# APPENDIX 3-5

## MECHANICAL AND ELECTRICAL SERVICES - BASIS OF DESIGN REPORT

# Knocknacarra District Centre, Rahoon, Galway

Glenveagh Living

Mechanical & Electrical Services
Basis of Design
Oct 2019

ethos
ENGINEERING

# Knocknacarra District Centre, Rahoon, Galway

## Glenveagh Living

### Mechanical & Electrical Services Basis of Design

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| **CURRENT ISSUE** | | | |
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| P2 | 23/4/19 | PON SMD | SC | Planning |
| P3 | 25/5/19 | PON SMD | SC | Planning |

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# 1. Introduction

Ethos Engineering have been commissioned to carry out the mechanical and electrical building services design for the proposed Knocknacarra District Centre, Rahoon development by Glenveagh Living.

We have prepared this report to document the proposed design criteria, concepts and design decisions which form the Basis of Design for the mechanical & electrical systems serving the residential apartments.

The purpose of this report is to advise Glenveagh Living on the systems proposed and identify any key client decisions required. This report gives general descriptions of the M&E systems and installations we consider are likely to be incorporated into the project.

It provides advice and information which serves to:

- Outline the proposed building services systems
- Confirm the overall space planning
- Provide a basis for an Cost Plan for the building services systems by the project quantity surveyor.

## 1.1. Project Components

The document is based on developed architectural design drawings produced by Reddy Architecture & Urbanism (RA) and discussions at recent meetings and workshops with Glenveagh Living, Architects, Civil/Structural Engineers, Project Managers, and Cost Consultants.

The lands at Knocknacarra District Centre, Rahoon are located adjacent the existing West District Retail Park. The lands are accessed from Western Distributer Road, Knocknacarra.

The proposed development provides for a mix of uses on the site with 335 residential units and ground floor retail units over 6 individual blocks.

## 1.2. Development Location


*Figure 1 - Site of Proposed Knocknacarra District Centre, Rahoon*


*Figure 2 – Depiction of Proposed Development (Courtesy of Reddy Associates)*

## 1.3. Limitations of the Report

There are a number of limitations and qualifications to the work we have undertaken in this concept design stage, to which we will progressively address through remaining design stages. They should be factored appropriately into any conclusion made from the information presented in this Report.

These are noted as follows.

- The report presents concepts or indicative sizing for major or non-standard building services components only.
- The building services concept presented here does not include sufficient detail to allow a Quantity Surveyor to perform an elemental take off to price elements individually. The Quantity Surveyor will need to apply appropriate unit rates (€/m2) to many areas of the development to formulate an appropriate budget estimate.
- Whilst we have attempted to identify and document major items of scope, there may be items that are not yet identified which may impact on the project cost plan.

# 2. Proposed Design Criteria

## 2.1. Mechanical Design Standards

The Mechanical Services Installation shall be designed in accordance with the following standards and amendments thereof:

- National Building Regulations – Technical Guidance Documents
- Local Authority / County Council Bylaws
- Safety, Health and Welfare at Work (Construction) Regulations
- Irish and European Standards, applicable and current at the design stage.
- British Standards (where referenced in this document)
- CIBSE Guides, Codes and Technical Memoranda
- BS 9251 Fire Sprinkler Systems For Domestic And Residential Occupancies
- Institute of Plumbing, Plumbing Services Design Guide 1990
- DW/144 Specification for Sheet Metal Ductwork incl. Addendum A
- DW/143 Practical Guide to Ductwork Leakage Testing

## 2.2. Mechanical Design Criteria

### 2.2.1. External Design Conditions

- Location: Dublin, Ireland
- Summer: 26°C db/20°C wb
- Winter: -5°C db (100% saturated)

### 2.2.2. Internal Design Conditions

Indoor design conditions to be used in heating and ventilation calculations and consequent equipment schedules to be:

| Area | Winter Temp. db °C | Summer Temp. db °C | RH % |
|---|---|---|---|
| Bathrooms | 20°C - 22°C | Not controlled | No Control |
| Bedrooms | 17°C - 19°C | Not controlled | No Control |
| Corridors/Stairs | 17°C - 19°C | Not controlled | No Control |
| Kitchen | 17°C - 19°C | Not controlled | No Control |
| Living Rooms | 17°C - 19°C | Not controlled | No Control |
| Lift lobbies | 17°C - 19°C | Not controlled | No Control |
| Retail | By tenant | By tenant | By tenant |
| Community Use | By tenant | By tenant | By tenant |
| Creche | By tenant | By tenant | By tenant |

### 2.2.3. Fresh Air Criteria:

- Bedroom supply air: 5 L/s + 4 L/s/person
- Kitchen extract air: 13 L/s
- Bathroom / ensuite extract air: 8 L/s
- Kitchenette 60 L/s extract
- Corridor 20 L/s extract
- Plantrooms As required to suit equipment
- Car-park Natural ventilation

### 2.2.4. Noise Criteria:

- Bedrooms NR 25
- Toilet Pod / Changing Rooms NR 35
- Living Room NR 30
- Kitchen Areas NR 40
- Plant Rooms NR 50

### 2.2.5. Heating Water Temperatures

- Central heating option: 70°C/40°C Flow & Return to HIUs
- Heat Pump option: Subject to heat pump selection

### 2.2.6. Water Storage

- Cold Water 212L/Apartment (TGD Part G)

### 2.2.7. Domestic Hot Water Temperatures

- Distribution Temperature 55°C
- Temperature after mixing 39-43°C

## 2.3. Electrical Design Standards

The electrical services installations shall be designed in accordance with the listed specification and amendments thereof:

- National Building Regulations – Technical Guidance Documents
- Local Authority / County Council Bylaws
- Safety, Health and Welfare at Work (Construction) Regulations
- National Rules for Electrical Installations, ET101
- I.S.3217:2013 Emergency Lighting requirements
- I.S.3218:2013 Fire Detection requirements
- I.S.EN 81 Lifts requirements
- I.S.EN 62305 Protection Against Lightning
- The ESB Requirements
- Irish and European Standards, applicable and current at the design stage.
- British Standards (where referenced in this document)
- CIBSE Guides, Codes and Technical Memoranda.

### 2.3.1. Internal Design Lighting Levels

| Area | Lighting Levels (Lux) | Control Method |
|---|---|---|
| Bathrooms | 150 | Manual On / Off |
| Bedrooms | 100 | Manual On / Off |
| Living Room/Kitchen | 300 | Manual On / Off |
| Plantrooms | 200 | Manual On / Off |
| Carpark | 100 | On Continuously |
| Comms Rooms | 200 | Manual On / Off |
| General/Circulation | 100 | PIR Sensor, Auto On – Auto Off |

### 2.3.2. Electrical Load Densities

Electrical load densities proposed will be used for electrical load assessments.

| Service | Load Density |
|---|---|
| Retail Units | F&B at 160w/m2 |
| Apartment (Local Heat Pump Option) | 16kVA for the 1st apartment & 5.5kVA there after |

## 2.4. Building Design Criteria

### 2.4.1. Floor Build Up

The following internal building design parameters have been taken from OMP's layouts and sections.

| Construction Element | Bedroom / Living Room (mm) | Bathroom/Stores (mm) | Corridors (mm) | Retail (mm) |
|---|---|---|---|---|
| Ceiling Void | 150 | 400 | 200 | 700 to 1000 |

It is noted that for a recessed sprinkler head, a minimum of 200mm ceiling void is required.

The electrical power services along with the other M&E services generally distributed through the ceiling voids.

### 2.4.2. Construction Details

The following U-Values will be used for the basis of the initial load assessments but will be subject to the Architects construction build ups and sustainability target requirements.

| Element | U value (W/m².K) | |
|---|---|---|
| | Draft Part L 2018 (NZEB) | Targeted |
| Pitched Roof | 0.16 | 0.16 |
| Flat Roof | 0.20 | 0.15 |
| Walls | 0.18 | 0.18 |
| Ground Floors | 0.18 | 0.15 |
| Exposed floors | 0.18 | 0.15 |
| External doors, windows and roof lights | 1.40 | 1.30 |
| Glazing gv (EN410) | | 0.4-0.6* |

# 3. M&E Services Infrastructure

## 3.1. Introduction

Utilities, such as natural gas, mains water, electricity, and telecoms are all local to the area.

Local utility services maps are appended for information. Further contact will be made with the utility providers once the detailed design is commenced to verify locations of sub stations, gas meters, incoming supply locations and the like.

## 3.2. Mains Water

Mains water is supplied into the site from the Local Authority. This will need to be upgraded as part of the new development as part of the Civil Engineering works. The new mains water supply will serve tanks in each of the separate plant rooms; one for cold water supply tank, one for the mains water supply tank, one for the sprinkler water tank and lastly one for the housekeeping water tank. Connection will be provided with a pulsed output water meter. Sub-metered branches will be provided to each apartment with pulsed signal provided for cold water consumption monitoring via the BMS.

Leak detection and metering will be installed as part of the water system to monitor usage in the building and advise facilities management in the event of a leak.

## 3.3. Natural Gas

It is proposed that a new natural gas supply will be taken from local gas network (TBC by GNI) to serve a new natural gas meter skid located as indicated on drawings. The gas skid will serve only retail units as there is no gas fired units within the scheme. The gas meter will be installed with a digital output to facilitate with monitoring gas usage on the BMS.

## 3.4. ESB Main Electricity Supply

The development shall be serviced by a series of strategically placed Substations and adjacent LV Rooms as follows:
Block A&B supplied from Double substation & LV Room arrangement. (Located within Block A)
Block B&C supplied from Single substation & LV Room arrangement. (Located in Block C)
Block E&F supplied from Double substation and LV Room arrangement. (Located within Block F)

Remote metering has been verbally agreed with local ESB which will allow metering at the ground floor entrance lobbies of each block within 2M of the entrance.

The assessed electrical loads for the development are listed below and will be requested from ESB.

- Block A Residential 650kVA
- Block B Residential 300kVA
- Block C Residential 80kVA
- Block D Residential & Retail 735kVA
- Block E Residential & Retail 410kVA
- Block F Residential & Retail 225kVA

## 3.5. Communications Services

The buildings shall be provided with diverse and dedicated telecommunications from the telecoms networks within the vicinity. The diverse routes will be provided within the development and will terminate in a dedicated telecom rooms. The area appears well serviced from the local area.

# 4. Mechanical Services

## 4.1. Heating

### 4.1.1. Heating Strategy

Heating to the apartments shall be via electric heating supplemented with domestic hot water heat pump per apartment and heat recovery ventilation. Suppliers as Dimplex provide an integrated system. (refer to appendix D for schematic)

#### Radiators

There are a number of options for Electric Radiators as described below

**Space heating Living - Quantum**

The space heating shall be provided by a high heat retention storage heater with heat retention not less than 45% measured according to IS EN 60531. The high heat retention storage core shall be high density magnetite storage cells, insulated with microporous silica and calcium silicate. They should incorporate an Electronic user interface with LCD display with 7 day 24 hour timer and electronic room thermostat to control the heat output and are user adjustable with 3 pre set timer profiles. Day night meters shall be provided to all apartments, and each heater will have duel day and night rate supplies.

**Space heating Living XLE**

The space heating shall be provided by a heat retention storage heater with heat retention not less than 38% measured according to IS EN 60531. The high heat retention storage core shall be high density magnetite storage cells, insulated with microporous silica and calcium silicate. They should incorporate an Electronic user interface with LCD display with 7 day 24 hour timer and electronic room thermostat to control the heat output and are user adjustable with 3 pre set timer profiles. Day night meters shall be provided to all apartments, and each heater will have duel day and night rate supplies. The heater shall have remote adjustment capability via wireless communication. The central control will allow the zoning of multiple heaters, energy management, time and temperature adjustment.

**Space heating Living QRAD**

The space heating shall be provided by a Dual-Element technology direct electric panel heater which can provide convected and radiant heat. Convection shall be provided by a tubular element with aluminium coated fins for improved convective performance. Radiant heat shall be provided via a silicone insulated heating cable on an aluminium sheet. They should incorporate an Electronic user interface with LCD display with 7 day 24 hour timer and electronic room thermostat accurate to +/- 0.2 degrees to control the heat output and are user adjustable with 3 pre set timer profiles. 'Eco-Start' delayed anticipatory control - the heater decides when to turn on to ensure target temperature is achieved at the selected time. It should also incorporate open window Technology automatically reduces output to prevent heat loss if a window is left open. Day night meters shall be provided to all apartments.

**Space heating Living PLXE**

The space heating shall be provided by a direct electric panel heater which provides convected heat. Convection shall be provided by a Compact, finned, mineral filled sheathed element for improved convective performance. The heater controls shall have a landlord lock function activated via a pin. This will ensure the user will have a the maximum operating temperature and runback duration in the runback lock mode. The heater shall also have a setback function where a non-adjustable setback temperature can be set. They should incorporate an Electronic user interface with LCD display with 7 day 24 hour timer and electronic room thermostat accurate to +/- 0.2 degrees to control the heat output and are user adjustable with 3 pre set timer profiles. 'Eco-Start' delayed anticipatory control - the heater decides when to turn on to ensure target temperature is achieved at the selected time. It should also incorporate open window Technology automatically reduces output to prevent heat loss if a window is left open. Day night meters shall be provided to all apartments. The heater shall have remote adjustment capability via wireless communication. The central control will allow the zoning of multiple heaters, energy management, time and temperature adjustment.

