

Energy and Sustainability Strategy

Kildare County Library
Newbridge, Co. Kildare

Kildare County Council

Project number: 60669624

08 March 2023

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
P01	28.02.22	For Review	RR	Raymond Reilly	Regional Director
P02	04.10.22	For Planning	RR	Raymond Reilly	Regional Director
P03	08.03.23	For Planning	RR	Raymond Reilly	Regional Director

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Table of Contents

1.	Executive Summary	5
2.	Introduction.....	5
3.	Design Basis & Approach	6
4.	Energy Conservation Approach	6
4.1	Passive Energy Reduction.....	6
4.2	Heating and Renewable Strategy.....	6
4.2.1	New Building.....	6
4.2.2	Existing (Protected) Structure	6
4.3	Ventilation & Overheating Strategy.....	7
4.3.1	New Building.....	7
4.3.1.1	Openable Windows for Overheating.....	8
4.3.2	Mechanical Ventilation in Other Spaces.....	9
4.3.3	Protected Structure	9
4.4	Photovoltaic Array	9
4.5	Lighting.....	10
4.6	Domestic Water Usage.....	10
4.7	Controls.....	10
4.8	Other Measures	10
5.	Embodied Carbon & Materials	10
6.	Sustainable Drainage (SUDS)	11
7.	Sustainable Transport Infrastructure	11
7.1	Bus.....	11
7.2	Rail.....	12
7.3	Car Club	12
7.4	Cycle Network.....	13
7.5	Electric Vehicle Charging.....	14
8.	Landscaping	14
8.1	Policy.....	15

1. Executive Summary

This report outlines the proposed energy & sustainability strategy for the proposed Kildare County Library, Newbridge, Co. Kildare.

The design will be heavily influenced by the sustainability principles of reduce, reuse, renewables and continual improvement (renewal) of the approach. The energy design will be heavily influenced by Part L of the Building Regulations – Conservation of Fuel and Energy (Buildings other than Dwellings) 2021.

Passive energy reductions will be maximised through the specification of a high performing building fabric. Active energy reductions include the provision of a high efficiency air to water heat pump system for space heating & domestic hot water, provision of natural / mixed mode ventilation throughout (with the exception of toilet spaces), specification of high efficiency lighting & controls and other discrete energy measures.

Embodied carbon will be a key consideration in the design. Materials of low embodied carbon, including recycled materials, will be preferred. Where possible locally sourced materials will be used to reduce the embodied carbon associated with transport.

A number of sustainable urban drainage systems (SuDS) are used to effectively intercept and reduce the quantity of runoff leaving the site including a green roof, permeable paving and bio-retention.

The site benefits from excellent transport links including bus, rail & cycle facilities which will encourage sustainable transport to and from the library. Additional cycle parking will be provided to encourage cycling. Limited parking is provided to discourage car use. Electric vehicle charging will be provided in line with the requirements of Part L of the Building Regulations – Conservation of Fuel and Energy (Buildings other than Dwellings) 2021.

A multipurpose public realm, encouraging pedestrian usage, will be provided to promote sustainable use by the local community and visitors from across the county. A fully accessible sensory garden will be provided to help children develop fine motor skills. The existing green & blue infrastructure of the nearby Liffey Linear Park will be extended into the public realm. The green roof will provide materials that will allow local birds and insects to thrive. Native planting will be used to integrate with the local habitat.

2. Introduction

Kildare County Council intend to develop the existing library in Newbridge, County Kildare into a new county library. The proposed Kildare County Library project comprises the following works:

- Demolition of the existing, non-protected structures on the site
- Redevelopment of the existing protected structure with new staff offices, support facilities and meeting rooms
- Construction of a new 3 storey, approx. 1800sqm library facility containing library spaces, exhibition spaces, reading rooms, meeting rooms, support facilities and a new document archive
- Services diversions and site infrastructure associated with the above including a new public realm.

Please refer to the statutory Part 8 notices which provide a full description of the proposed development including the breakdown of applicable floor areas.

