Influence of Exposure to Nature on Inpatient Hospital Stays: A Scoping Review](#). HERD: Health Environments Research & Design Journal



Ongoing Peer Reviewed document

Living Roofs: Boosting Urban Biodiversity From Above

Authors: Marion Jammet and Irene Rondini

Construct Innovate RPO: Irish Green Building Council

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LIVING ROOFS: BOOSTING URBAN BIODIVERSITY FROM ABOVE



About the Project

Green roofs are vegetative roofs designed to support plant growth. They are installed on flat or low-sloping roofs of buildings and can provide numerous benefits such as **thermal regulation, water management, and carbon sequestration** and can have a **positive impact on biodiversity**.

This case study focuses on the creation of a **new biodiverse green roof** on The Observatory building in Dublin City's docklands and also **models the potential upgrade of an existing sedum roof to an extensive green roof** (see page 2:5 for further on different types of green roof) on the adjacent 1 Windmill Lane (1WML) building.

Figure 2-1: Example of semi-intensive green roof, Portugal
Source: European Federation, Green Roofs & Walls (2025)



“Recent policy and regulatory changes, such as the Taskforce on Nature-related Financial Disclosures (TNFD) and the Corporate Sustainability Reporting Directive (CSRD), have led investors to focus more and more on enhancing biodiversity in the built environment, but the drivers are multiple. For instance, tenants are increasingly asking for access to green space in their buildings.”

Neil Menzies
Director of Sustainability at Hibernia Real Estate Group Limited

In 2016, when the original sedum roof was installed on 1 WML, reaching a **LEED certification**^a was the main reason the building owner incorporated this green infrastructure. However, **stronger legislative drivers** have been introduced since then, such as the EU's **Corporate Sustainability Reporting Directive (CSRD)**^b, and **Nature Restoration Law**^c. The disclosure recommendation and guidance from the **Taskforce on Nature-related Financial Disclosures (TNFD)**^d are also strong drivers for businesses to integrate nature into their buildings.

At the local level, the **Dublin City Development Plan 2022-2028**^e states that the Council will require all new development projects over 100 sqm. to provide green roofs to support climate action and urban drainage^f (see SI23).



Figure 2-2: Example of semi-intensive green roof
Source: Universal Floral (2025)



Figure 2-3: Example of a semi-intensive roof with rooflights. Source: Engineers Ireland, Dublin

a <https://www.usgbc.org/leed>

b Refer to Figure 2-4 and <https://eur-lex.europa.eu/eli/dir/2022/2464/oj/eng>

c https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-regulation_en

d <https://tnfd.global>

e https://www.dublincity.ie/sites/default/files/2021-11/draft-dublin-city-development-plan-2022-2028-chapter-10-green-infrastructure-and-recreation_21-11-21.pdf

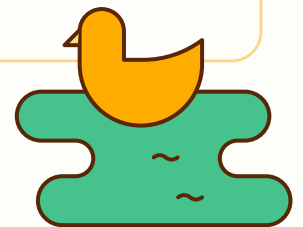
f Refer to SI23 : <https://www.dublincity.ie/dublin-city-development-plan-2022-2028/written-statement/chapter-9-sustainable-environmental-and-flood-risk/95-policies-and-objectives>

Companies subject to the **Corporate Sustainability Reporting Directive (CSRD)** will have to report according to **European Sustainability Reporting Standards (ESRS)**. ESRS framework, specifically the **ESRS E4** requires companies to **disclose and report on their biodiversity and ecosystem risks and impacts**, both positive and negative, and outline their actions to mitigate negative impacts, protect ecosystems, and integrate biodiversity considerations into their operations and value chains.