**Space heating Bathroom - BPH100M**

Shall be provided by a direct electric bathroom panel heater which provides convected heat and is IP25 rated. Convection shall be provided by a extruded aluminium plate element improved convective performance. They should incorporate an Electronic user interface with LCD display with 7 day 24 hour timer and electronic room thermostat accurate to +/- 0.2 degrees to control the heat output and are user adjustable with 3 pre set timer profiles. 'Eco-Start' delayed anticipatory control - the heater decides when to turn on to ensure target temperature is achieved at the selected time. It should also incorporate open window Technology automatically reduces output to prevent heat loss if a window is left open. Day night meters shall be provided to all apartments. The heater shall have remote adjustment capability via wireless communication. The central control will allow the zoning of multiple heaters, energy management, time and temperature adjustment.

#### Domestic hot water heat pump

**DHW Edel 200**

The hot water heat pump consists of an integrated stainless-steel tank and 1.65kW heat pump. It is an air source heat pump that extracts energy from the outside air and will have two separate ducts for supply and extract to the outside only. The heat pump must have a minimum COP of 3.21 according to EN16147 at outside air temperature of 7°C and water set temperature of 55°C. The heat pump must be capable of raising the temperature of the hot water cylinder to 60°C without any need for immersions. The cylinder should have a standing loss no greater than 1.65 kWh/24. The heat exchange to the water shall be an external aluminium heat exchanger with mini channels that maintains perfect contact with the outside of the tank for highly efficient heat transfer and eliminates the risk of the refrigerant leaking inside the hot water. The heat pump shall use a zero ODP (Ozone Depletion Potential) and low GWP (Global Warming Potential) refrigerant, such as R290 that complies with all current Irish legislation. The hot water heat pump shall also be capable of taking a low voltage signal from a PV system to optimise the use of generated PV energy. The enclosure for the hotwater heat pump shall be min 50 mm stud work double slabbed with 15mm plasterboard on either side and insulated between the studs with high density fibre insulation. The door to the enclosure should also be an appropriately rated acoustic fire door.

**Ducting for DHW Edel 200**

The DHW ducting to the outside shall be 220mm x 90mm extruded uPVC ridged ducting with a free area of 17968mm2. The ducting shall be insulated with 20mm flame retardant (EN 13163 class E) Silver EPs (expanded polystyrene) with 0.03 W/(m.K) thermal conductivity at 20mm insulation thickness. All unnecessary 90 bends are to be avoided. The external extract and supply grills shall be a double air brick 140mm x 250 mm.

#### Heat Recovery Ventilation System

**Ventilation NA180**

The unit shall be a balanced whole-house mechanical ventilation with heat recovery system with a SAP appendix Q Specific Fan Power to the 2012 Standard of 0.68 W/I/s and an efficiency of 86% for a kitchen and 1 wet room. The unit shall have a Maximum Extract Performance of 60l/s @250Pa. The motors shall be low energy EC with constant volume functionality. The unit shall have an integral datalogger, recording its daily use showing whether the unit has been in use or if a tenant has switched it off. The unit shall have a high efficiency composite plastic counterflow heat exchanger, supply and extract filters, automatic summer bypass, integral minimum and maximum infinitely variable speed controls with fascia mounted failure indication. The unit shall have low energy, high efficiency EC fan/motor assemblies with sealed for life bearings. The impellers shall be high efficiency forward curved centrifugal type. The unit shall have the facility to commission the supply and extract fans independently on minimum speed (continuous background ventilation), and boost speed, via inbuilt minimum and maximum speed adjustment. The unit shall have heat exchanger cell with a thermal efficiency of up to 92% when tested to EN 308. This shall be protected by G4 grade synthetic filters on supply and extract. Complete with a condensate drip tray and drain connection. The user interface therein shall be removable for remote mounting if required.

**Ventilation Ducting Air 75**

Ducting shall be semi ridged PE ducting arranged as a radial system. All pipe and distribution components have a construction height of less than 75 mm. Plenum distribution chambers shall be made of ABS plastic with 20 way and 8 way connections with a Hight not greater than 60mm. Th PE semi ridged pipe shall have a maximum diameter of 75mm and an internal diameter of 61mm and should accommodate a max air volume at

3m/s of 30 m3/h. If air-conveying pipes are routed outside a heated room or must cross one another these must have appropriate and standard-compliant thermal insulation and be equipped with vapour blocks.

**Photovoltaics**

The PV panels (allowance per apartment) shall be 360Wp 72 cell monocrystalline panels with black frame measuring 1960 x 992 x 40mm. The module efficiency shall be 18.51%. It should have a positive power tolerance 0 / + 4.99 Wp. It shall have a linier performance warranty of 83% after 25 years. Open circuit voltage shall be 47.20 V and maximum power voltage shall be 38.95V.

The inverters shall be micro inverters located behind each panel. The micro-Inverter converts the generated energy and should be pre set out of the box to meet the requirements of ESB Networks Conditions Governing the Connection and Operation of Micro-generation, deviations for Ireland according to EN50438:2007. The micro inverter is directly connected to a PV-module. The AC out put is by a bus cable system.

Each apartment shall have the appropriate number of PV panels to meet compliance with TGD Part L using SEAI's DEAP tool. Each mini array shall have a dedicated appropriately sized cable going back to a suitably sized isolatable 16 or 20 amp RCBO in the apartments consumer board.

## 4.2. Ventilation

It is recommended that a domestic extract hood is provided over all ovens as opposed to using recirculating hoods. The hoods extract steam and cooking odours at source and typically include adjustable speed control. The cooker hood normally forms part of the kitchen package with ductwork provided by the mechanical contractor.

Large purge ventilators will also be incorporated in the window design which allows for a large free area for rapid ventilation. The style of these will be coordinated with the Architect but at a minimum shall provide $1/20^{th}$ of the adjacent floor area as openable section to comply with the Building Regulations Part F.

Fire Smoke Dampers (FSDs) complete with monitoring system will be provided throughout where ductwork crosses fire walls or slabs. FSDs will be required to be installed strictly in accordance with the CE Certified installation details. Where flat pack ducting crosses fire walls (the intention is to avoid this in all areas) intumescent fire dampers, purposely made for flat pack ducting and CE certified will be used.

All diffuser and grille types are to be agreed with the Architect prior to tender.

## 4.3. Domestic Water System

Mains water will be piped to the various outlets and sanitary facilities to be provided in the apartments. Dedicated pre-insulated mains water storage tanks will be installed to provide 24-hour water storage for the building based on the proposed occupancy levels in compliance with the local water regulations. The cold-water storage tanks and associated booster sets shall be located in the ground floor plant-rooms. A pressure reducing valve shall be fitted on the incoming mains supply on each floor prior to distribution to each apartment. The mains water shall be routed to the kitchen sink where it shall be fitted with an isolation valve prior to final connection to the sanitary ware.

Low flow taps and fittings should be used throughout (specified by the Architect) and will aid towards NZEB compliance.

The Domestic Hot Water service shall have instantaneous hot water generation via heat meter.

## 4.4. Gas

Natural gas can be provided to the proposed commercial/retail units if required.

## 4.5. Above Ground Soils & Waste System

The above ground soils and waste system shall remove all waste from the toilet pods and all areas where sanitary fittings are installed and transport it into the site/council foul drain as directly and unobtrusive as possible without risk of contaminating any surrounding areas.

The installation shall consist of a complete soils and waste system with the pipework generally of Friophon acoustic soils and waste pipework. The system shall include for all traps, overflows, vents and access points. All work shall be carried out to the exact requirements of the relevant Local Authority.

The system shall be designed and installed to minimise the possibility of blockage. It is essential that adequate access for cleaning and pipe work accessibility is provided, at least at every other floor level. Intumescent fire sleeves shall be installed where plastic pipes of 40mmØ or greater penetrate fire compartment walls and floors.

The Architect must ensure that drainage stacks run straight from roof to connection into the Civil upstand from the foul water system. No transfers can occur within Apartments.

## 4.6. Fire Fighting & Portable Fire Extinguisher System

Dedicated dry risers shall be provided within the firefighting stair cores as indicated by the Fire Engineer. Dedicated landing valves shall be provided to comply with the fire officer requirements.

The building shall be provided with portable fire extinguishers to comply with IS EN3.

Fire hose reels will be provided in the ground floor carpark as part of the fire engineering strategy.

A foam suppression system will be provided in the generator plantroom with inlet adjacent the fuel fill point coordinated into the external landscape.

## 4.7. Automatic Sprinkler System

An automatic sprinkler system is to be provided within the apartments, with the exception of the social and affordable housing block. The system will be designed to BS9251. The fire engineer will be required to confirm each space to be sprinkler protected. A sprinkler tank and pump set will be provided on the ground floor which will house electrical pumps fed from essential board backed up by the lift safety generator.

An absolute minimum of 200mm ceiling void is required to install sprinklers. Where this is not provided, horizontal discharge sprinklers can be used however a clear bulkhead of at least 200mm is required.

**Retail spaces are not proposed to have sprinkler coverage.**

## 4.8. Firefighting Lobby Ventilation

Firefighting lobby requirements have been advised by the Fire Engineer.

Specialist designed (FlaktWoods or Colt) smoke extract system is to be proposed within the firefighting staircores. The system requires a riser shaft directly adjoining the firefighting lift lobby. The system includes duty/standby extract fans on the roof, a riser shaft with lobby vent at each level and an automatically door between the lobby and staircore. Controllers are provided in the staircore at the bottom and top level, in each firefighting lobby and a control panel at the main entrance adjacent the fire alarm panel.

AOVs, specified by the Architect will be provided at the top of the firefighting stairwells. Power will be provided to each AOV.

*Figure 4 – Smoke Shaft Ventilator*

## 4.9. Building Energy Management System

A full Building (Energy) Management System (BMS/BEMS) will be installed to monitor and control mechanical and electrical plant and equipment. A monitor and PC known as the Front End will be provided as part of the installation and positioned in a specified location, normally the facility manager's office where all the plant can be monitored and controlled.

The front end will be networked via its own LAN network to each of the controllers in the MCC panels where the plant is powered from and all the field instruments are wired back to. The BEMS will be linked to various energy meters within the development which will continuously monitor the actual energy usage for the various utilities and clusters.

The heating energy and water consumption of each apartment will be monitored.

The BMS can also include for a link to a read switch in each bedroom window, notifying the system when a bedroom window is open and turning off the radiator in that room preventing heat waste to outside.

## 4.10. Insulation and Labelling

- All supply and return ductwork shall be insulated with Class 'O' foil back insulation and clearly labelled.
- All extract ductwork to be clearly labelled.
- All domestic water pipework to be insulated with Class 'O' foil back insulation and clearly labelled.

## 4.11. Testing and Commissioning

The mechanical contractor will be responsible for pre-testing and final testing of each system within his scope of work in accordance with CIBSE commissioning codes and the project specification.

Ethos Engineering will witness testing and commissioning of major plant and systems and random sections of routine testing and commissioning.

# 5. Electrical Services

## 5.1. Capacity and Infrastructure

As outlined above the various blocks shall be serviced from strategically placed Substations and LV Rooms with a decentralised metering arrangement with meters in a dedicated metering cupboard just inside the lobby of each block. The final electrical load requirement will be confirmed during the detailed design stage but indicative figures are as outlined above.

The new client main LV Switchboards will house all landlord and tenant power supplies. The switchboards will be designed as Form 4 Type 2 construction.

Each sub distribution board will be provided with multifunction meters with additional sub metering provided locally to each section of the sub distribution boards, Lighting, General Services and Mechanical Power.

## 5.2. Cable Routing

The decentralised metering arrangement verbally agreed with ESB shall require a series of unmetered cables to distribute across the site. These shall be routed as prescribed by local ESB and shall be separate to other site services.

Cabling will be routed through the various blocks via dedicated electrical vertical risers on cable ladder, tray, trunking or basket depending on the type of service.

Power cabling shall generally be distributed throughout the building on cable tray or within galvanised steel trunking and conduit. All cabling for extra low voltage systems will be routed on dedicated tray/trunking and shall be electrically separated from all power cabling.

## 5.3. Cabling

Sub mains cabling shall generally be copper conductor multi-core armoured c/w XLPE/LSF insulation and sheathing. Essential fire services shall be cabled in FP 200/400 Gold PH120 or similar fire resistant cabling tested to I.S. EN 50200 and relevant BS standards.

All general internal wiring for lighting, general services, small power etc. shall be carried out in LSF (low smoke and fume) cabling.

## 5.4. Standby Power

A new stand-by life safety diesel generator will be provided complete with a proprietary base oil storage tank to operate the generator to serve the life safety systems only, for a period of 3 hours. A new twin wall stainless steel flue is to be routed within the main flue riser and vent at roof level. The generator will be alarmed on the landlord BMS system for status and common fault.

The generator will support the fire lift, smoke vents and any other life safety systems as per fire certificate and BS 9999 requirements.

The generator room should be provided with a 100mm bund to prevent oil spread in the event of a leak.

## 5.5. Electrical Services to Mechanical Plant

The main landlord mechanical plant such as the boilers, heat pumps and pumps etc will be supplied from the new MCC panels located at the ground floor level.