The purpose of this document is to outline the proposed energy conservation and sustainability approach for the Kildare County Library project. The goal of this strategy will be to provide highly efficient, low energy and sustainable library & support facilities. These facilities will minimise the carbon footprint of the development and provide an exceptional library environment and, in the case of the existing protected structure, while respecting the significant historical importance of the building.

Reducing carbon dioxide emissions into the atmosphere to reduce impact on climate change is a one of the major objectives of sustainable development. The purpose of this document is to outline the energy efficiency measures,

on site generation and embedded renewable energy strategies that will be adopted to substantially reduce the energy demands and carbon emissions from the proposed Kildare County Library.

3. Design Basis & Approach

Building energy efficiency and sustainability involves all designers and stakeholders from the start of the design process. The most successful sustainable sites are those which keep energy efficiency and sustainability at the core of project from design through to construction.

The 4 main principles to achieve energy efficient buildings are:

Reduce: Reduce energy consumption by passive and active means, for example improving building fabric and utilising low energy equipment.

Reuse: Reuse energy & materials where possible by recovering waste energy where possible.

Renewables: Utilise renewable technologies to offset energy from fossil fuel technologies.

Rethink: Constantly rethink and refine the energy & sustainability strategy and approach.

The potential strategies outlined in this report are based around these principles.

The new building will be designed to meet Part L of the Building Regulations (Conservation of Fuel and Energy – Buildings other than Dwellings) 2021 incorporating Nearly Zero Energy Building (NZEB) standards. The existing protected structure will meet the requirements of Part L where possible within the conservation strategy.

4. Energy Conservation Approach

4.1 Passive Energy Reduction

The first step to implementing a low energy design for the Kildare County Library will be to reduce the energy required to heat the building using passive means. For the new building this will include the specification of a high-performance building fabric with u values exceeding that of the backstop values in Part L of the Building Regulations – Conservation of Fuel & Energy (Buildings other than Dwellings) 2021. Air tightness and thermal bridge details will be carefully designed to limit heat loss. Glazing will be specified to reduce solar gain while still providing adequate daylight. In certain areas blinds (automatic or manual) will be provided to reduce solar gain. The building will also be constructed with a high thermal mass to reduce the incidence of overheating throughout the day and maximise the effectiveness of night-time ventilation / cooling.

For the existing protected structure, the thermal performance of the existing fabric will be improved through the additional of insulation on walls, floor and roof, unless prohibited by the conservation strategy. Due to the historical significance of the existing windows no thermal upgrades are proposed.

4.2 Heating and Renewable Strategy

4.2.1 New Building

Heating in the new building will be provided by a high efficiency air to water heat pump system. Space heating will be generated by high efficiency air to water heat pumps located on the roof of the new library building. The air to water heat pumps will generate space heating via renewable means to meet the renewable energy requirements of Part L of the Building Regulations (Conservation of Fuel and Energy – Buildings other than Dwellings) 2021.

It is anticipated that the air to water heat pumps will also provide the majority of the domestic water heating demand, with supplementary electric heating for the balance of the demand. This will be confirmed at the next stage of the design.

4.2.2 Existing (Protected) Structure

The heating strategy used in the existing (protected) structure will be largely dependent on the fabric upgrades that will be possible while maintaining the conservation strategy. While heating using air to water heat pumps, as

described for the new building above, is preferable their use may not be feasible for the existing (protected) structure. This is because the efficiency of air to water heat pumps significantly reduce as the circulation temperatures increase, and comparatively higher circulation temperatures will be required for the protected structure vs. the new building given lower expected fabric performance.

If air to water heat pumps are found to be unsuitable 2 no. heating options will be considered:

Low Temperature Hot Water (LTHW) with Gas Fired Boiler: This matches the current installation in the existing library. LTHW will be generated by a new gas fired boiler utilising the existing natural gas supply. LTHW will be distributed via flow and return pipework to wall mounted perimeter radiators. LTHW flow and return pipework will be concealed or surface mounted depending on the location and the final distribution strategy.

Electric Space Heating: Space heating will be provided by wall mounted direct electric perimeter radiators.