Navigating ESRS E4 Requirements

- » **ESRS E4-1 | Transition Plan:** Companies must disclose their transition plan aligning with biodiversity preservation and EU Biodiversity Strategy 2030 targets. This includes correlation with business strategy, approval from governing bodies, and feasibility considerations.
- » **ESRS E4-2 | Biodiversity Policies:** Disclosure of strategies addressing biodiversity effects, risks, and opportunities, considering dependencies and activities like production and procurement.
- » **ESRS E4-3 | Actions and Resources:** Details on biodiversity efforts and resource allocation, including measures for biodiversity compensation and whether they're integrated into ongoing practices.
- » **ESRS E4-4 | Biodiversity Targets:** Outline objectives, progress, and assessment of biodiversity targets, considering scientific evidence and ecological thresholds.
- » **ESRS E4-5 | Impact Metrics:** Disclosure of significant influences on biodiversity, including indicators for changes in species' status and proximity to protected areas.
- » **ESRS E4-6 | Financial Effects:** Disclosure of potential financial impacts from biodiversity risks and opportunities, quantifying effects on financial standing and performance, unless exempted under specific circumstances.

Figure 2-4: Focus Box on policy and statutory background for companies



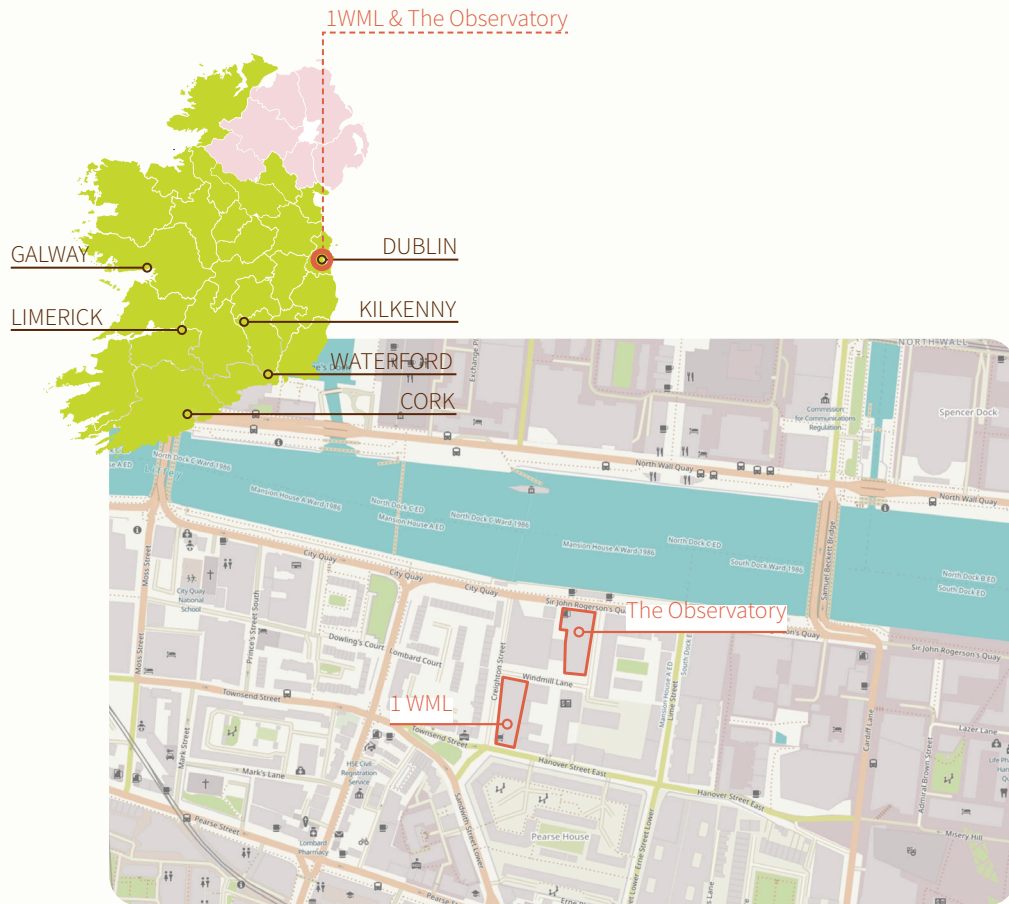


Figure 2-5: Location of the 1 Windmill Lane building (1WML) and The Observatory Buildings in Dublin City's South Docklands. Source: EPA Maps, 2024.