All mechanical plant power commercial/retail units will be from fed from the local tenant sub-distribution boards' motive power section and local Motor Control Centres (MCCs).

All controls for the main landlord plant will be wired to the MCC panel located in the ground floor plantrooms. Multifunction meters will be provided to each section of the distribution board and these shall be wired to the BMS to provide real time and historical consumption data. The BMS systems shall be installed in the main boiler plant room.

## 5.6. General Services (LV Distribution)

Each apartment shall be provided with an incoming 230V metered power supply, which shall be terminated in a consumer unit within 2m of the apartment entrance. All circuits serving socket-outlets and portable equipment shall be protected by a residual current device with maximum permissible 30mA trip setting. The protection devices shall be suitable for operation in circuits supplying switch mode power supply units and frequency converters.

Each bedroom will be furnished with a double socket with USB ports adjacent to each bed and then a double socket on the wall opposite the ensuite door. In the kitchen spaces, there will be spurs for cooking appliances and three sets of double sockets. There will also be a double socket and TV connection in the living areas.

Cleaners socket outlets shall generally be placed along corridors at no more than 15m intervals. These sockets shall be clearly labelled as maintenance sockets.

All landlord circuits shall be fed from the general services distribution board and protected by 20A RCBO's.

## 5.7. Lighting

The lighting installation will be designed to comply with the requirements of the CIBSE Lighting guides and I.S.EN 12464.

The lighting layout for any area of work will be designed to meet the construction solution adopted and specific client and Architect's aesthetic requirements. The lighting types for each space need to be agreed with the client and the Architect's at an early stage so that the lighting analysis can be completed.

| Room | Lighting Performance Parameters |
|---|---|
| Bedrooms | Recessed down lights controlled locally. |
| Circulation Corridors | Recessed flush ceiling mounted circular or square, 50% controlled via presence detection and remainder 50% will be permanently lit. |
| Living Rooms | Recessed LEDs body, Light source to be warm white, controlled locally via light switches. |
| Main Entrance | Lighting to compliment the architectural design intent. Vandal resistant where exposed. |
| Plant Areas | LED IP65, high impact polycarbonate body, polycarbonate diffuser, metal clips, and controlled via a local light switch. Light switch to be complete with neon indicator. |
| Reception Areas | Lighting to compliment the architectural design intent. Vandal resistant where exposed. |
| Stairs | Wall mounted, integrated emergency, surface or recessed, PL, LED or 2D lamps, controlled locally via presence detection with override, vandal resistant diffuser and body. |
| Toilets | Recessed flush or ceiling mounted, circular or square, dust sealed to IP44, vandal resistant diffuser. |

All lighting throughout the project will be LED type light source to minimise energy consumption. There will be surface vapour proof fittings in plantroom areas.

### 5.7.1. Emergency Lighting

The emergency lighting system will be controlled via the lighting management system. Standalone emergency LED fittings which will be installed to meet the requirement of IS 3217:2013 and will meet Technical Guidance Document Part M requirements in designated DAC access routes. There will be no provision for an addressable emergency lighting system for this facility.

## 5.8. Lightning Protection System

A full lightning protection system will be provided in accordance with the latest revision of the IS EN 62305 standard and will include appropriate surge protection devices in electrical distribution board to protect against transient voltage surges. Copper tapes and down conductors will be installed to underground earth rods.

## 5.9. Life Safety Systems

The fire alarm installation will be installed to meet requirements of an L3X type system to each residential unit, as defined by IS 3218:2013 Code of practice for fire detection safety and alarm systems for buildings and in accordance with the Fire Certificate. This will be by a heat detector situated within the entrance lobby of each unit. The common/communal areas shall be provide with a fire alarm system to provide L3X coverage. The car park will be provided with a fire alarm system which will provide

L4 coverage. A fully addressable main control panel will be installed at the main entrance for the fire service to view alarm conditions.

Detection will be provided as follows:

- Bedrooms – Optical detectors
- Kitchen/Living Areas – Rate of Rise Heat Detectors
- Corridors - Optical detectors
- Service Areas – Rate of Rise Heat Detectors
- Sounder/Strobes will be located as required by codes
- Break glass units shall be provided at all final exits doors only from the building

Main networked fire control panels will be strategically located throughout the building in accordance with fire alarm standards and building regulations.

In the event of activation, the fire alarm shall initiate the various interfaces including the following in accordance with the approved fire strategy:

- Closure of all automatic fire doors and fire dampers.
- Shutdown of plant as required.
- Lifts to return to ground floor and doors to open.
- Automatic opening smoke vents.
- Operation of gas slam shut valves.

A fire alarm cause and effect strategy will be developed and all actions will be agreed with the client and local fire officer.

## 5.10. Earthing & Bonding

The electrical installation shall be effectively earthed and non-current carrying metalwork shall be bonded, all in accordance with ETCI rules and as described below.

The earthing system shall be type TN-C-S. Neutralising of the incoming supply shall take place at the main distribution board.

Phase and neutral cables shall run from the ESB substation via the incomer switchgear to the main LV distribution board. A neutralizing link shall be provided in this board between the neutral and earth bars.

All non-current carrying metalwork entering and within the building shall be bonded together and ultimately to the main earth bar to ensure an equipotential network of non-current carrying metalwork. Bonding connections shall utilize 10mm$^2$ green/yellow insulated wire.

## 5.11. Telecoms/Structured Cabling

Provision shall be made for a minimum of two diverse fibre entry points to the building terminating into each ground floor telecoms room. Diverse vertical cable-ways will be provided to allow install of fibre services to each floor. A Cat 6 cabling standard will be provided throughout the development.

A new multi-core copper cable will be installed for the landlord services terminating into a wall mounted IDF cabinet. This will facilitate dial out facility for the landlord intruder and fire alarm systems to a remote monitoring station. A copper line will also be provided for the MCC panel and the lighting management system.

## 5.12. Satellite & Digital TV System

Each apartment will be provided with TV points to enable occupants to watch free to air digital channel TV and be wired for either all or specific TV and internet vendors. Each vendor require separate cabling and have different installation requirements. Amplified signal boosters will be provided within each riser to provide optimum signal strength. The TV system will be distributed via a RG59 co-axial cabling system.

## 5.13. Security Systems

The landlord areas shall be provided with access control, intruder alarm and CCTV systems at strategic locations within the building. The systems shall be designed to IS EN 50131 standards and the PSA Code of Practice. Final security strategy for the building is to be developed.

### 5.13.1. CCTV System

A fully integrated IP CCTV system which will incorporate fixed cameras, LCD monitors and digital recorders will be provided. The CCTV system will be linked back to a central monitoring station at the reception desk where each camera location can be viewed individually or collectively. They will be complete with a fully working multiplexed system installed in a dedicated location and will be colour. Full digital recording and playback facilities will be available. The recording systems shall be fully extendable and shall be complete with a minimum 20Tb hard drive.

The extent of coverage would include entrance and exit points, reception area, lift cars, public areas, common rooms and any vulnerable areas.

The external cameras shall have an external waterproof vandal resistant housing, heating element and window wiper. The internal cameras shall be vandal resistant.

### 5.13.2. Intercom Installation

The main entrance will be provided with a video intercom system. Each apartment shall be equipped with an audio intercom hand set. Each audio console module shall incorporate the facility to allow the occupant to receive a call from the door entry keypad, located at the main external entrance, speak to the person requiring entry.

An additional handset will be provided at the main entrance reception desk to allow management to be able to contact each apartment. A remote door release button shall be located at the reception desk with final locations shall be agreed with the Client.

## 5.14. Disabled Refuge System

Currently, a disabled refuge system is not required as part of the Fire Safety Certificate.

## 5.15. Disabled Toilet Alarm Installation

A disabled alarm system for disabled toilets will be provided which will consist of ceiling mounted pull chord switches, reset buttons and over-door indicators for local indication. Alarms shall be relayed to a main indicating panel located in the main reception.

## 5.16. Persons with Disability

The full electrical installation shall be suitable for persons with disability. Installation height of switches and control points shall be suitable for wheelchair users in accordance with Part M of the Building Regulations.

## 5.17. Testing & Commissioning

The electrical contractor will be responsible for pre-testing and final testing of each system within his scope of work in accordance with CIBSE commissioning codes and the project specification.

Ethos Engineering will witness testing and commissioning of major plant and systems and random sections of routine testing and commissioning.

# 6. Vertical Transportation

## 6.1. Passenger Lifts

The following summarises the lift provision following a lift traffic analysis.

Block A

On the current layouts this block is served by 2No. lift cars which share the same lift lobby. Based on the analysis and simulation results 2No. lift cars at a speed of 1m/s shall be sufficient for meeting the target performance criteria once the lifts remain in the same lobby.

In the event a lift being out of action, based on the simulation results, 1No. lift would be sufficient to meet the target performance criteria without impacting the quality of service to the block.

Block C

On the current layouts this block is served by 2No. lift cars which share the same lift lobby. Based on the analysis and simulation results 2No. lift cars at a speed of 1m/s shall be sufficient for meeting the target performance criteria once the lifts remain in the same lobby.

In the event a lift being out of action, based on the simulation results, 1No. lift would be sufficient to meet the target performance criteria without impacting the quality of service to the block.

General

One larger lift should be considered in both blocks for ease for moving furniture incl. beds etc. Increasing the size of the lift will have almost no change in the lift performance. We have based our selections on 1000kg lifts, smaller sizes could be utilised but given the building height we recommend 1000kg as a minimum.

In single lift cores, when the lift is out of service it will be challenging for elderly, disabled persons or those with groceries, prams etc. to walk upstairs, particularly to the upper levels.

For this reason, the CIBSE Guide D: Vertical Transportation recommends a single lift should only be considered in buildings with four or five levels above the entry level. Beyond this it may be unreasonable to expect all residents and visitors to be able to walk upstairs in the event of a lift failure and two lifts should be considered in residential buildings with more than five storeys.

It would be uncommon for five storey apartment buildings in Ireland to have two lifts however we would recommend that for six and above levels, two lifts should be provided.

The speed of the lift assists lift performance to a point but generally lift speeds above 1.6m/s would not be the typical for projects of this height as the effectiveness of higher lift speeds is minimal as most lift journeys are short and the lifts cannot accelerate up to the rated speed. Increasing lift speeds will also increase their cost as well as requiring greater pit depths and over-run headroom.

For better passenger comfort and an improved experience, cars should be wide and shallow to minimise stacking and to ease the process for people getting into and out of the lift.

## 6.2. Firefighting Lifts

A fire fighting lift shall be required in Block B (Social and affordable housing block). The Firefighting lift must comply with I.S EN81-72 (Firefighting) with each firefighting lift contained in its own lift shaft. If the main core lifts are to be used as firefighting lifts, a dividing wall must be installed between the lifts, increasing the size of the shaft.

The following electrical equipment must be installed to comply with I.S EN81-72 (Firefighting) when installing a firefighting lift;

- Primary and secondary power supply to be fire protected.
- Secondary power supply to be kept separate from primary power supply.
- Any electrical equipment located less than one meter from pit floor to be IP67 protected (sockets and lights).
- Electrical equipment located one meter above the pit floor to b IPX3 rated (sockets and lights).
- Red/green type LED indicator on FSAL beside firefighting intercom to indicate whether the power supply is from the primary or secondary source.
- The lobby at each level should slope away from the lift shaft by 25mm.

# 7. Sustainable Design

We understand that Glenveagh Living want to achieve the following target to assists with their leasing strategy;

- NZEB Compliance

# 8. As Built Documentation

The Contractor will provide a complete set of 'As Built' information and drawings relevant to all aspects of the mechanical installation for inclusion in the O&M Manuals, prior to client hand over.

The O&M manual will be "red lined" during the course of the project to ensure accuracy of the information at the end of the project.

# 9. Building Control Amendment Regulations

The Building Control Amendment Regulations (BCAR) will apply to this development. This is a process that will involve all members of the design team to carry out regular inspections of works in their discipline, and compile reports and records of inspection accordingly. Ethos will assist the process by providing the relevant documentation to the Assigned Assessor.

# 10. CE Marking

All mechanical and electrical equipment and systems supplied will be required to conform to the appropriate EU Directives and will carry the applicable CE Marking. The Supplier's Documentation will be required to include declarations of conformity for electrical equipment within his scope of supply as required by the Machinery Directive, LV Directive and EMC Directives. The Suppliers will be required to compile the necessary Technical Files or Technical Construction Files to demonstrate suitability for CE marking and these will be available to the Purchaser at any stage during the project or during the life of the installation.

# 11. Warranties

Mechanical and Electrical systems will be subject to a 12 month defects liability period, and new equipment shall come with warranty periods appropriate for the product provided.

# 12. Training

The project will include training for the Owner in respect of all system installed.