A gas boiler will have lower Day 1 CO₂ emissions vs. electric heating. However, the Climate Action Plan (CAP) 2021 includes an objective for 80% of all electricity used to be generated by renewable sources by 2030. As the electricity grid becomes more efficient in line with the CAP the CO₂ emissions of electric heating will reduce.

Due to the conservation impact of a wet (LTHW) system the current preference is to use an electric space heating system. This will be confirmed at the next stage of the design.

4.3 Ventilation & Overheating Strategy

The objectives of the ventilation & overheating strategy for the Kildare Library project are:

1. To maintain good air quality levels throughout the spaces at all times of the year.
2. To minimise overheating in summer months.
3. To minimise energy consumption and associated carbon emissions associated with HVAC plant.
4. To minimise the acoustic impact of traffic noise (from openable windows) in the library spaces from the adjacent roads.

4.3.1 New Building

During the pre-planning design development, several ventilation and overheating strategies were considered for the new build library to achieve the above objectives as follows:

Option 1 utilises openable windows for year-round ventilation and summer overheating.

Option 2 utilises mixed mode system incorporating mechanical ventilation for year-round ventilation and openable windows for summer overheating.

Option 3 is a full mechanical ventilation and cooling solution providing year-round ventilation and cooling by mechanical means.

Following a detailed analysis Option 2 was selected as the preferred option as:

1. Option 1 has a significant impact on the acoustics in the library as it requires the windows to be open year-round (*to some extent*) to provide ventilation.
2. Option 3 has significantly higher energy consumption and associated carbon emissions versus other options due to the requirement to provide mechanical cooling.
3. Option 2 is preferred as it can deliver excellent year-round air quality through the use of mechanical ventilation and can limit the requirements for windows to open to summer months only. While the requirement to open windows in summer months does impact on the acoustics of the library, this option provides the best balance between acoustics, air quality and energy consumption / carbon emissions to achieve the objectives outlined above. For further details of the acoustic impact refer to the Acoustic Consultants report.

Using dynamic thermal modelling software and occupancy profiles provided by KCC, a detailed analysis was completed on the L01 Adult Library space to estimate the window opening hours in summer months to limit overheating for a typical library space. Note: Limiting overheating is as per the requirements of CIBSE TM52: *The*

limits of thermal comfort: Avoiding overheating in European buildings. The analysis was completed using an industry standard (IWEC3) weather file based on average climatic data for the period 1990 – 2020, as well as a typical hot year. The results of the analysis are shown below:

Table 1. L01 Adult Library – Window Opening Durations to Limit Overheating

Month	IWEC3 1990-2020		Typical Hot Year	
	No. of hours	% Occupied hours	No. of hours	% Occupied hours
January	0	-	0	-
February	0	-	0	-
March	0	-	0	-
April	6	2%	6	2%
May	0	-	66	16%
June	40	10%	175	45%
July	222	55%	358	89%
August	95	24%	226	56%
September	2	7%	14	4%
October	1	-	1	-
November	0	-	1	-
December	0	-	0	-

The above analysis demonstrates that the requirement to open windows to limit overheating is estimated to be minimised to summer months and, with the exception of July (*and August in a hot year*), the windows are not estimated to be required to open for a majority of the occupied hours in these summer months.

To minimise energy consumption ventilation will be provided via an air handling unit (AHU) incorporating high efficiency heat recovery via a thermal wheel. The thermal wheel will recover heat from the exhaust air from the space to heat the incoming fresh air, thus reducing heating demand. To minimise fan energy consumption the ductwork system will be carefully designed to limit the Specific Fan Power (SFP) below the minimum requirements set out in Part L of the Building Regulations (*Buildings other than Dwellings*).

To limit peak overheating in the spaces the AHU will incorporate a cooling coil providing tempered air to the space in summer. The cooling coil will also provide some resilience for future ambient temperature increases due to climate change.

Further analysis will be completed at the next design stage to optimise the building fabric, in particular the glazing properties and shading devices, to maximise daylight to the space while minimising solar heat gains and thus window opening requirements.