Keywords:

Non-Residential Development

Brownfield

Existing Building

Large site (over 5,000 sqm)

Climate adaptation

Maintenance

Biodiversity metrics used

SuDS

Green Roofs

Location: Windmill Quarter, D02 F206

Client: Hibernia Real Estate Groups Ltd

Budget: Estimated installation cost: approximately €130 per m² (The Observatory)
Estimated Maintenance cost: approx. € 4,000 per year (The Observatory)

Funding: Privately funded

Start Date: 2024 (original sedum green roof completed in 2016)

Completion Date: Expected in 2025 (ongoing)

Green Building Certificate: ✓ **1WML:** LEED for Building Design and Construction (LEED BD+C) and LEED for Operations and Maintenance (LEED O+M) Gold certified. **The Observatory:** Aiming for LEED for Operations and Maintenance (LEED O+M) Gold certification following refurbishment works.

Ecologist Involvement? ✓

Biodiversity Metric(s) used: ✓ Biodiversity Net-Gain England Metric, DEFRA methodology and Ecosystem Serviced Provision, Environmental Benefits from the NATURE tool [[Statutory Biodiversity Metric](#)]

Key Stakeholders:

- » Dublin Climate Action Regional Office (CARO) and University College Dublin (UCD) as part of a research project on rainwater runoff and climate adaptation
- » No current engagement with tenants. However, this will be required later to ensure maintenance and will be achieved through the inclusion of a green clause within the leases for the relevant spaces of the Observatory

Project Team:

- » Ecologist: Greengage
- » Landscape Architects: Connect Construct
- » Lead Architect: MCA Architects
- » Green Roof Design: Landtech Soils and Universal Flora
- » Research Team: CARO Research Team and UCD

A water retention capacity study of various green roof mediums was carried out in 2023-2024. You can read more [HERE](#) and [HERE](#).

Links to legislation and policies:

- » [Corporate Sustainability Reporting Directive \(EU\) 2022/2464](#)
- » [EU Nature Restoration Law \(Regulation \(EU\) 2024/1991\)](#)
- » [National Biodiversity Action Plan 2023 – 2030](#)
- » [National Adaptation Framework 2024](#)
- » [Dublin Development Plan 2022-2028](#)

Biodiversity Status Pre-Project

The baseline and post-development scenarios were calculated by the project ecologist using the **Statutory Biodiversity Metric England^a** and the **Environmental Benefits from Nature (EBN) tool^b**.

A **baseline biodiversity unit** (habitat units per hectare) and an **ecosystem services provision assessment** (across 18 criteria) were completed on both buildings – with the green roof already in place on 1 WML and none on the Observatory. These assessments were complemented by a **potential biodiversity uplift opportunities assessment** aligned with the English

a [The Statutory Biodiversity Metric, User Guide](#)

b [The NATURE Tool](#)

c A water retention capacity study of various green roof mediums was carried out in 2023-2024. You can read more [HERE](#) and [HERE](#).



Figure 2-6: Existing Space in the 1 WML Roof
Picture taken by Neil Menzies, 2024



Figure 2-7: Existing space in the Observatory roof
Picture taken by Neil Menzies, 2024

Biodiversity Net Gain (BNG) requirements. This is important to anticipate regulatory changes and ensure future compliance.

Baseline at 1WML

The existing green roof (Figure 2-6) was classified under “Other Green Roof” category, alongside “Introduced Shrubs” and “Developed Land-Sealed Surface” habitats, as defined by the Statutory Biodiversity Metric guidance. Under this framework, these habitats are not subject to assessment of their ecological condition.

An assessment of the water retention^a capacity of the sedum roof was undertaken by the Dublin Climate Action Regional Office (CARO)^c (Figure 2-8).

Baseline at The Observatory

Pre-redevelopment, the existing building was classified within the “Developed Land-Sealed Surface” habitat category, as outlined in the Statutory Biodiversity Metric guidance by the project ecologist. Under this framework, these habitats are not subject to condition assessments.