- Mechanical & Electrical testing (including engineer witnessing)
- Commissioning
- Production of record drawings
- Production of Operation and Maintenance Manuals (2No. handover copies)
- Training (minimum of 3No. persons per system)

# Appendix A – Site Utilities Maps

ESB Networks

# TITLE: 20181015-026_A3

COLOUR CODE:

- BLACK - 38KV & HIGHER VOLTAGE OVERHEAD LINES
- GREEN - MV(10KV/20KV) OVERHEAD LINES
- BLUE - LV (400V/230V) OVERHEAD LINES
- CYAN - 38KV & HIGHER VOLTAGE UNDERGROUND CABLE ROUTES
- RED - MV/LV (10KV/20KV/400V/230V) UNDERGROUND CABLE ROUTES

DATE: 15-Oct-2018

** SCALE: 1:2000

** SCALE WHEN PRINTED ON AN A3 PAGE
XY COORDINATES DISPLAYED IN IRISH GRID COORDINATE SYSTEM

## WARNING

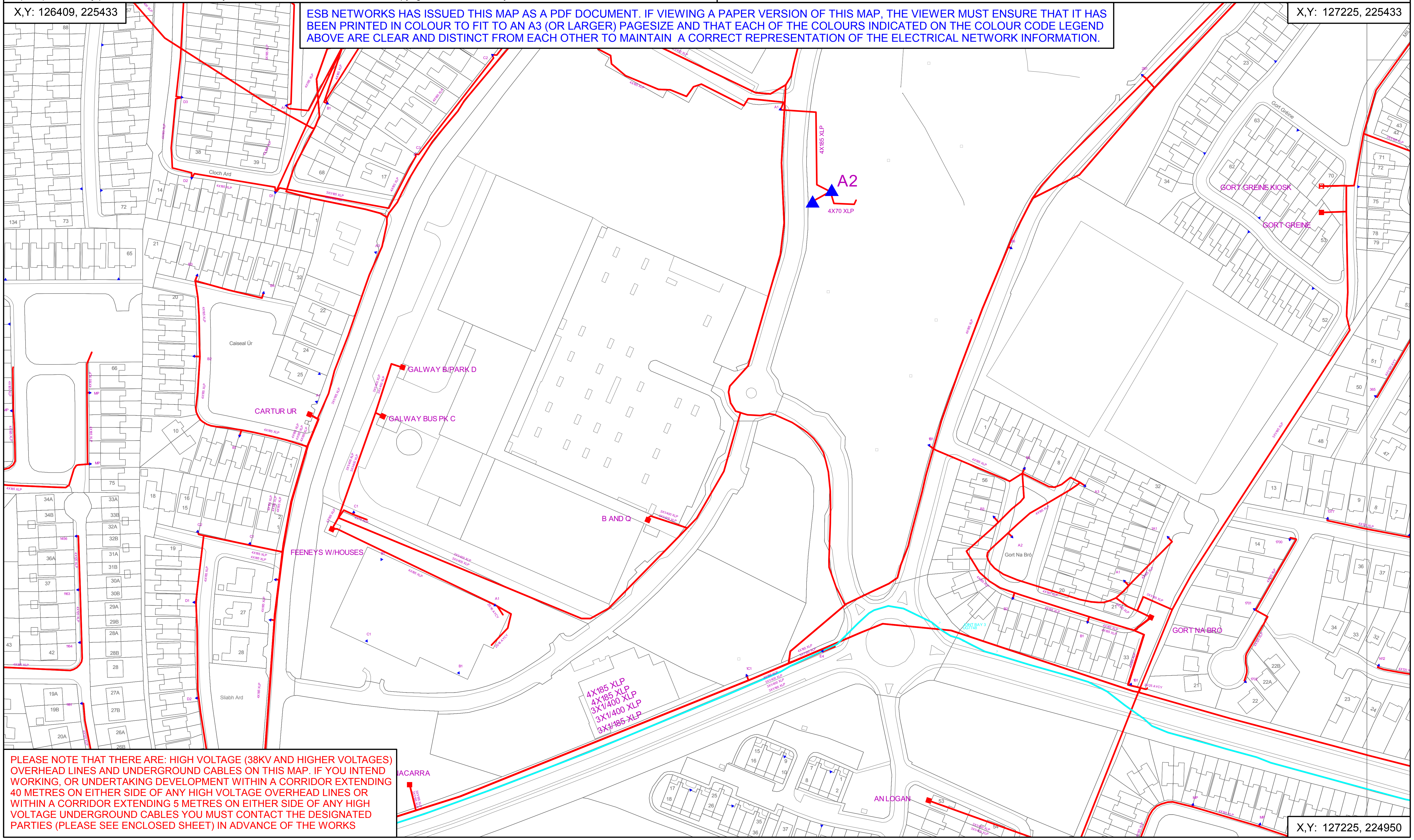
THIS MAP INDICATES THE APPROXIMATE LOCATION OF ESB TRANSMISSION (400KV, 220KV, 110KV, 38KV) AND DISTRIBUTION (20KV, 10KV, 230V/400V) UNDERGROUND CABLES AND OVERHEAD LINES IN THE GENERAL AREA OF THE PROPOSED WORKS. ESB NETWORKS TAKES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE MAP. IT IS THE USER'S RESPONSIBILITY TO INDEPENDENTLY VERIFY THE INFORMATION AND THE LOCATION OF UNDERGROUND CABLES AND OVERHEAD LINES. LOW VOLTAGE (230V/400V) SERVICE CABLES (E.G. HOUSE SERVICES, FACTORY/SHOP SERVICES, PUBLIC LIGHTING LAMP SERVICES, ETC) ARE NOT INCLUDED BUT THEIR PRESENCE SHOULD BE ANTICIPATED. THE DEPTHS OF UNDERGROUND CABLES MUST NEVER BE ASSUMED. ADDITIONAL MORE DETAILED INFORMATION IS AVAILABLE FOR HIGH VOLTAGE TRANSMISSION UNDERGROUND CABLES (38KV, 110KV, 220KV, 400KV) FROM THE LOCAL ESB NETWORKS TRANSMISSION REPRESENTATIVE - SEE ATTACHED LIST FOR CONTACT DETAILS OR CALL 1850 372 757. NO WORK SHOULD BE CARRIED OUT IN THE VICINITY OF 38KV OR HIGHER VOLTAGE UNDERGROUND CABLES WITHOUT PRIOR CONSULTATION WITH ESB NETWORKS. BEFORE ANY MECHANICAL EXCAVATION IS UNDERTAKEN, THE ACTUAL LOCATION OF ALL UNDERGROUND ELECTRICITY CABLES MUST BE ESTABLISHED AND VERIFIED ON THE SITE USING: (A) UP-TO-DATE MAP RECORDS; (B) CABLE LOCATER EQUIPMENT OPERATED IN BOTH POWER AND RADIO MODES; (C) CAREFUL HAND DIGGING OF TRIAL HOLES USING 'SAFE DIGGING PRACTICE'. REFER ALSO TO 'HSA CODE OF PRACTICE FOR AVOIDING DANGER FROM UNDERGROUND SERVICES'. ESB TAKES NO RESPONSIBILITY FOR AND SHALL BEAR NO LIABILITY, HOWSOEVER ARISING, IN RELATION TO ANY DAMAGE, INJURY/DEATH OR LOSS OF SUPPLY AS A RESULT OF DAMAGE OR INTERFERENCE WITH ITS NETWORKS.



X,Y: 126409, 225433

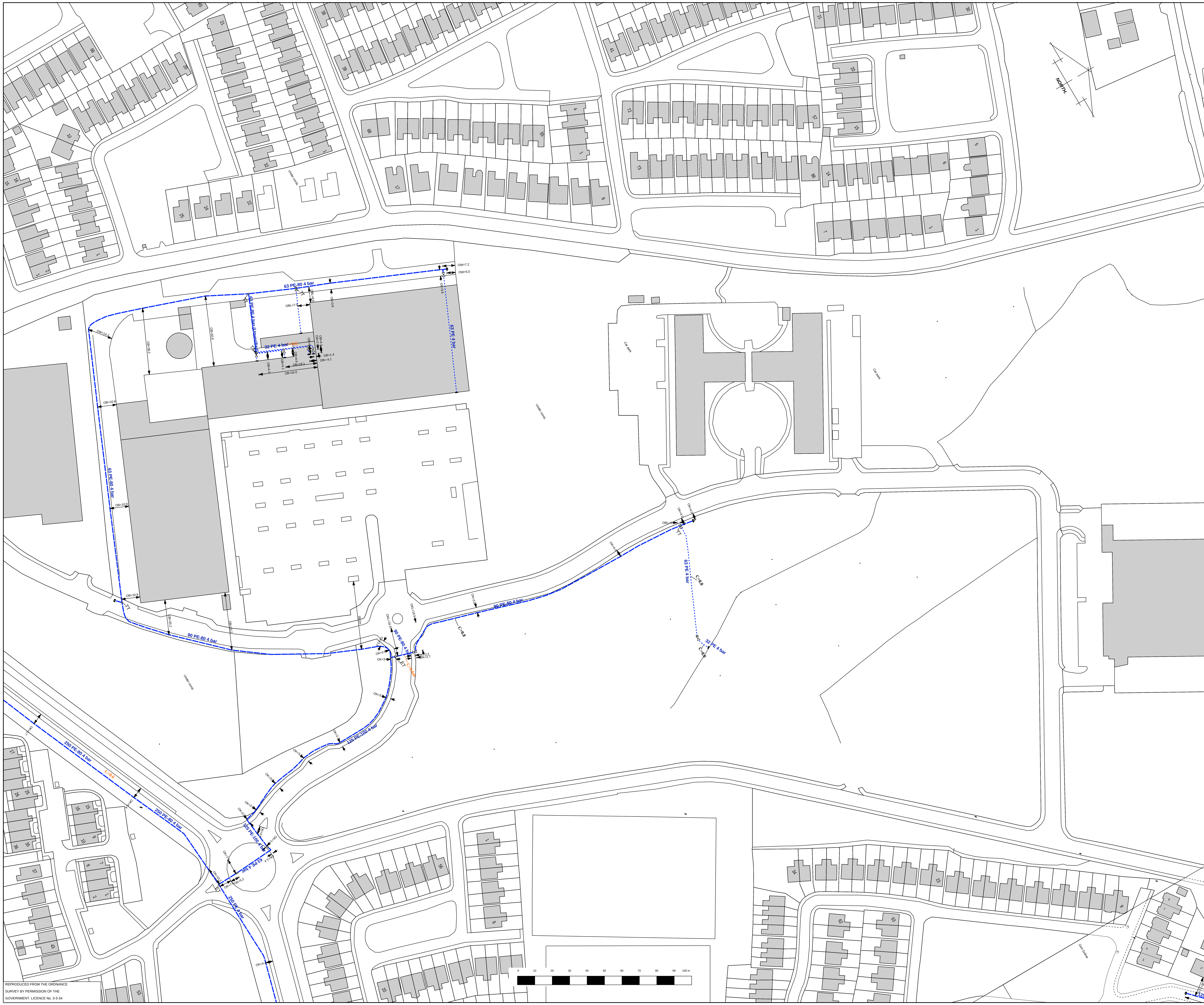
ESB NETWORKS HAS ISSUED THIS MAP AS A PDF DOCUMENT. IF VIEWING A PAPER VERSION OF THIS MAP, THE VIEWER MUST ENSURE THAT IT HAS BEEN PRINTED IN COLOUR TO FIT TO AN A3 (OR LARGER) PAGESIZE AND THAT EACH OF THE COLOURS INDICATED ON THE COLOUR CODE LEGEND ABOVE ARE CLEAR AND DISTINCT FROM EACH OTHER TO MAINTAIN A CORRECT REPRESENTATION OF THE ELECTRICAL NETWORK INFORMATION.

X,Y: 127225, 225433




PLEASE NOTE THAT THERE ARE: HIGH VOLTAGE (38KV AND HIGHER VOLTAGES) OVERHEAD LINES AND UNDERGROUND CABLES ON THIS MAP. IF YOU INTEND WORKING, OR UNDERTAKING DEVELOPMENT WITHIN A CORRIDOR EXTENDING 40 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE OVERHEAD LINES OR WITHIN A CORRIDOR EXTENDING 5 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE UNDERGROUND CABLES YOU MUST CONTACT THE DESIGNATED PARTIES (PLEASE SEE ENCLOSED SHEET) IN ADVANCE OF THE WORKS

X,Y: 127225, 224950






**Important Safety Notice:**

Damage to gas pipelines can result in serious injury or death. Gas network information is provided as a general guide. The exact location and depth of medium or low pressure distribution gas pipes must be verified on site by carrying out necessary investigations, including, for example, hand digging trial holes along the route of the pipe. Service pipes are not generally shown but their presence should always be anticipated.

High pressure transmission pipelines are shown in red. If a transmission pipeline is identified within 10m of any intended excavations then work must not proceed before GNI has been consulted. The true location and depth of a transmission pipeline must be verified on site by a representative of GNI. Contact can be made through 1850 427 747.

All work in the vicinity of the gas network must be completed in accordance with the current edition of the Health & Safety Authority publication, Code of Practice For Avoiding Danger From Underground Services which is available from the Health and Safety Authority (1890 289 389) or can be downloaded at www.hsa.ie.

**Legal Notice:**

Gas Networks Ireland (GNI) and its affiliates, accept no responsibility for the accuracy of any information contained in this document including data concerning location and technical designation of the gas distribution and transmission network (the Information ). The Information should not be relied on for accurate distance or depth of cover measurements.

Any representations and warranties, express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect or consequential loss, arising out of or in connection with the use or re-use of the Information.