4.3.1.1 Openable Windows for Overheating

Naturally ventilated buildings utilise openable windows (either manual or motorised) to provide ventilation or minimise overheating using outside air. Natural ventilation is particularly suitable for shallow plan, low density spaces with multiple exposed facades where cross ventilation can be employed. Ireland's temperate climate is ideal for naturally ventilated buildings.

The height, aspect and depth of the proposed Kildare County Library make it ideally suited for natural ventilation. As described above natural ventilation will be utilised for summer overheating in the new building library. Two types of natural ventilation strategies will be employed, as follows:

Cross ventilation Cross ventilation utilises openings on both sides of a room and relies on density differences to cross ventilate the space. Cross ventilation can ventilate much wider rooms than single sided ventilation. Cross ventilation will generally be used in the main library spaces on all floors. Cross ventilation in these spaces will be achieved by using the central stair core as a stack, which will ventilate above roof level.

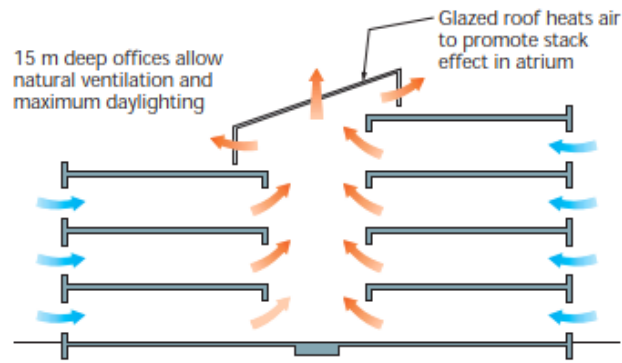


Figure 2.25 Atrium stack ventilation (Barclaycard Headquarters)

Example of cross ventilation using a central stack from CIBSE AM10. The principle applied in the Kildare Library will be similar, with the stair core providing the stack effect.

Single sided ventilation utilises external openings on a single external façade and relies on buoyancy and wind pressure forces to ventilate the room. Single sided ventilation is particularly suitable for shallow plan, low occupancy density spaces. Single sided ventilation will be used in some areas of the new building which meet the geometry limits of single sided natural ventilation as set out below, such as the meeting rooms, 2nd floor reading room / local studies and office spaces.

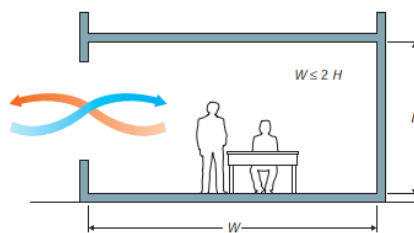


Figure 2.18 Single sided ventilation, single opening

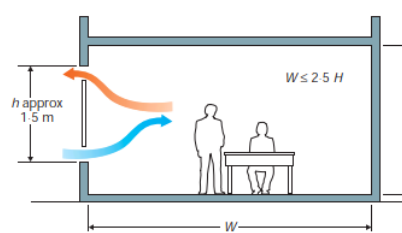


Figure 2.19 Single sided ventilation, double opening

Excerpts from CIBSE AM10 showing geometry limits for single sided natural ventilation

4.3.2 Mechanical Ventilation in Other Spaces

As well as the library spaces (as described above), mechanical ventilation will be employed for all toilets and changing rooms. Mechanical ventilation will be provided via a high efficiency packaged ventilation unit. This unit will incorporate high efficiency heat recovery to recover waste heat from the exhaust air which will be used to heat the supply air.

Specific fan powers will exceed the minimum requirements of Part L to minimise motor energy consumption.

4.3.3 Protected Structure

Single sided natural ventilation (as described in section 4.3.1.1 above) will be used throughout the protected structure for overheating and ventilation, as retrofitting mechanical ventilation to the protected structure would not align with the conservation approach / strategy. As modifications to the existing window openings in the protected structure will not be possible, it may not be possible to design the natural ventilation systems fully in accordance with CIBSE AM10 in this area. However, the requirements of AM10 will be met where practical / possible.