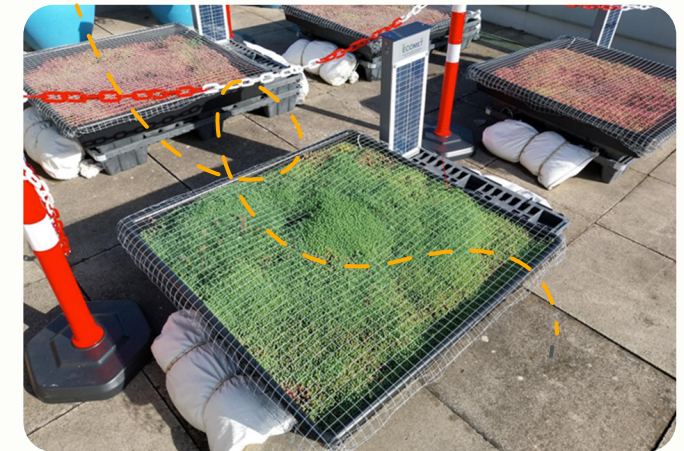
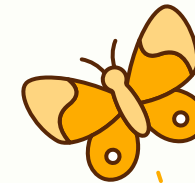


Figure 2-8: Trial conducted on the roof. Source: Research Project.
Picture taken by Hannah O’Keeffe, 2024

Green Roof Considerations

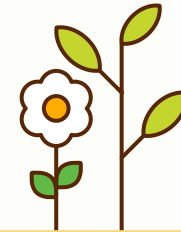
Green roofs can have a positive impact on biodiversity, especially when they are intensive (soil depth: 200-750mm+) or semi-intensive (150-250mm).

Intensive Green Roofs can accommodate taller plants such as shrubs and trees, creating natural habitats in the urban environment and attracting more insects and birds. These are also often called **Living Roofs**. Whereas Semi-Intensive Roofs can support, for example, a shallow rooting meadow. A semi-intensive green roof will be installed at The Observatory. Due to structural loading capacity, Extensive Green Roofs are often more suitable for retrofit of existing buildings as they use less growing media (100-200mm) (IGBC, 2023). Extensive green roofs do still provide a biodiverse habitat, in particular for insects and birds, but there is not the

diversity of plant species and variety in terms of plant heights that can be accommodated in an intensive or semi-intensive green roof.

This case study models the potential effect on biodiversity of replacing the sedum roof at 1WML with an extensive green roof. Another good approach is to leave at least a part of the green roof to self-vegetate from windblown and seed dispersal by birds. Known as Brown Roofs, these are the best way of replicating the wild urban spaces that are found at ground level (IGBC, 2023). Green roofs are particularly suited for small sites in densely populated urban areas where space is limited. However, this solution may not be ideal for enhancing

biodiversity in all buildings. Retrofitting green roofs to existing structures can pose challenges due to structural load limitations. In existing and new buildings, the embodied carbon emissions^a from using construction materials to make the roof structurally able to accommodate an intensive green roof should always be evaluated.



In the English statutory Biodiversity Metric (versions 3.0 and 4.0) used for Biodiversity Net Gain (BNG) assessments, the three condition categories are defined as follows:

Good condition refers to habitats that:

- » Meet all or most of the positive criteria for that habitat type
- » Have appropriate physical structure and vegetation composition
- » Function well ecologically
- » Contain characteristic species assemblages
- » Show minimal signs of degradation or negative impacts

These habitats **typically score 3 out of 3 on the condition assessment scale.**

Moderate condition refers to habitats that:

- » Meet some but not all of the criteria for “good condition”
- » Have some of the desired physical structure and vegetation composition, but with notable deficiencies
- » May have some impairment of function
- » May be somewhat degraded but still functioning as that habitat type

These habitats **typically score 2 out of 3 on the condition assessment scale.**

Poor condition refers to habitats that:

- » Fail to meet the criteria for moderate or good condition
- » Have significant deficiencies in their physical structure and vegetation composition
- » Have substantially impaired ecological function
- » Are heavily degraded or modified from their natural state
- » Typically have few characteristic species present

These habitats **typically score 1 out of 3 on the condition assessment scale.**

^a In any building structure and substructure have the highest embodied carbon ([Indicate project, 2024](#)). To learn more about measuring Embodied Carbon can look at the on-demand training available on the [IGBC learning platform](#)