- Aurora Telecom Fibre Optic Cable
- Aurora Telecom Duct
- Aurora Telecom Sub-duct
- Aurora Telecom Inserted Gas Pipe

Contact Aurora Telecom on 1850-427-399 or (01)203-0120.

- Transmission Pipe (High Pressure)
- Transmission Pipe (Construction Issue)
- Distribution Pipe (Medium Pressure)
- Distribution Pipe (Low Pressure)
- Service Pipe (Medium Pressure)
- Service Pipe (Low Pressure)
- Strategic Pipe (Medium Pressure)
- Strategic Pipe (Low Pressure)
- Inserted Pipe (Medium Pressure)
- Inserted Pipe (Low Pressure)
- Distribution Pipe (Abandoned)

| | | | |
|---|---|---|---|
| .C=? | Cover (depth in meters) | | Pressure Monitor |
| | CP Test Point | | Protection (Sleeve) |
| | End Cap | | Protection (Slabbing) |
| | Hot Tap | | Reducer |
| | Installation | | Service Terminator |
| | Valve | | Tee |
| | Mains Verification ** | | Transition |

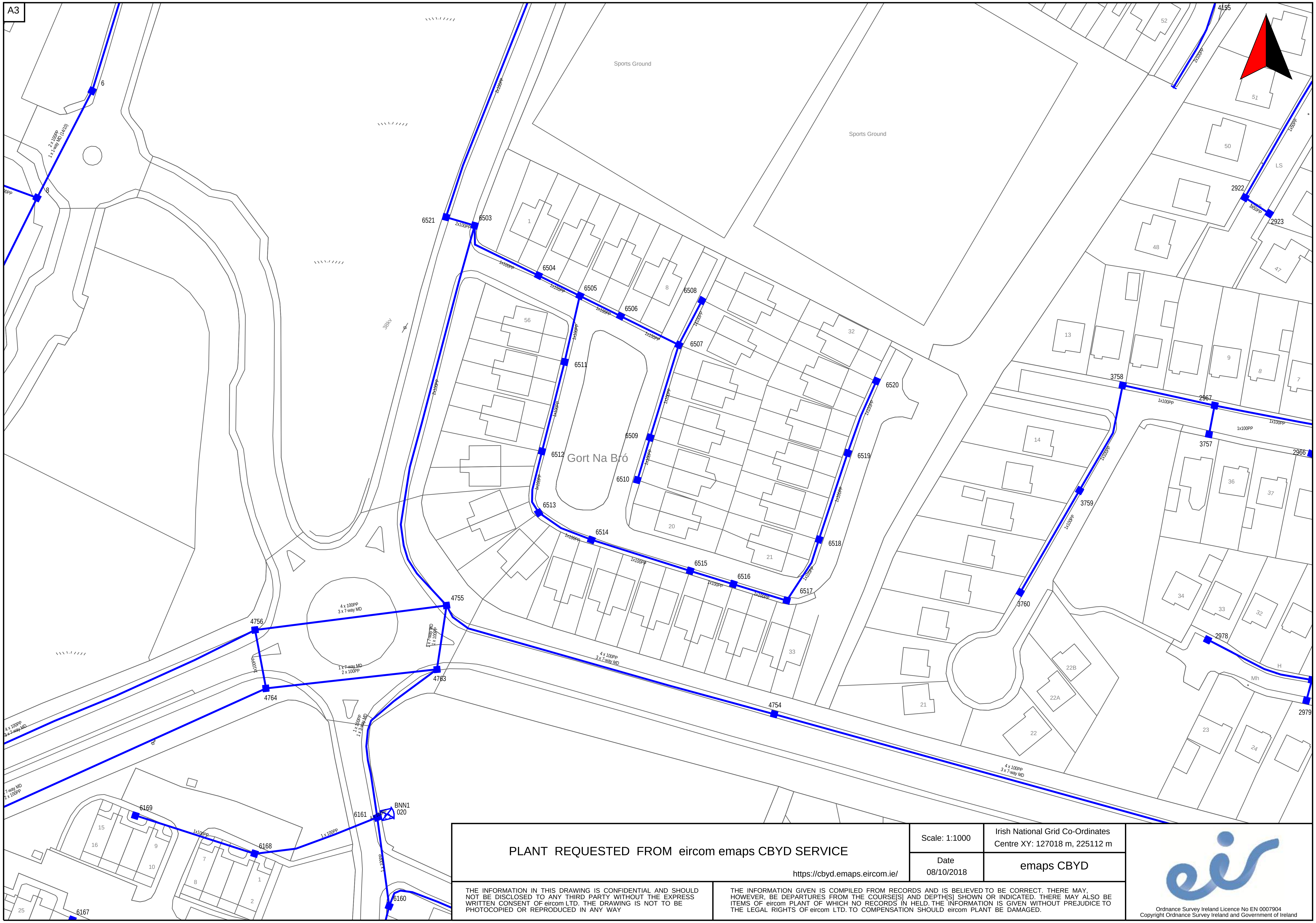
** Please contact GNI on 1850-427747 for specific information.

Design Department - DUBLIN

Gas Networks Ireland

# GAS NETWORK INFORMATION

| | |
|---|---|
| Issue: APEX | |
| Location: Knocknacarra, Galway | |
| Plot Date: 08/10/2018 | Contact: PO'N |
| Plotted by: AA | Scale: 1:1000 |




PLANT REQUESTED FROM eircom emaps CBYD SERVICE

https://cbyd.emaps.eircom.ie/

| | |
|---|---|
| Scale: 1:1000 | Irish National Grid Co-Ordinates<br>Centre XY: 127018 m, 225112 m |
| Date<br>08/10/2018 | emaps CBYD |

# Appendix B – Energy Report

# Knocknacarra District Centre, Rahoon, Galway

# Energy Statement

Glenveagh Living

18_D132

February 2019

ethos ENGINEERING

# Knocknacarra District Centre, Rahoon, Galway

# Energy Statement

Glenveagh Living

| CURRENT ISSUE | | | |
|---|---|---|---|
| Issue No: | P3 | Issue Date: | 24th May 2019 |
| Sign Off | Originator: | Checker: | Reason For Issue: |
| Print Name: | Jamie Molony | PJ Ryan | Issue for Planning |

| PREVIOUS ISSUES (Type Names) | | | | |
|---|---|---|---|---|
| Issue No: | Date: | Originator: | Checker: | Reason For Issue: |
| P0 | 08 February 2019 | Jamie Molony | PJ Ryan | Issue for Planning |
| P1 | 11 February 2019 | Jamie Molony | PJ Ryan | Issue for Planning |
| P2 | 21 March 2019 | Jamie Molony | PJ Ryan | Issue for Planning |
| | | | | |

# Contents





ethos ENGINEERING

# 1. Introduction

This Energy Statement prepared by Ethos Engineering is to form part of the planning submission documentation to An Bord Pleanala for the proposed Knocknacarra District Centre development.

The proposed site is located on Gort na mBro, Rahoon, Knocknacarra, Co. Galway approximately 3.1km west of Galway City Centre. The development is subject to the planning requirements applicable to the Galway City Council Development Plan 2017-2023.

This report aims to satisfy the legislative planning requirements by addressing how the overall energy strategy of the proposed development has been approached in a holistic manner, striving to meet the highest standards of sustainable building design such as passive solar design, high efficiency systems and use of renewable energy technologies.

This report also addresses how the proposed development will comply with NZEB (Part L 2018 Dwellings). The principles underpinning Part L compliance are energy demand reduction through passive measures and increased supply from renewable and efficient sources. The proposed design will follow this principle.

Assessments carried out in this report are based on latest floor plans and elevations received from the architect.

## 1.1. Site and Building Summary

The subject site is located at Gort na mBro, Rahoon, Knocknacarra, Co. Galway approximately 3.1km west of Galway City Centre. The residential development consists of a mix of 1-bed, 2-bed and 3-bed arrangements.

The proposed site development will meet or exceed where feasible the requirements of the Part L 2018 draft building regulations, which stipulates requirements on minimum renewable contribution, minimum fabric and air permeability requirements, maximum energy use and carbon dioxide emissions as calculated using the DEAP (Dwellings Energy Assessment Procedure) methodology.


*Figure 1: Phase 3 site in context to surrounding area (left) and development site layout plan (right)*

# 2. Legislative/Planning Requirements

## 2.1. Part L

Draft 'Technical Guidance Document Part L 2018 – Conservation of Fuel and Energy – Dwellings (public consultation edition)' (referred to in this document as "Part L or NZEB") stipulates requirements on, minimum fabric and air permeability requirements, maximum primary energy use and carbon dioxide ($CO_2$) emissions as calculated using the DEAP (Domestic Energy Assessment Procedure) methodology. This is a national standard and compliance is compulsory for all new dwellings. Three design aspects demonstrate compliance:

1. The limitation of primary energy use and $CO_2$ emissions
2. Building fabric
3. The use of renewable energy sources

### 2.1.1. Limitation of Primary Energy Use and $CO_2$ Emissions

In order to demonstrate that an acceptable primary energy consumption rate has been achieved, the calculated Energy Performance Coefficient (EPC) will be no greater than the Maximum Energy Performance Coefficient (MEPC). The MPEPC is 0.30.

To demonstrate that an acceptable $CO_2$ emission rate has been achieved, the calculated Carbon Performance Coefficient (CPC) of the dwellings being assessed will be no greater than the Maximum Carbon Performance Coefficient (MPCPC). The MPCPC is 0.35.

### 2.1.2. Building fabric

In order to limit the heat loss through the building fabric the thermal insulation for each of the plane elements of a new dwelling must meet or better the area weighted average elemental U-Values (Um) as specified by Part L, listed in Table 1 (column; Part L 2018).

**Table 1: Fabric U Values Comparison Part L 2011 vs Part L 2018 (Draft)**

| Element | U-value (W/m².K) | U-value (W/m².K) |
|---|---|---|
| | Part L 2011 | Draft Part L 2018 (NZEB) |
| Pitched Roof (Insulated on slope or ceiling) | 0.16 | 0.16 |
| Flat Roof | 0.20 | 0.20 |
| Walls | 0.21 | 0.18 |
| Ground Floors | 0.21 | 0.18 |
| Exposed floors | 0.21 | 0.18 |
| External doors, windows and roof lights | 1.60 | 1.40 |

### 2.1.3. Use of Renewable Energy Sources

In order to comply with NZEB, dwellings must conduct a comparative analysis for specified renewable technologies to demonstrate compliance with Regulation L3 (b).

Renewable Energy Ratio (RER) is the ratio of the primary energy from renewable energy sources to total primary energy as defined and calculated in DEAP. The following represents a very significant level of energy provision from renewable energy technologies in order to satisfy Regulation L3 (b).

Where the MPEPC of 0.3 and MPCPC of 0.35 are achieved, a RER of 0.20 represents a very significant level of energy provision from renewable energy technologies

## 2.2. Nearly Zero Energy Buildings (NZEB)

### 2.2.1. About NZEB Standard

The European Energy Performance of Buildings Directive Recast (EPBD) requires all new buildings to be Nearly Zero - Energy Buildings (NZEB) by 31st March 2020. This means that any building completed after these dates must achieve the standard irrespective of when they were started. This is quite different to the transitional arrangements for previous building regulations revisions.

'Nearly Zero - Energy Buildings' means a building that has a very high energy performance, Annex 1 of the Directive and in which "the nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby"

### 2.2.2. Implementation of NZEB in Ireland

Each member Government has discretion in how the standard is applied nationally. To comply with the NZEB requirement, the Irish Government has amended the 2011 Part L to include the following paragraphs:

*'In order to achieve the acceptable primary energy consumption rate for a nearly zero energy dwelling, the calculated energy performance coefficient (EPC) of the dwelling being assessed should be no greater than the Maximum Permitted Energy Performance Coefficient (MPEPC). The MPEPC for a nearly zero energy dwelling is 0.30.*

*To demonstrate that an acceptable CO2 emission rate has been achieved for a nearly zero energy dwelling, the calculated carbon performance coefficient (CPC) of the dwelling being assessed should be no greater than the Maximum Permitted Carbon Performance Coefficient (MPCPC). The MPCPC for a nearly zero energy dwelling is 0.35.'*

## 2.3. Galway City Council Development Plan 2017-2023

The energy strategy will consider the following council policies and objectives as outlined in the Galway City Council Development Plan 2017-2023. The Galway City Council require applications to meet the highest standards of sustainable design and construction and conform in full with the sustainable energy policies set out in Chapter 9 of the City Development Plan 2017-2023 (Environment and Infrastructure). For major developments an Energy Statement should accompany the planning application. The following council policies have been considered as part of the Energy strategy:

- **Policy 2.2: Housing Strategy**
  - Support a diverse range of housing types, size and tenures within housing developments.

- **Policy 2.5 Outer Suburbs – Knocknacarra**
  - Encourage higher residential densities at appropriate locations especially close to public transport routes and routes identified in the Galway Transport Strategy as suitable for high frequency, public transport services.
  - Ensure that sustainable neighbourhoods are places where housing, streets, open spaces and local facilities come together in a coherent, integrated and attractive form.
  - Ensure the layout of residential developments has regard to adjoining developments.
  - Encourage a mix of housing types and sizes within residential developments.
  - Encourage the use of homezones within residential developments.