4.4 Photovoltaic Array

To provide renewable electricity generation for the library, a circa 5kW (peak) photovoltaic (PV) array will be installed on the roof of the library. As the remainder of the roof area is required for green roof to comply with SUDS and as the Fire Officer will not permit PV on a green roof it is not possible to provide a larger PV array. The PV array will generate approx. 16MWh of electric energy and offset circa 6kg of carbon dioxide per annum.

4.5 Lighting

Lighting will account for a significant proportion of the energy consumption of the Kildare County Library. The strategies that will be employed in the design of the Kildare County Library to reduce the energy consumption from lighting will be:

- Careful lighting design in all areas to provide adequate lux levels while eliminating over provision / over design of lighting
- Selection and specification of low energy use light fittings through including LED's where practical
- Careful specification of lighting controls which may include occupancy sensing, daylight sense and smart lighting control systems.

4.6 Domestic Water Usage

The design for the Kildare County Library will seek to reduce hot water consumption insofar as possible. Some of the measures that will be considered included minimising domestic hot water storage losses, the use of low use water fittings and the reduction of circulation losses through high levels of insulation. Leak detection will be used in high-risk areas to provide early warning of leaks, thus minimising water losses.

4.7 Controls

A fully automated Building Management System (BMS) will be provided to control all HVAC systems. The BMS will incorporate fully automated temperature control systems and will include automated optimisation strategies to minimise energy consumption. Energy metering will also be provided, allowing the end user to accurately monitor energy consumption and identify high energy users. This data can in turn be used to fine tune the control strategies to improve efficiency.

The use of smart building technologies can significantly reduce the energy consumption of buildings. The latest proposals from the EU for the revised Energy Performance of Buildings Directive (EPBD) recognise this and the revised EPBD will place much more emphasis on smart building technologies into the future. The use of smart building technologies will be considered where practical for the Kildare County Library.

4.8 Other Measures

Other energy conservation measures that will be employed on the Kildare County Library include:

- Variable speed drives will be provided on all motors greater than 1kW.
- Variable flow water flow heating systems will be used throughout.
- EC fans will be used on all ventilation systems.
- Low / zero Global Warming Potential (GWP) refrigerants will be used on Comms Room cooling systems.
- Lifts with regenerative drives will be used where feasible.
- Materials with low or zero volatile organic compound (VOC) content will be used to maximise Indoor Air Quality (IAQ).
- Kildare County Council have committed to providing appliances that use energy from the SEAI Triple E register or equivalent.

5. Embodied Carbon & Materials

The use of construction products leads to a wide range of environmental and social impacts across the life cycle through initial procurement, wastage, maintenance and replacement. Taken together, construction products make a highly significant contribution to the overall life cycle impacts of a building. In some cases, they may even outweigh operational impacts (such as energy consumption). The introduction and development of Part L into the building regulations has led to significant reductions in the operational energy consumption of buildings and these regulations are being progressively tightened. As a result, greenhouse gas emissions from other aspects of

buildings, such as embodied emissions, are becoming increasingly important in terms of reducing the overall emissions that lead to climate change and arise from the procurement, maintenance and replacement of construction products over the building's lifetime. In addition to climate change, there are several other embodied environmental impacts associated with construction products and the processes that occur during and after construction that should be considered during design, for example corporate social responsibility and other regulatory obligations.

In this context, the selection of materials for the Kildare County Library will aim to reduce the burden on the environment from construction products by recognising and encouraging measures to optimise construction product consumption efficiency and the selection of products with a low environmental impact (including embodied carbon), over the life cycle of the building.

Where possible locally produced products will be used thus minimising the embodied carbon associated with transport. Where timber products are specified only products with the Forest Stewardship Council's (FSC) Trademark or other label from an equivalent internationally recognised, globally applicable, independent certification system for good forest management will be used. Metrics for recycling waste during construction will also be set.

6. Sustainable Drainage (SUDS)

The proposed drainage design will include a number of Sustainable urban Drainage Systems (SuDS) measures which will intercept and treat runoff prior to entering the positive drainage network. The current proposals include the use of green roof, permeable paving and bio-retention to effectively intercept and reduce the quantity of runoff leaving the site. An oil separator will be provided upstream of the proposed outfall to the existing positive drainage network. The proposed SuDS design has been prepared in accordance with the Greater Dublin Strategic drainage Study (GDSDS) Volume 2 New Development and relevant best practice guidance in order to ensure that the measures proposed are sufficient to reduce the quantity and improve the quality of runoff entering receiving watercourses from the proposed site.