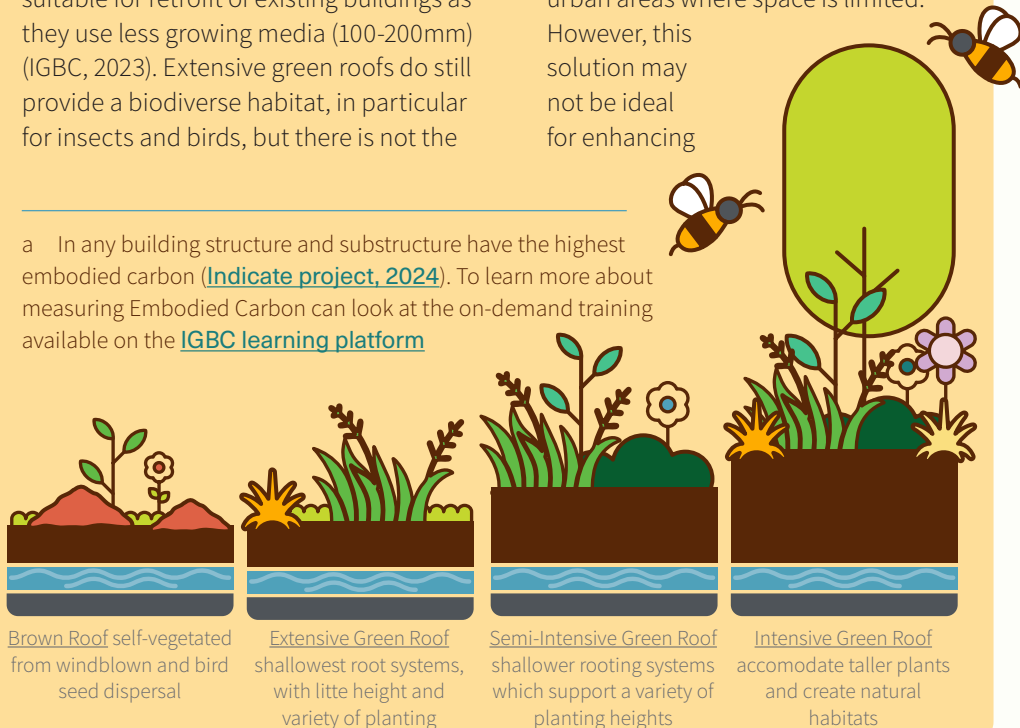


Figure 2-9: Focus Box on English statutory Biodiversity Metric used to assess the case study green roofs

Project Intervention

The following biodiversity enhancement measures were proposed by the project ecologist.

Enhancement at 1 WML:

Improvement of the existing sedum roof by:

- » Installing an **extensive, biodiverse green roof** in its place, covering an area of 0.0333 hectares. The newly proposed extensive biodiverse green roof would be expected to achieve a moderate condition
- » Installation of a series of **intensive green roof planters** on the southern terrace projected to achieve good condition, covering an area of 0.0036 hectares
- » Installation of **additional extensive biodiverse green roof areas** across other rooftop sections to achieve good condition

- » Installation of four sections of the “**other green roof**” category from the Statutory Biodiversity Metric guidance, most likely to be **sedum**, to cover an area of 0.0085 hectares. This would be expected to achieve a moderate condition
- » Creation of a **courtyard garden** consisting of both **shade-tolerant and moisture-tolerant species**. This would be expected to achieve a good condition.

The Observatory:

- » Installation of several areas of semi-intensive **biodiverse green roofs**, expected to achieve a good condition, covering an area of 0.0821 hectares. This action has been prioritised due to

its potential impact to achieve a good condition status while balancing other project priorities.

- » The aim is for a semi-intensive green roof (150-250mm substrate) which includes a sedum blanket installed further seeded with taller flowers and plug planted with shrubs. The plan for this includes a **sowing plan** and a **maintenance plan with tasks and time estimated**
- » Installation of **bat and bird boxes** on trees of suitable size and orientation throughout the site.