  - Require residential developments of over 10 units to provide recreational facilities as an integral part of the proposed open space.
  - Ensure a balance between the reasonable protection of the residential amenities of the outer suburbs and the protection of the established character and the need to provide for sustainable residential development.
  - Encourage the integration of energy efficiency in the design and layout of residential development.
  - Encourage the promotion of universal design principles and lifetime adaptability in the design and layout of residential developments.

- **Policy 9.4: Renewable Energy**
  - Promote and facilitate the development of renewable sources of energy within the city, and support national initiatives, in conjunction with Galway Energy Agency (GEA) and other agencies, which offer sustainable alternatives to dependency on fossil fuels and a means of reducing greenhouse gas emissions, subject to the avoidance of unduly negative visual and environmental impacts, or impacts on residential amenity.

- **Policy 9.5: Sustainable Building Design and Construction**
  - Increase the energy performance of future buildings in the city by encouraging energy efficiency and energy conservation in the design and construction of development.
  - Encourage new development to limit greenhouse gas emissions and make use of opportunities for renewable and low carbon energy including through design, layout, orientation and use of materials.
  - Encourage high standards of energy conservation and improved energy performance in all existing and planned local authority housing.
  - Encourage consideration of orientation in the siting, layout, massing, land form and aspect in the design of future housing developments, in order to avail of passive solar gain and natural ventilation.
  - Continue to support the installation of improved energy conservation measures.
  - Ensure that the development of renewable energy and its associated infrastructure avoids negative impacts on European Sites and adhere to the requirements of Article 6 of the Habitats Directive (92/43EEC).

# 3. Part L Compliance

The proposed development will meet or exceed where feasible the requirements of Part L. Apartments have been assessed using the Sustainable Energy Authority of Ireland (SEAI) DEAP 4.1 (beta) software which demonstrates Part L compliance. Software inputs and outputs are summarised in section 5 of this report.

## 3.1. Building Fabric

In order to limit the heat loss through the building fabric of the proposed apartments the thermal insulation for each of the plane elements of the development will meet or better the area weighted average elemental U-Values (Um) as specified by Part L. Table 2 lists the Part L area weighted average elemental U-Values and the targeted U-Values of the proposed design.

**Table 2: Fabric U Values (Apartments)**

| Element | U value (W/m$^2$.K) | |
|---|---|---|
| | Draft Part L 2018 (NZEB) | Targeted |
| Pitched Roof | 0.16 | 0.16 |
| Flat Roof | 0.20 | 0.15 |
| Walls | 0.18 | 0.18 |
| Ground Floors | 0.18 | 0.18 |
| Exposed floors | 0.18 | 0.18 |
| External doors, windows and roof lights | 1.40 | 1.30 |
| Glazing gv (EN410) | | 0.4-0.6* |

* Pending Overheating Calculation

## 3.2. Thermal Bridging

To avoid excessive heat losses and local condensation problems, consideration will be given to ensure continuity of insulation and to limit local thermal bridging, e.g. around windows, doors and other wall openings, at junctions between elements and other locations.

Acceptable Construction Details will be adopted for all key junctions where appropriate (i.e. typical/standard junctions). For all bespoke key junctions certified details which have been certified by a third party certification body (such as Agrément or equivalent) will be used or calculated by an NSAI registered thermal modeller.

Heat loss associated with thermal bridges is taken into account in the DEAP methodology and can heavily impact the calculated energy use and $CO_2$ emissions. In general this is done by including an allowance for additional heat loss due to thermal bridging, expressed as a multiplier (Ψ, psi) applied to the total exposed surface area or by the calculation of the transmission heat loss coefficient $H_{TB}$. A default Ψ value of 0.15 is applied in DEAP; the proposed design is targeting a Ψ value of at least 0.08 or equivalent $H_{TB}$ value.

## 3.3. Building Envelope Air Permeability

In addition to fabric heat loss/gain, considerable care will be taken during the design and construction to limit the air permeability (Infiltration). High levels of infiltration can contribute to uncontrolled ventilation.

Part L requires an air permeability level no greater than $5m^3/m^2/hr$ @ 50Pa for a new dwelling; which represents a reasonable upper limit of air tightness. The design intent for the proposed apartments will be to target an air permeability of $2m^3/m^2/hr$ @ 50Pa.

Air permeability testing will be carried out by a person certified by an independent third party (National Standards Authority of Ireland or equivalent certification body) in accordance with I.S. EN 13829: 2000 "Thermal performance of buildings: determination of air permeability of buildings: fan pressurisation method". All apartments will be tested in this way.

## 3.4. Building Services

### 3.4.1. Heating Appliance Efficiency

Regulation L3 (d) requires that space heating and water heating systems in dwellings are energy efficient, with efficient heat sources and effective controls. More specifically, Regulation L3 (e) provides that oil and gas fired boilers must achieve a minimum seasonal efficiency of 90%.

The proposed system design for the apartments is to generate heat for domestic hot water (DHW) using a hot water heat pump and to generate heat for space heating using direct acting electric space heaters.

Space heating will be provided to the space by appropriately sized heat emitters.

### 3.4.2. Space Heating and Hot Water Supply System Control

Space and water heating systems should be effectively controlled so as to ensure the efficient use of energy by limiting the provision of heat to that required to satisfy the user requirements.

The design intent is to provide the following minimum level of control;

- Automatic control of space heating on the basis of room temperature
- Automatic control of heat input to stored hot water on the basis of stored water temperature
- Separate and independent automatic time control of space heating and hot water

- Shut down of boiler or other heat source when there is no demand for either space or water heating from that source

We propose to use a control system with full time and temperature control in each occupied room

### 3.4.3. Insulation of Hot Water Storage Vessels, Pipes and Ducts

All hot water storage vessels, pipes and ducts (where applicable) will be insulated to prevent heat loss. Adequate insulation of hot water storage vessels will be achieved by the use of a storage vessel with factory applied insulation tested to BS 1566, part 1:2002 Appendix B. Water pipes and storage vessels in unheated areas will be insulated for the purpose of protecting against freezing. Technical Guidance Document G and Risk report BR 262, Thermal insulation avoiding risks, published by the BRE will be followed.

### 3.4.4. Low Flow Sanitary Ware

At the time of writing the official DEAP4 software is yet to be made available. It is expected that this updated version for assessing the building energy rating will give credit for water efficient showers, taps, wash hand basins and baths. The installation of flow restrictors is recommended. Good practice would include:

- Shower – 6L/min
- Bath Volumes – Can vary but 175-130 L would be usual. 150L would be a recommended design target.

These figures will be confirmed when the software officially becomes available.

### 3.4.5. Lighting Design

A focus on lighting design will be another new aspect of the DEAP4 software where it is expected that credit will be given for an appropriate LED lighting design in relation to the dwelling. In the case of a deprived or over-elaborated lighting design spec, there will be a penalty for the building energy rating. A full lighting design analysis using appropriate software i.e. Dialux or Relux can help create a balanced lighting design.

### 3.4.6. User Information

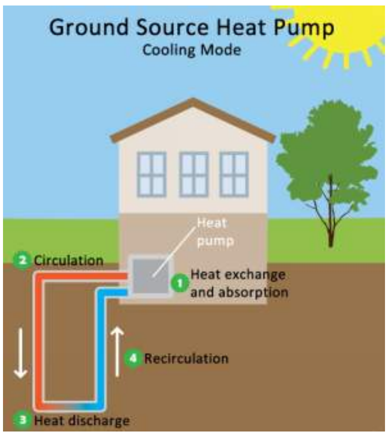
After the completion of the proposed Development the end user(s) will be provided with sufficient information about the building, its installed services and their maintenance requirements so that the Apartments can be operated in line with their optimum operation for energy efficiency.

## 3.5. Use of Renewable Energy Sources

The following low & zero carbon technologies were reviewed in terms of their applicability for this development;

- Wind Power
- Photovoltaic Cells (PV)
- Solar Thermal Collectors
- Biomass Heating
- Ground Source Heat Pumps (GSHPs)
- Air Source Heat Pumps (ASHPs)
- Combined Heat and Power (CHP)
- Hot water Heat pump

| Technology | Feasibility | | | Comments |
|---|---|---|---|---|
| | High | Medium | Low | |
| Micro Wind  | | | √ | **Technology Description:** Micro wind turbines can be fitted to the roof of a building but would contribute a negligible amount of energy to the development.<br><br>**Applicability to this Development:** Due to the suburban nature of the development site, this renewable has not been deemed viable. Vertical axis wind turbines may be more suited to this building, but there would still be the obvious aesthetic and potential noise issues. |
| Wind Power  | | | √ | **Technology Description:** Mast-mounted wind turbines can be located in an open area away from obstructions such as buildings and tall trees.<br><br>**Applicability to this Development:** Due to the suburban location of the site and its location close to other residential buildings it is deemed that a large wind turbine installation is not feasible. |
| Solar Photovoltaic (roof mounted)  | √ | | | **Technology Description:** Photovoltaic (PV) Cell technology involves the conversion of the sun's energy into electricity. PV panels can be discrete roof-mounted units or embedded in conventional windows, skylights, atrium glazing, façade cladding etc.<br><br>**Applicability to this Development:** Residential developments can be suitable locations for the installation of PV depending on orientation roof pitch and over-shading while also being virtually maintenance free. PV will be included for this development and assessed further at detailed design. |

| Technology | Feasibility | | | Comments |
|---|---|---|---|---|
| | High | Medium | Low | |
| **Solar hot water systems**<br> | | | √ | **Technology Description:** Active solar hot water technology uses the sun's thermal radiation energy to heat fluid through a collector in an active process.<br><br>**Applicability to this Development:** Due to the maintenance factor surrounding solar panels a solar hot water system is not considered feasible at this site. |
| **Biomass Heating**<br> | | | √ | **Technology Description:** Biomass boilers work on the principle that the combustion of wood chip or pellets can create heat for space heating and hot water loads.<br><br>**Applicability to this Development:** This technology requires substantial space allowance in a boiler room, access for delivery trucks, a thermal accumulator tank and considerable space for fuel storage of wood chips or pellets. The system also requires regular maintenance to remove ash etc.<br><br>The use of biomass calls for a continuous local supply of suitable fuel to be truly sustainable.<br><br>Concerns exist over the level of NOx and particulate emissions from biomass boiler installations, particularly in urban areas. |
| **Ground source heat pump (GSHP)**<br> | | | √ | **Technology Description:** GSHP technologies exploit seasonal temperature differences between ground and air temperatures to provide heating in the winter and cooling in the summer. GSHP systems use some electricity to run the heat pump, but as most of the energy is taken from the ground, they produce less greenhouse gas than conventional heating systems.<br>Ground source heat systems deliver low temperature heat and high temperature cooling, suitable for underfloor heating or chilled beams.<br><br>**Applicability to this Development:** Site restrictions would require the use of vertical boreholes as opposed to horizontal ground loops. GSHP technology would need further |

| Technology | Feasibility | | | Comments |
|---|---|---|---|---|
| | High | Medium | Low | |
| | | | | investigation during detailed design and will depend on a favourable ground Thermal Response Test.<br><br>Additionally capital costs are high and ideally, there should be a good balance between heating and cooling loads to allow for high COPs and reasonable capital payback. While a well-designed GSHP system operating under favourable conditions can achieve good efficiencies, the capital cost difference may still outweigh potential energy savings. As there is no cooling load, this investment is not deemed viable |
| **Air source heat pump (ASHP)**<br><br> | √ | | | **Technology Description:** ASHP technologies exploit seasonal temperature differences between external air and refrigerant temperatures to provide heating in the winter and cooling in the summer. ASHP systems use more electricity to run the heat pump when compared to GSHP, but as most of the energy is taken from the air, they produce less greenhouse gas than conventional heating systems over the heating season.<br><br>Their COP can reduce to below 2.0 when outside air temperatures are ≤0°C and they can require additional energy for a defrost cycle.<br><br>**Applicability to this Development:** Heat pumps are generally safer than the combustible based heating systems and have a relatively low carbon footprint. Heat pumps can deliver heat at low outside temperatures which can be considered suited to the Irish climate. |

| Technology | Feasibility | | | Comments |
|---|---|---|---|---|
| | High | Medium | Low | |
| **Exhaust Air source heat pump (EAHP)**<br> | √ | | | **Technology Description:** The exhaust air heat pump uses otherwise wasted heat in the warm air areas of your home (bathrooms, kitchen, utility..) and transfers that heat to hot water using the same principles as air source and ground source heat pumps. An Exhaust Air Heat Pump (EAHP) extracts heat from the exhaust air and transfers the heat to domestic hot water and/or hydronic heating system (underfloor heating, radiators).This type of heat pump requires a certain air exchange rate to maintain its output power. Since the inside air is approximately 20-22 degrees Celsius all year round, the maximum output power of the heat pump is not varying with the seasons and outdoor temperature<br><br>**Applicability to this Development:** Exhaust Air Heat Pumps are best suited to apartments which will have low fabric heat losses. The latest units with inverter controlled compressor also have a ducted outside air supply which means the unit can draw on outside air when extract rates are low but without the need for an external condenser unit. |
| **Hot Water Heat Pump**<br> | √ | | | **Technology Description:** A hot water heat pump extracts heat from external air to produce hot water efficiently. It can be used in conjunction with electric space heating.<br><br>**Applicability to this Development:** The hot water heat pump is best suited to apartments which will have low fabric heat losses and where there is sufficient load requirement for water heating.<br><br>In addition hot water heat pumps produce a low carbon footprint.<br><br>The hot water heat pump has been deemed suitable for the proposed development due to the nature of the load requirement. |

| Technology | Feasibility | | | Comments |
|---|---|---|---|---|
| | High | Medium | Low | |
| **Combined Heat and Power (CHP)**   | √ | | | **Technology Description:** Combined heat and power (CHP), also known as co-generation, is the simultaneous generation of both useable heat and electrical power from the same source. A CHP unit comprises of an engine (referred to as the prime mover) in which fuel is combusted. The mechanical power produced by the engine is used to generate electricity using an integral electrical generator. The heat emitted from the engine (waste heat) is used to provide space heating and domestic hot water<br><br>**Applicability to this Development:** CHP systems can be used in applications where there is a significant year-round demand for heating in addition to the electricity generated. CHP has been deemed suitable for the proposed development for the provision of space heating and/or DHW demand due to annual hours of operation considering the nature of the development. |

### 3.5.1. Knocknacarra District Centre – Apartment Strategy

The proposed combined strategy will comply with Part L regulations (NZEB) and consist of the following arrangement:

- 100% electric space heating via direct acting electric heaters
- Hot water heat pump per apartment supplying domestic hot water for each apartment
- Mechanical ventilation with heat recovery per apartment
- 2 no. PV panels per apartment

# 4. Passive Design

A focus for this project is to operate the building with low energy consumption. The building will be designed to minimise/avoid the requirements for mechanical ventilation and/or air conditioning. This will be done with the use of passive systems to control the internal environment, where possible.

