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Galway County Council

Residential Development, Baile an Chlair, Claregalway, Co. Galway

Civil Works Design Report

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Civil Works Design Report

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1 INTRODUCTION

TOBIN Consulting Engineers were appointed to provide engineering consultancy services for the proposed residential development at Baile an Chlair, Claregalway Co. Galway. (Figure 1 – Site Location & Figure 2 - Proposed Development Layout).

This report has been prepared to detail the Civil Works Planning submission element associated with the proposed residential development. It should be read in conjunction with the foul and storm design, watermain and roads drawings as outlined and noted herein.

The proposed development will consist of the construction of:

1. 88 residential units comprising:
    - 2 no. 4 bedroom two storey houses
    - 19 no. 3 bedroom two storey houses
    - 18 no. 2 bedroom two storey houses
    - 15 no. 3 bedroom apartments
    - 21 no. 2 bedroom apartments
    - 13 no. 1 bedroom apartments

2 Creche (21 children)
3 Two estate entrances, one from R381 (to Oranmore) and one from the L7110.
4 Children's playground to Lakeview Road
5 Landscaped amenity public open space
6 IW pumping station
7 ESB substation
8 All necessary site development works

Figure 1- Site Location

Figure 2- Proposed Development Layout

2 WASTEWATER DRAINAGE SYSTEM OVERVIEW

The proposed wastewater drainage system for the development will consist of a combination of gravity and pumped discharge to a local gravity foul sewer. All gravity sewers shall be laid under roads and open spaces.

Due to site topography, a pumping station is required to service part of the development. The pumping station is to be located at the lowest point of the developable area in the northern section of the site, where it will pump wastewater via a ø 110mm HDPE Rising Main to a newly constructed discharge manhole and then via gravity will be discharge in the proposed ø150mm foul sewer line (that will receive the foul generated by the 34 no. of residential units) until be discharge via gravity sewer to the existing manhole with a ø300mm foul sewer line which runs parallel to the R381 across the proposed development entrance.

It is proposed that the onsite pumping station will provide 24-hours storage for approximately 54 no. of residential units + 01 creche and will comply with the requirements of the IW Code of Practice for Wastewater Infrastructure.

The foul sewer network was designed using Innovyze MicroDrainage modelling software. Outputs from the foul sewer design can be found in **Appendix A** of this document. The proposed foul sewer network is presented graphically on Drawing No. 11171-2002. The foul sewer network was designed to cater for the 90 units associated with the proposed development.

It is proposed that all pipes will be thermoplastic structured wall pipes. The maximum pipe diameter is to be 225mm, with a maximum and minimum gradient of 1/60 and 1/200. All proposed gradients lie within the requirements as set out in the table in section 3.6 –

Hydraulic design of Gravity Sewers of the Irish Water Wastewater Infrastructure Code of Practice.

Table: Sewer Size/Gradient for Multiple Properties

Number of Dwellings	Pipe Diameter	Minimum Gradient
2 to 9	150mm (or 225mm)	1:60
10 to 20		1:150
21 to 210	225mm	1:200
211 to 250		1:150
251 to 330		1:100
331 – 450	300mm	1:300
451 to 565		1:200
566 to 655		1:150
656 to 830		1:100

Figure 3- Sewer Gradient - Irish Water Code of Practice

3 STORMWATER DRAINAGE SYSTEM OVERVIEW

The proposed storm water drainage system has been designed to cater for all surface water runoff from all hard surfaces within the proposed development including roadways, roofs, parking areas etc. The storm water drainage services have been designed to take account of the requirements of the Department of Environment "Recommendation for Site Development Works for Housing Areas" 1998 and "Sewers for Adoption" published by WRC, UK.

The proposed storm water drainage generated will flow by gravity and discharge via an Oil/Petrol Interceptors to 2 no. soakaway units strategically located throughout the development. The soakaways units shall be of cellular nature (95% void ratio) at locations as shown on Drawing No. 11171-2002.

All soakaways are designed to accommodate a 1 in 100-year storm event + 20% for Climate Change throughout the site.

The maximum pipe diameter is to be 375mm, with a maximum and minimum gradient of 1/40 and 1/200. All velocities at said gradients fall within the limits of 0.75 and 3m/sec as set out in "Recommendations for Site Development Works" as published by the Department of Environment.