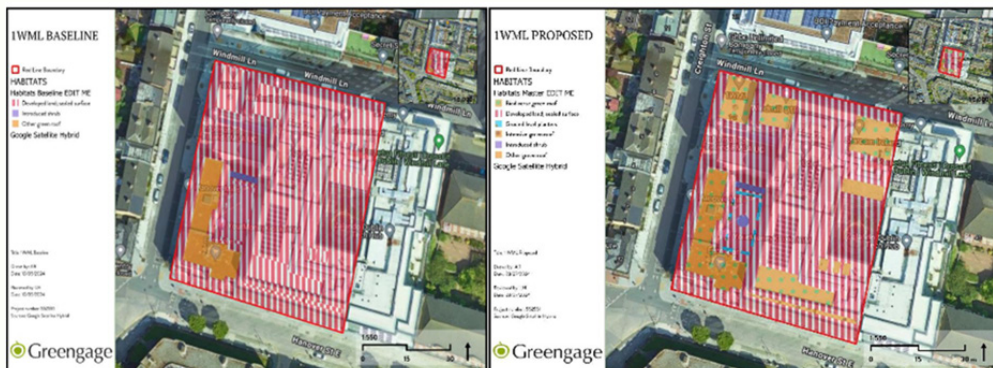


Figure 2-10: 1WML Baseline and proposed intervention. Source: Greengage, 2024

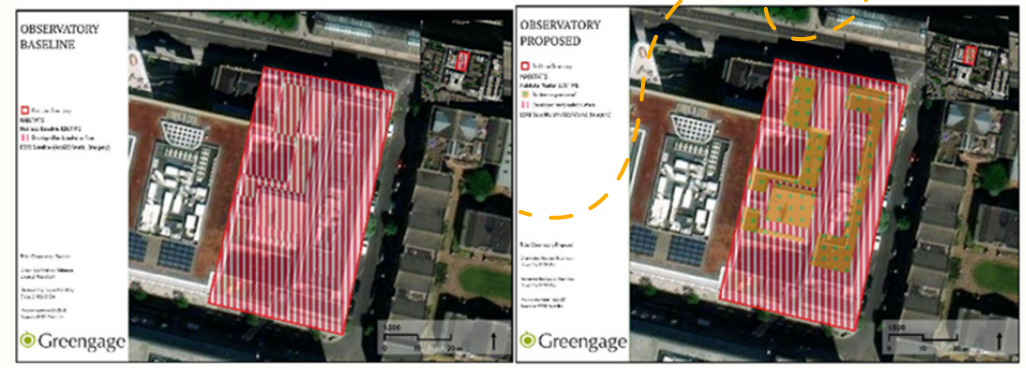


Figure 2-11: Observatory Baseline and proposed intervention. Source: Greengage, 2024

(Expected) Biodiversity Status Post-Project

The preliminary results suggest that **both buildings are likely to achieve a positive net change** in habitat units after the proposed interventions, in particular in relation to **pollination and pest control services**.

A summary of the results of 1WML and the Observatory using the Statutory Biodiversity Metric England is provided in Tables 1 and 2. The results from the Environmental Benefits from Nature (EBN) tool for both roofs are explored in Table 3.

| | Baseline | Proposed Uplift | Net Change | Percentage Change |
|---------------|----------|-----------------|------------|-------------------|
| Habitat Units | 0.07 | 0.54 | 0.47 | 666.68% |

Table 2-1: 1WML results summary. Source: Greengage, 2024

| | Baseline | Proposed Uplift | Net Change | Percentage Change |
|---------------|----------|-----------------|------------|-------------------|
| Habitat Units | 0.01 | 0.19 | 0.18 | 3245.25% |

Table 2-2: The Observatory results summary. Source: Greengage, 2024

| | Year 1 | Year 10 | Year 30 | Confidence | Year 1 | Year 10 | Year 30 | Confidence |
|--------------------------|--------|---------|---------|------------|--------|---------|---------|------------|
| Food production | → | → | → | 2 | → | → | → | 2 |
| Wood production | → | → | → | 2 | → | → | → | 2 |
| Fish production | → | → | → | 2 | → | → | → | 2 |
| Water supply | → | → | → | 1 | → | → | → | 1 |
| Flood regulation | ↗ | ↗ | ↗ | 1 | → | → | → | 1 |
| Erosion protection | → | → | → | 1 | → | → | → | 1 |
| Water quality regulation | → | → | → | 1 | → | → | → | 1 |
| Carbon storage | → | → | → | 2 | → | → | → | 2 |
| Air quality regulation | ↗ | ↗ | ↗ | 2 | → | → | → | 2 |
| Cooling & shading | ↗ | ↗ | ↗ | 2 | ↗ | ↗ | ↗ | 2 |
| Noise reduction | → | → | → | 2 | → | → | → | 2 |
| Pollution | ↗ | ↗ | ↗ | 1 | ↗ | ↗ | ↗ | 1 |
| Pest Control | ↗ | ↗ | ↗ | 1 | ↗ | ↗ | ↗ | 1 |
| Recreation | ↗ | ↗ | ↗ | 1 | → | → | → | 1 |
| Aesthetic value | ↗ | ↗ | ↗ | 1 | ↗ | ↗ | ↗ | 1 |
| Education | ↗ | ↗ | ↗ | 1 | → | → | → | 1 |
| Interaction with nature | ↗ | ↗ | ↗ | 1 | ↗ | ↗ | ↗ | 1 |
| Sense of place | ↗ | ↗ | ↗ | 1 | ↗ | ↗ | ↗ | 1 |