7. Sustainable Transport Infrastructure

The purpose of this section is to outline the sustainable transport infrastructure that exists and that will be provided as part of the project to facilitate sustainable transport to and from the proposed Kildare Library.

7.1 Bus

As graphically illustrated below in figure 7.1 below, the site is situated to benefit from bus transport connections allowing all site users to travel by this sustainable mode. There are 10 no. bus stops located within a 900m walking catchment of the site. These bus stops are operated by various bus providers.



Figure 7.1 – Existing Bus Stops (Source www.journeyplanner.ie)

7.2 Rail

The closest railway station to the site is the Newbridge Train Station located 1.2 km (15 min walk) northwest of the subject site. Newbridge Train Station is located four stops away from Dublin Heuston, which forms part of the Southwestern Commuter service which provides rail services west to Galway, Limerick and Cork. Figure 7.2 below illustrates the site location in relation to Newbridge Train Station.



Figure 7.2 – Train Station Proximity (Source: Google Earth)

7.3 Car Club

There is 1 no. GoCar hire station located within a 1.2km walking catchment of the subject site. GoCar members can book cars online or via the app for durations of as little as an hour. They then unlock the car with their phone or a GoCard; the keys are in the car, with fuel, insurance and city parking all included. The benefits of such car sharing services include:

- The reduction of cars on the road and therefore traffic congestion, noise and air pollution;
- Frees up land traditionally used for private parking spaces;

- Encourages and potentially increases use of public transport, walking and cycling as the need for car ownership is reduced;
- Car sharing allows those who cannot afford a car the opportunity to drive, encouraging social inclusivity; and
- Car share replaces approximately 20 private car parking spaces.

The location of the GoCar GoBase is illustrated in figure 7.3 below.

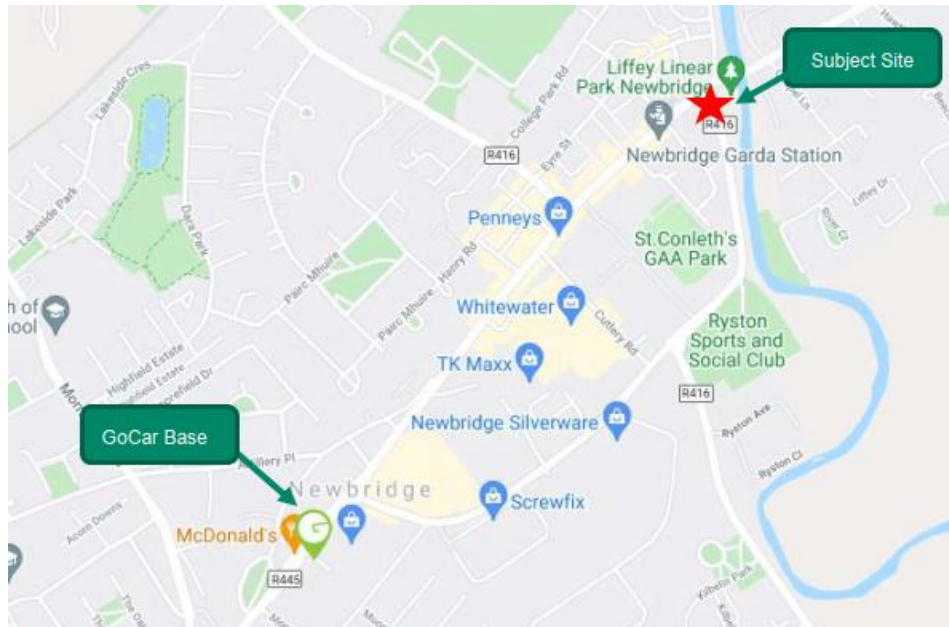


Figure 7.3 – GoCar GoBase Locations (Source: www.gocar.ie)

7.4 Cycle Network

Figure 7.4.1 illustrates the proposed cycle network for Newbridge. One of the objectives of the proposed cycle improvements is to provide cycle parking stands in key locations throughout Newbridge.