This will be further developed with the client, architect, structural engineer and cost consultant as the scheme develops. The passive systems will aim to reduce external noise and pollution, reduce heat loss (in winter), reduce solar gains (in summer), and maximum daylight while maintaining comfort conditions.

## 4.1. Natural Ventilation

Natural ventilation will be incorporated wherever possible via either single sided or cross ventilation. Where natural ventilation cannot provide the comfort and air quality needs of the occupants or the space and mechanical ventilation cannot be avoided, these systems will incorporate energy efficient solutions to maximise the efficiency of the systems through the use of heat recovery and the efficient controls. This will be fully assessed during detailed design in accordance with procedures in CIBSE TM59 – 'Design methodology for the assessment of overheating risk in homes'.

For dwellings that incorporate mechanical solutions as in paragraph 4.2 below, it should be noted that these systems will not be sufficient to prevent summertime overheating alone. CIBSE TM59 states that 'homes that are predominantly naturally ventilated, including homes that have mechanical ventilation with heat recovery (MVHR), with good opportunities for natural ventilation in the summer should assess overheating using the adaptive method'. This will involve detailed consideration of openable windows and doors and testing the design for a number of typical worst case apartments using dynamic simulation software.

## 4.2. Balanced Whole House Mechanical Ventilation with Heat Recovery


*Figure 3: Balanced Whole house Mechanical Ventilation with heat recovery*

The proposed system for apartments will use mechanical ventilation with heat recovery (MVHR), which is a whole-house ventilation system that generally supplies fresh air to dry rooms and extracts stale air from wet rooms.

Both air flows are to be ducted and driven by two fans, one on the supply side and one on the extract side. This will provide whole building ventilation as the mechanical extract fan will remove odours and excessive humidity to maintain a good air quality. A key component of the system is that a heat recovery unit is utilised to transfer heat from the warm exhaust air to the fresh air, achieving heat recovery.

The ventilation system should be listed on SAP appendix Q which ensures a suitable method of testing procedure for Irish use.

## 4.3. Passive Solar

Daylight in buildings creates a positive environment by providing connectivity with the outside world and assisting in the wellbeing of the building inhabitants. Daylight also represents an energy source; it reduces the need for artificial lighting, particularly in dwellings where natural light alone is often sufficient throughout the day. The design intent is to maximise the use of natural daylight to enhance visual comfort and not compromise thermal performance. The proposed development will have glazing specified that will minimise thermal conduction (u-value) while allowing for sufficient daylight levels and the maximisation of solar gain. Maximising solar gain within the limitations of thermal comfort will allow for a portion of the space heating load to be met passively during the day.

## 4.4. Water Conservation

During the detailed design stage for the proposed development the consumption of potable water in sanitary applications will be strongly considered and where possible low water use fittings and dual flush WCs less will be specified.

A rainwater harvesting system will also be considered for this project and during the detailed design stage; calculations will be carried out to evaluate the suitability of this type of system. Reclaimed rainwater can be used for a range of applications such as toilet flushing, washing machines and irrigation. There are three main types of rainwater recovery systems: indirectly pumped, directly pumped, and gravity fed. The benefits of rain water harvesting is twofold as not only does it help to reduce the use of treated mains water for non-potable use, it can also help reduce water run –off and risk of flooding.

# 5. DEAP Calculation Summary

DEAP calculations have been carried out using SEAI DEAP 4.1 (beta) software in order to demonstrate compliance with Part L 2018 on a sample of 2-bed apartments. The DEAP calculations are based on the following provisional inputs:

- **SEAI DEAP 4.1 (beta) Inputs – Apartment Fabric U Values**
    - Wall U value = 0.18 $W/m^2K$
    - Semi exposed walls = 0.23 $W/m^2K$ (walls to unheated voids/risers)
    - Floor = 0.18 $W/m^2K$
    - Flat Roof = 0.15 $W/m^2K$
    - Doors = 1.40 $W/m^2K$
    - Glazing/Balcony door = 1.30 $W/m^2K$ (whole window unit inclusive of frame)
    - Glazing gv (EN410) = 0.4-0.6 subject to overheating study
        - Frame Factor = 0.7 (i.e. 30% frame)
- Air permeability = 2 $m^3/m^2/hr$ at 50 Pa

- Thermal bridging = 0.08 W/m².K
- Ventilation = MVHR
- Specific Fan Power = 0.38 W/l/s
- Heat Exchanger Efficiency = 93%
- Lighting = 100% Low energy
- Heating system category: Room heaters
- Sub-category: Electric (direct acting) room heaters:
- Heating system: Panel, convector or radiant heaters
- Heating System Controls: Programmer and room thermostats
- Efficiency of main space heating system = 100
- DHW Supplied by hot water heat pump: All (tested to EN 16147:2011)
    - Heat Pump efficiency = 295%
- Renewables = 2 no. Photovoltaic Panels

## 5.1. SEAI DEAP 4.2(beta) Outputs – Apartments

Table 4 summaries the results of the preliminary DEAP calculations carried out for a representative 2-bed apartment on various levels using the energy strategy detailed in this report. Appendix 1 contains the DEAP output which demonstrates draft Part L 2018 (NZEB) compliance.

**Table 3: DEAP Output Summary - Apartment (Draft Part L 2018)**

| Apartment | | Energy Rating | EPC | CPC | RER |
|---|---|---|---|---|---|
| Example Apartment - Block A | 2-Bed apartment | A2 | 0.237 | 0.229 | 0.390 |

## 5.2. Conclusion

### 5.2.1. Draft Part L 2018 - Apartment compliance:

This report confirms that the proposed Knocknacarra District Centre apartments will comply with Part L regulations (NZEB). The report highlights that Part L will be achieved if applied as the report suggests. The strategies adopted for the Knocknacarra District Centre apartments are outlined here:

- U-values for floor and roof will exceed the building regulation backstops
- Using Glazing U-Value target outlined in this report
- Better performance air permeability than the backstop, adding to building air tightness and ventilation effectiveness
- Balanced whole house mechanical ventilation with heat recovery
- High performance thermal bridging
- Heat Pump supplying Domestic Hot Water and direct acting electric heaters supplying space heating
- Renewable Sources – 2no. PV Panels on rooftop

# Appendix 1: DEAP Part L Compliance Report

## DEAP Report

DEAP Workbook: Aligned to DEAP software version 3.2 (plus draft changes for NZEB part L)
Inputs and results, with selected intermediate results shown in *italics*
Details not applicable for this dwelling are grayed out.
Print out 'Proj' worksheet separately if required.

**Dwelling dimensions** **TGD L version** 2018

| | Area [m$^2$] | Height [m] |
|---|---|---|
| Ground floor | 78 | 2.7 |
| First floor | 0 | 0.0 |
| Second floor | 0 | 0.0 |
| Third and other floors | 0 | 0.0 |
| *Total floor area [m$^2$]* | 78 | |
| *Dwelling volume [m$^3$]* | 210 | |
| Living area [m$^2$] | 33.7 | |

**Ventilation**

| | | |
|---|---|---|
| Number of chimneys | 0 | |
| Number of open flues | 0 | |
| Number of intermittent fans and passive vents | 1 | |
| Number of flueless gas fires | 0 | |
| Is there a draught lobby on main entrance? | Yes | |
| Number of storeys in the dwelling | 1 | |
| Has an air permeability test been carried out? | Yes | 1 |
| *If no* Not applicable | | |
| *If yes* : | | |
| Air permeability [m3/h.m2 at 50 Pa] | | 0.1 |
| *End if* | | |
| Number of sides sheltered | 2 | |
| Ventilation method | Balanced whole-house mechanical ventilation with heat recovery | 6 |
| *Effective air change rate [ac/h]* | 0.16 | |
| *Ventilation heat loss [W/K]* | 11 | |
| Permeability test carried out and meets guidelines in TGD L? | | |
| For mechanical ventilation, other than positive input ventilation from loft: | : | |
| Is measured "Appendix Q" data available? | Yes | |
| Manufacturer and model | Vent Axia Sentinel Kinetic Advance | |
| Specific fan power [W/(l/s)] | 0.38 | |
| Heat exchanger efficiency [%] | 93 | |

**Windows**

| Orientation | East/West | East/West | East/West | SE/SW | South | North | North | North | Horizontal |
|---|---|---|---|---|---|---|---|---|---|
| Orientation ID | 3 | 3 | 3 | 4 | 5 | 1 | 1 | 1 | 6 |
| Area [m$^2$] | 14.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| U-value [W/m$^2$ K] | 1.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Is U-value a manufacturer's certified value? | Yes | - | - | - | - | - | - | - | - |
| *If yes:* | | | | | | | | | |
| Manufacturer and model | - | - | - | - | - | - | - | - | - |
| Solar energy transmittance | 0.4 | 0.4 | 0.4 | - | - | - | - | - | - |
| *End if* | | | | | | | | | |
| Correction for roof window and/or metal frame if applicable (Table 6a, notes 1 and 2). | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Overshading ID | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frame factor (Table 6c) [-] | 0.70 | 0.70 | 0.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Window type ID | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |

**Fabric**

| Exposed element type | Area [m$^2$] | U-value [W/m$^2$ K] | *AU [W/K]* | Comment (optional) | Element type (for assessing TGD L conformity) |
|---|---|---|---|---|---|
| *Windows/rooflights* | 14.5 | 1.24 | 18.0 | - | |
| Doors | 0.0 | 0.00 | 0.0 | - | |
| Floor | 0.0 | 0.00 | 0.0 | - | No underfloor heating |
| Floor (type 2) | 0.0 | 0.00 | 0.0 | - | - |
| Floor (type 3) | 0.0 | 0.00 | 0.0 | - | - |
| Walls | 40.3 | 0.18 | 7.2 | Wall Type 1 | Wall relevant for TGD L fabric compliance check |
| Walls (type 2) | 9.7 | 0.23 | 2.2 | Wall to Riser | Wall not relevant for TGD L fabric compliance check |
| Walls (type 3) | 0.0 | 0.00 | 0.0 | - | Wall relevant for TGD L fabric compliance check |
| Walls (type 4) | 0.0 | 0.00 | 0.0 | - | Wall relevant for TGD L fabric compliance check |
| Walls (type 5) | 0.0 | 0.00 | 0.0 | - | Wall relevant for TGD L fabric compliance check |
| Roof | 77.7 | 0.15 | 11.6 | Flat Roof | Flat roof |
| Roof (type 2) | 0.0 | 0.00 | 0.0 | - | - |
| Roof (type 3) | 0.0 | 0.00 | 0.0 | - | - |
| Roof (type 4) | 0.0 | 0.00 | 0.0 | - | - |
| Roof (type 5) | 0.0 | 0.00 | 0.0 | - | - |
| *Total area of elements [m$^2$]* | 142.18 | | | | |
| *Heat loss via plane elements [W/K]* | | | 39 | | |
| Factor for thermal bridging [W/m$^2$ K] | | | 0.08 | | |
| *Fabric heat loss [W/K]* | | | 50 | | |
| *Dwelling heat loss coefficient [W/K]* | | | 62 | | |
| *Heat loss parameter, HLP [W/K m$^2$]* | | | 0.79 | | |