Table 2-3a: 1WML EBN results. Source: Greengage, 2024

Table 2-3b: The Observatory EBN results. Source: Greengage, 2024

Change in average score per hectare

- Large decrease (> -2.5 out of 10) ↓
- Decrease (-0.25 to -2.5 out of 10) ↘
- Minor Change (-0.25 to 0.25 out of 10) →
- Increase (0.25 to 2.5 out of 10) ↗
- Large increase (> 2.5 out of 10) ↑

Confidence rating for each service

- 1** The relationship between the provision of the ecosystem and the habitat is complex. Evidence for scoring is partial. Evidence gaps have been filled by consulting experts and with a degree of subjectivity.
- 2** Some suitable evidence to calibrate the range of scores across habitats
- 3** Strong evidence base for scores across the range of habitats and multipliers used.

The above compare the outcomes for the two buildings within this case study. The arrows indicate the magnitude and direction of change, looking at the score for each ecosystem service at three points in time compared to the pre-intervention baseline.

Co-Benefits

Rainwater Runoff Management

Green roofs can **help stormwater management** by capturing and retaining rainfall, which reduces runoff volume and slows its flow into urban drainage systems. The vegetation and substrate layers absorb and gradually release water, preventing system overload during heavy storms. This mitigates flooding risks, particularly in densely built-up areas with limited permeable surfaces, such as the one described in this case study.

Green roofs can also **enhance water quality** by filtering pollutants and sediments, reducing their entry into waterways. In addition, they assist in the insulation of roofs, as well as in reducing the urban heat island effect.

Occupant Benefits

Green roofs can enhance physical and mental well-being by providing a connection to nature within an urban setting. Where accessible, they can also offer recreational opportunities for building occupants (e.g., gardening).

Educational Opportunities

Green roofs can serve as valuable tools for environmental education, acting as "**living labs**" to demonstrate sustainability practices, foster community engagement, and raise environmental awareness among users. This opportunity may be limited, so it is recommended to prioritise accessibility when designing green roofs.

Financial Benefits

Additional accessible green space in an urban context can **reduce vacancy periods for buildings**, and contribute to attracting higher rents, as well as **increase interest from investors**.



Figure 2-12: Windmill Quarter site from across the river, showing The Observatory (left of image), Source: Windmill Quarter



Figure 2-13: 1WML entrance at night, Source: Windmill Quarter

Project Challenges

- » **Lack of financial mechanisms.** Financial mechanisms to support the creation, enhancement, and maintenance of green roofs on existing assets can be difficult to identify. Explaining the immediate costs against future benefits they offer to financial teams can also be challenging. Additionally, unless the green roof is accessible, building occupiers may be hesitant to invest in its implementation and maintenance. **Green clauses** may be used to ensure green roofs are properly maintained.
- » **Structural capacity of the existing building to support the additional load of the green roof.** Many roof spaces, particularly on existing buildings, are not designed to support the load of a green roof, including the soil-saturated weight. This must be investigated by a structural engineer, which may increase cost. Involving a structural engineer is essential to assess the feasibility of modifications to an existing roof. If the roof's load significantly increases, structural reinforcement may be necessary, adding to the cost. This is a key reason why green roofs are more commonly implemented in new builds,

where they can be integrated more easily and cost-effectively at the design stage. This is one of the main reasons why green roofs are primarily introduced in new built. It's easier and cheaper to introduce it at the design stage **Reinforcing the structure to retrofit an intensive biodiverse green roof can also be expensive.**

- » **Ensuring safe and secure access to green roofs.** Roof spaces can often be difficult to access, posing **safety risks for installation and ongoing maintenance.** Working at height introduces logistical challenges, including transporting materials to the roof level. Moreover, existing buildings may **lack accessible water points**, and without a rainwater harvesting system, irrigation may rely on potable water sources, which is less sustainable.