Figure 7.4.1 – Greater Dublin Area Cycle Network Plan – Proposed Cycle Network Newbridge

The proposal for the cycle network adjacent the library and Riverbank Theatre is shown in Figure 7.4.2 (for further details refer to the AECOM Landscape drawing 60669624-ACM-XX-00-DR-LA-00-0001).

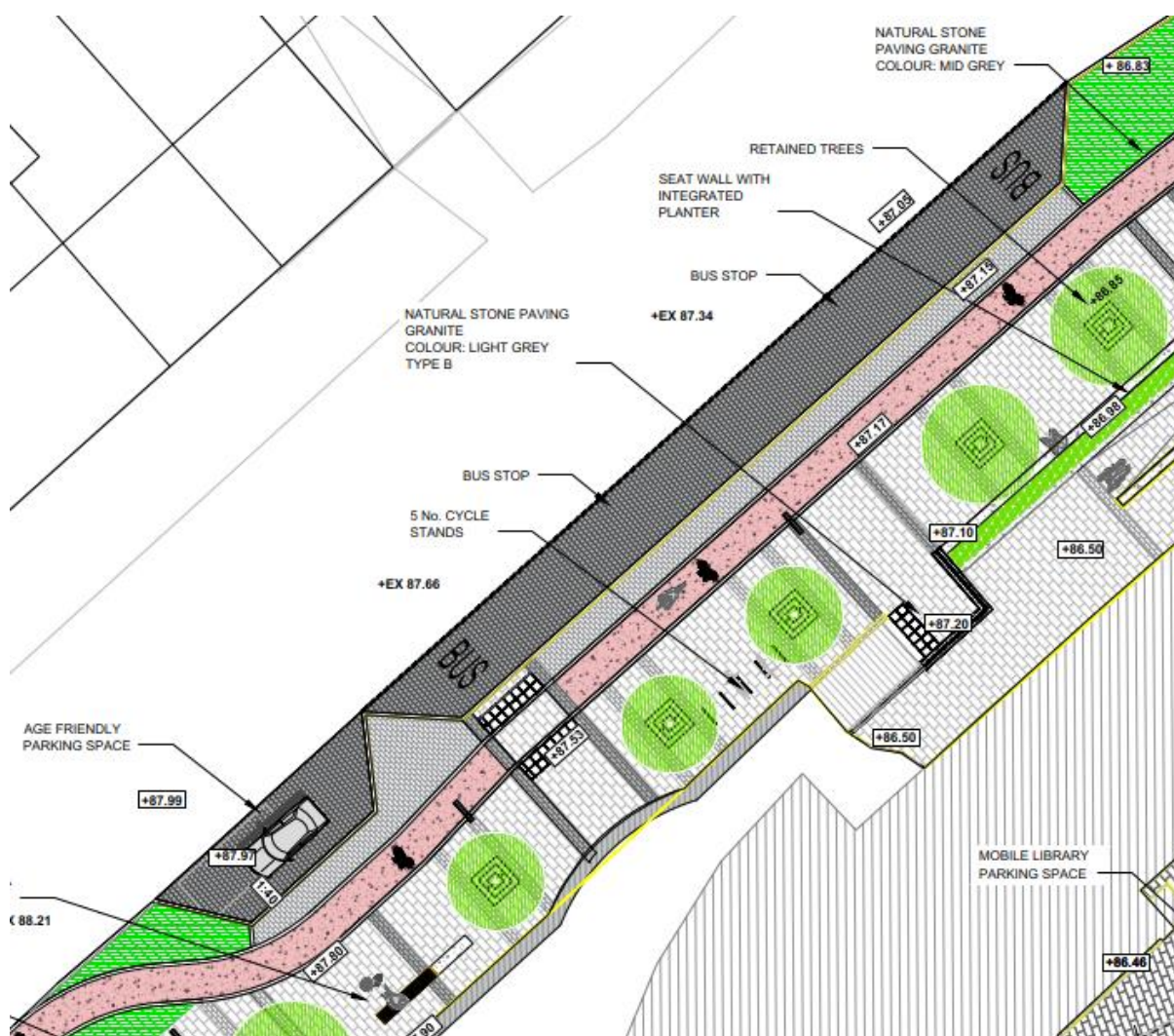


Figure 7.4.2 – Main Street Cycle Proposals (AECOM Landscape layout)