| | | | | |
|---|---|---|---|---|
| **Water heating** | | | | |
| Are there distribution losses? | Yes | | | |
| Distribution loss [kWh/y] | 250 | | | |
| Are there storage losses? | Yes | 1 | | |
| If yes : | | | | |
| Water storage volume [litres] | 200 | | | |
| Is manufacturer's declared loss factor available? | Yes | 1 | | |
| If yes : | | | | |
| Manufacturer and model name | Dimplex Edel 200 Air | | | |
| Manufacturer's declared loss factor [kWh/day] | 1.85 | | | |
| If no | Not applicable | | | |
| End if | | | | |
| Temperature factor unadjusted (Table 2) | 0.6 | | | |
| Temperature factor multiplier (from Table 2 notes) | 0.9 | | | |
| End if | | | | |
| Is there a solar water heating system? | No | 0 | | |
| If yes | Not applicable | | | |
| Solar fraction [%] | 0 | | | |
| End if | | | | |
| Primary circuit loss [kWh/y] (Table 3) | 0 | | | |
| Additional loss for combi boiler [kWh/y] (Table 3a) | 0 | | | |
| Electricity consumption of electric keep-hot facility of combi boiler [kWh/y] (Table 4f) | 0 | | | |
| Is supplementary electric immersion heating is used in summer? | No | | | |
| *Output from main water heater [kWh/y]* | 2031 | | | |
| *Output from supplementary heater [kWh/y]* | 0 | | | |
| *Heat gains from water heating system [W]* | 93 | | | |
| Is hot water storage indoors or in group heating scheme? | Yes | | | |
| **Lighting** | | | | |
| Proportion of fixed lighting outlets that are low-energy [-] | #REF! | | | |
| *Annual energy used for lighting, EL [kWh/y]* | 202 | | | |
| **Internal gains** | | | | |
| *Net internal gains [W]* | 381 | | | |
| **Heat use** | | | | |
| Living area fraction [-] | 0.434127 | | | |
| Thermal mass category of dwelling | Medium | | | |
| *Heat use [kWh/y]* | 1340 | | | |
| **Space heating** | | | | |
| ***Control and responsiveness*** | | | | |
| Temperature adjustment (Table 4e), where appropriate [C] | 0 | | | |
| Heating system control category (Table 4e) | 3 | | | |
| Heating system responsiveness category (Table 4a or 4d) | 1 | | | |
| ***Pumps/fans*** | | Enter number present | If present, is boiler controlled by room thermostat? | If present, inside dwelling? |
| Central heating pump (supplying hot water to radiators or underfloor system) | | 0 | No | |
| Oil boiler - pump (supplying oil to boiler and flue fan) | | 0 | - | - |
| Gas boiler - flue fan (if fan assisted flue) | | 0 | | |
| Is there a warm air heating system present? | No | | | |
| ***Emission efficiency*** | | | | |
| Is main heat emission system within an envelope element? (e.g. underfloor heating in ground floor) | | | No | 0 |
| If yes, U-value of envelope element [W/m$^2$ K] | | | 0.15 | |
| Type of main heating system | Individual system | 1 | | |

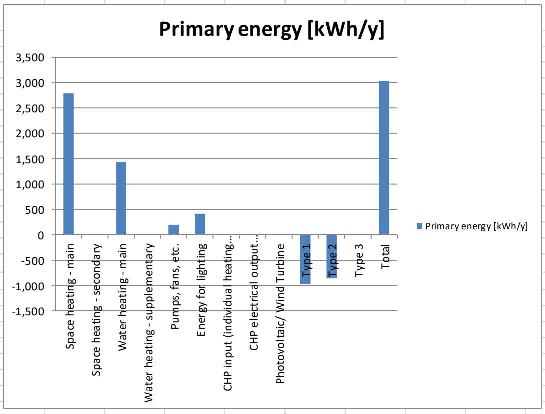
**Energy requirements - individual heating systems** :

| | | | | | |
|---|---|---|---|---|---|
| ***Space Heating*** | | | | | |
| Efficiency of main heating system [%] (from HARP or from Table 4a or 4b) | | | | 100 | |
| Efficiency adjustment factor from Table 4c [-] | | | | 1 | |
| Fraction of heat from secondary / supplementary system (from Table 7, Table 10 or Appendix F) | | | | 0 | |
| Efficiency of secondary / supplementary heater(s) [%] (from Table 4a or Appendix E) | | | | 0 | |
| ***Water heating*** | | | | | |
| Efficiency of main water heater [%] (from HARP or from Table 4a or 4b) | | | | 295 | |
| Efficiency adjustment from Table 4c [-] | | | | 1 | |
| ***Fuel data*** | Fuel | | | | |
| Space heating - main | electricity | | | | |
| Space heating - secondary | - | | | | |
| Water heating - main | electricity | | | | |
| Water heating - supplementary | - | | | | |
| Renewable and energy-saving technologies | | Primary energy factor [-] | CO2 factor [kg/kWh] | | Delivered energy [kWh/y] |
| Type 1 Description | 2 x 300W Solar Panels, Horizontal | | | | |
| Energy produced or saved | | 2.08 | 0.409 | | 462 |
| Energy consumed | | 0.00 | 0.000 | | 0 |
| Type 2 Description | Dimplex Edel cylinder | | | | |
| Energy produced or saved | | 2.08 | 0.409 | | 409 |
| Energy consumed | | 0.00 | 0.000 | | 0 |
| Type 3 Description | - | | | | |
| Energy produced or saved | | 0.00 | 0.000 | | 0 |
| Energy consumed | | 0.00 | 0.000 | | 0 |

| Results | | | | | |
|---|---|---|---|---|---|
| | | | Delivered energy | Primary energy | $CO_2$ emissions |
| | | | [kWh/y] | [kWh/y] | [kg/y] |
| Space heating - main | | | 1,340 | 2,788 | 548 |
| Space heating - secondary | | | 0 | 0 | 0 |
| Water heating - main | | | 688 | 1,432 | 282 |
| Water heating - supplementary | | | 0 | 0 | 0 |
| Pumps, fans | | | 97 | 202 | 40 |
| Energy for lighting | | | 202 | 420 | 83 |
| Renewable and energy-saving technologies | | | | | |
| Type 1 | 2 x 300W Solar Panels, Horizont | | -462 | -961 | -189 |
| Type 2 | Dimplex Edel cylinder | | -409 | -852 | -167 |
| Type 3 | - | | 0 | 0 | 0 |
| Total | | | 1,456 | 3,029 | 596 |
| per $m^2$ floor area | | | 18.8 | 39.0 | 7.7 |
| | | | | | |
| Building Energy Rating [kWh/$m^2$ y] | | | | 39 | A2 |

| | | | | |
|---|---|---|---|---|
| ***Check conformity with MPEPC and MPCPC requirements in TGD L*** | | | | ***2018*** |
| | | Max permitted | | |
| EPC | 0.237 | 0.30 | Complies | |
| CPC | 0.229 | 0.35 | Complies | |

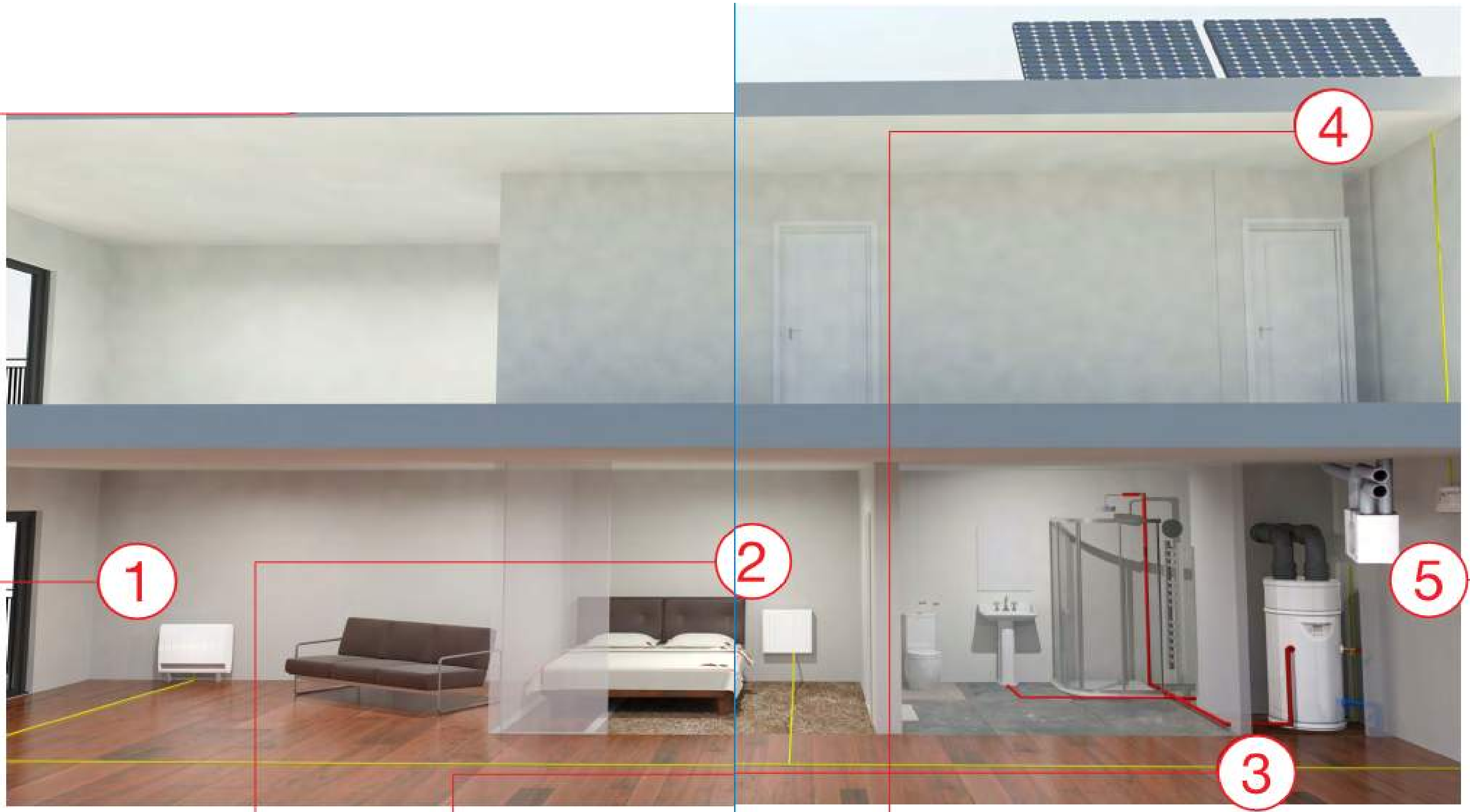
| Results | | | | |
|---|---|---|---|---|
| | | Delivered energy | Primary energy | $CO_2$ emissions |
| | | [kWh/y] | [kWh/y] | [kg/y] |
| Space heating - main | | 1,340 | 2,788 | 548 |
| Space heating - secondary | | 0 | 0 | 0 |
| Water heating - main | | 688 | 1,432 | 282 |
| Water heating - supplementary | | 0 | 0 | 0 |
| Pumps, fans, etc. | | 97 | 202 | 40 |
| Energy for lighting | | 202 | 420 | 83 |
| CHP input (individual heating systems only) | | 0 | 0 | 0 |
| CHP electrical output (individual heating sys | | 0 | 0 | 0 |
| Photovoltaic/ Wind Turbine | | 0 | 0 | 0 |
| Type 1 | 2 x 300W Solar Panels, Horizont | -462 | -961 | -189 |
| Type 2 | Dimplex Edel cylinder | -409 | -852 | -167 |
| Type 3 | - | 0 | 0 | 0 |
| Total | | 1,456 | 3,029 | 596 |
| per $m^2$ floor area | | 18.8 | 39.01 | 7.67 |
| | | | [kWh/$m^2$ y] | |
| Building Energy Rating | | | 39 | A2 |




**Check conformity with MPEPC, MPCPC and RER requirements in TGD L**
Relevant for new-build.

| | Primary energy | CO2 emissions | Renewable |
|---|---|---|---|
| | [kWh/y] | [kg/y] | Energy Ratio |
| Totals for reference dwelling | 12,798 | 2,603 | |
| | EPC | CPC | RER |
| Performance coefficients | 0.237 | 0.229 | 0.39 |
| Maximum permitted | 0.300 | 0.350 | 0.20 |
| | Complies | Complies | Complies |

# Appendix C – Dimplex Domestic Hot Water Heat Pump Overview




1 Dimplex Quantum is the world's most advanced electric space heater. It uses low-cost, off-peak energy, making it the most economical electric heating system on the market today. It adapts to match lifestyle and climate conditions, delivering heat only when it's needed.

2 Dimplex Q-Rad is a smart electric heater. It knows precisely how long it takes to get to the desired temperature and when to turn off as it approaches that target temperature. This minimises the energy that it uses, while maximising comfort – keeping you warm for the lowest possible cost.

3 The Dimplex Edel hot water heat pump uses an integrated high-performance compressor to extract energy for hot water production from the external air using insulated duct work. Using up to three times less electricity than direct acting water heaters, it produces renewable energy to aid building regulation compliance.

4 The Dimplex PV system uses high performance PV panels. This electricity is directly supplied back to each apartment. This means the apartment owner gets all the benefit from the creation of renewable electricity to power the heating and hot water, further reducing the energy bills.

5 The Xpelair Heat recovery ventilation system is key to a healthy home. It is designed to combat condensation, mould and pollutants to ensure the air you're breathing is clean, fresh and healthy, while recovering up to 90% of the heat from the stale air leaving the building. This ensures a continuous fresh air supply while maintaining the maximum efficiency for the building and its occupants.

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