Figure 2-14: Greenery extending into courtyard spaces at Windmill Quarter (under construction), Source: Cameo & Partners

Lessons Learnt

- » **Long-term benefits and investments.** Highlighting the long-term advantages of green roofs, such as **climate adaptation, reduced energy costs, improved stormwater management, and increased property value**, can foster broader adoption. Providing stakeholders such as financial teams, property occupiers, and decision-makers with case studies and measurable data on these environmental and economic benefits strengthens acceptance and facilitates investment in these solutions.
- » **Early integration into design.** Incorporating green roofs during the initial planning and design phases **ensures they align with structural requirements, cost considerations, and ecosystem benefits**. This approach (where possible) minimises retrofitting challenges and associated expenses.
- » **Prioritise maintenance planning.** The long-term success of green roofs depends on the establishment of a **clear maintenance plan**, including the appropriate budget for regular inspections and an ecological management plan feeding into an asset manager maintenance plan to sustain ecological and functional benefits. A detailed maintenance plan has been developed for the Observatory, outlining tasks, their frequency, and, crucially, the associated costs.

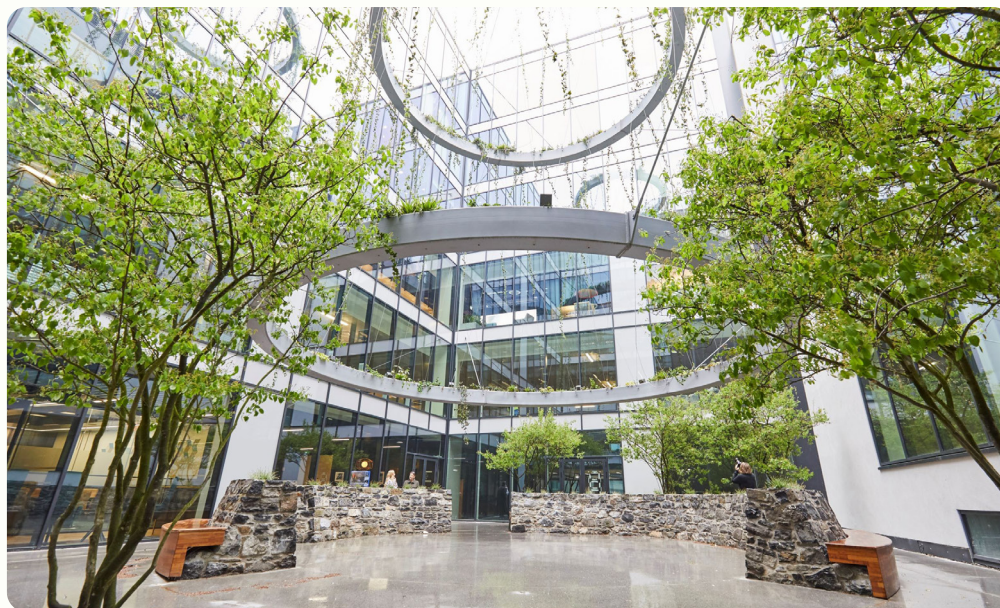


Figure 2-15: Green courtyards at Windmill Quarter, source: Cameo & Partners

References

- » Department for Environment, Food & Rural Affairs (2024). [The Statutory Biodiversity Metric: User guide](#)
- » Dublin City Council (2022). [Chapter 10: Green Infrastructure and Recreation. In: Dublin City Development Plan 2022-2028](#)
- » [Nature Tool 2.0](#) (2021)
- » McCloy, Anthony and Barton, Kevin (2021). [Green Blue Roof Guide 2021](#). Dublin City Council.
- » Jammet, M. and Rondini, I. (n.d.). [Biodiversity and the Built Environment IGBC's Insights](#)

[all hyperlinks checked:
February 2025]