It is proposed that cycle parking is provided within the internal courtyard to help promote cycling for staff to the Library. It is proposed to provide 8 no. cycle parking spaces within the courtyard for staff and 20 no. cycle spaces along the main street for visitors. The cycle parking spaces are envisioned to be Sheffield stands with the staff parking to be covered.

7.5 Electric Vehicle Charging

A limited number of parking spaces will be provided in the courtyard to the rear of the library. It is proposed that 13 no. spaces will be provided within the internal courtyard which would consist of 12 no. standard car parking spaces and 1 no. mobility impaired space with 1 no. service vehicle parking space which is for the mobile library. Electric Vehicle (EV) charging will be provided on these spaces in line with the revised requirements of Part L of the Building Regulations (Conservation of Fuel & Energy – Buildings other than Dwellings) 2021.

8. Landscaping

Sustainability comprises of 3 spheres, social, economic and environment.

The landscape for Kildare County Library will be a space that can be utilised by the local community and visitors from across the county adhering to the social sphere of sustainability. The sensory garden will provide an accessible space, encourage end users to engage all their senses and help children develop their fine motor skills. The invigorated public realm will provide an attractive open space marking the entrance to Newbridge and creating a sense of place. This space will encourage pedestrian use increasing utilisation for the space.

Economically the landscape will provide opportunities for funding through the use of the space. The courtyard will become an event space for festivals, art installations and markets.

The environmental aspect of the landscape for KCL links the existing green infrastructure to planting onsite, native plants, the use of SUDS onsite and the materiality onsite. The existing green and blue infrastructure of the nearby Liffey Linear Park and the River Liffey will link to the site through the tree line and the use of local plants. Additionally, the green roof will provide materials that will allow local birds and insects to thrive. The SUDs will be incorporated into the project through a variety of typologies including green roofs, permeable paving, rain gardens and underground storage. These typologies add to the character of the area and retain water during peak rainfall events creating a more resilient space. The green roof with 100mm can retain 369mm of run-off (Metens, 2006). Rain gardens provide biodiversity by using flood tolerant plants. Underground storage will be utilised under permeable parking and under street trees to retain water. Native planting will be utilised across the site for better integration into the local habitat. The materiality will include permeable paving that allows for water infiltration and reclaimed hardscape materials.



Sensory gardens have opportunities for exploration through planting that engages all the senses.



Event taking place within a mixed use courtyard.



SUDS underground storage for tree pits in hardscape.

8.1 Policy

Policy supporting the social sphere:

- Kildare County Development Plan have objectives around mixed-use spaces including ECD 39 - Support Festivals, WC 8 - Require secure cycle parking, C 2 - Promote the use of community facilities and LBO 2 - Improve library provision.
- Newbridge LAP has objectives about pedestrian spaces including PKO 4: Cycle parking, CF 10 - Accessible facilities and GMO 2: Promote pedestrian modes.

Policy supporting the economic sphere:

- Kildare County Development Plan have objectives around mixed-use spaces including ECD 39 - Support Festivals and SC 2 - Cultural facilities are focal points
- Newbridge LAP aims that are relevant to this typology include TC3 - Protect Town Centre Role
- Policy supporting the environmental sphere:
 - Kildare County Development Plan: PK 8 - Utilise SUDS, 15.8.9 Sustainable Urban Drainage Systems (SUDS) which includes utilising local species to create amenity spaces and GI 5 - Connect to parks.

- Rain gardens, green roofs and permeable paving align with the Newbridge LAP goals of SW 1: SUDs and SW 4: Site Specific Solutions for controlling surface water drainage.