4 WATERMAIN OVERVIEW

It is proposed to connect a ø100mm watermain to an existing ø150mm Irish Water Watermain, that is located running along the existing road R381, approximately 10m west of the proposed site entrance.

The proposed ø100mm watermain will be used as a spine which will service the development. All watermain designs will be fully vetted by Irish Water prior to receiving an offer to connect. Details of the watermain arrangement for the proposed development is presented in this report and in Drawing No. 11171-2001.

A pre-connection enquiry has been submitted to Irish Water and the subsequent Confirmation of Feasibility has been granted (CDS22000604) and is attached in **Appendix D** of this report.

5 ROADS OVERVIEW

Vehicular access to the proposed development will be via an existing entrance on the R381 and Lakeview Road, on the west and south of the site, respectively. The main access roads within the site are proposed to be 6.0m and the maximum speed within the development is to be 30km/hr. A network of 2.0m wide footpaths is proposed inside the development as shown on Drawing No. 11171-2003.

All internal roads have been designed in accordance with the requirements of Design Manual for Urban Roads and Streets and the Recommendations for Site Development Works for Housing Areas.

6 WASTEWATER DRAINAGE DESIGN

It is proposed that the sewer generated by 54 no. of residential units and 1 No. creche on east of the development will discharge via gravity to a pumping station located in the northern area on the residential section of the site. From here foul flow will be pumped via ø 110mm HDPE Rising Main to a newly constructed discharge manhole and then via gravity will be discharge in the proposed ø 150mm diameter foul sewer line which will run in the west of the development until be discharge via gravity sewer to the existing manhole with a ø300mm foul sewer line located parallel to the R381 across the proposed development entrance.

The pipework for the wastewater drainage system has been designed to provide six times the dry weather flow in accordance with the Irish Water Code of practice and standard details- **Appendix B** – Gravity Sewer Design Requirements, section 2.2.5 Domestic Wastewater Peaking Factors.

The proposed foul sewer network was designed using Innovyze MicroDrainage modelling software. The design outputs from MicroDrainage can be found in **Appendix A** of this report and the proposed foul sewer network is presented on Drawings No. 11171-2002.

6.1 Loading rates

An average rate of 2.7 P.E. per dwelling has been taken for the development to account for the varying unit occupancies. The sewer network has been designed to cater for 6 times the dry weather flow rate. The occupancy per dwelling figures have been obtained from the Irish Water Codes of Practice as per Wastewater Code of Practice, Appendix B – Gravity Sewer Design Requirements, section 2.2.1 Housing Density & Occupancy.

A flow of 150 litres per head per day plus an additional 10% allowance to account for infiltration within a new development have been considered in the foul sewer design as per Irish Water Code of Practice for Wastewater Infrastructure - Section 3.6 Hydraulic Design for Gravity Sewers.

6.2 Pumping Station

The pumping station will be designed in accordance with the requirements set out in the Irish Water specification for wastewater systems IW-CDS-5030-03. The pumping station will be 13m from the boundary of the nearest dwelling.

The pumping station will be designed to cater for 24-hr storage for 54 no. of residential units and 1 No. creche in the proposed site in accordance with Irish Water requirements.

The pumping station layout is illustrated on Drawings No. 11171-2002 and 11171-2013 includes a 4.0m front space, (in accordance with Irish Water Standard Detail STD-WW-26), to allow for an occasional tanker or service vehicles to be parked outside the pumping station. It is estimated that tanker movements to the site would be minimal and subject to the operational efficiencies of the pumping station. However, it would be anticipated that no more than 2 to 4 tanker visits would be required per annum.

Therefore:
1. 54 residential units of the proposed site
2. Creche (21 no. children)

Design:
1. 54 x 150 x 2.7 = 21,870 litres/day
2. 'Non-residential with canteen cooking on site' IW CoP Appendix C – 90 x 25(assume 21 children and 4 adults) 90 x 25 = 2,250 litres/day

Total = 21,870 + 2,250 = 24,120 litres or 24.120 m^3.

Therefore 24-hour storage required within pumping station of min. capacity of 24.120 m^3.

Provide 4.0m long x 3.5m wide x 2.0m deep storage volume (below incoming invert) = 28.00 m^3.

28.00>24.120 – OK

Therefore, tank volume provided = 28.00 m^3 for 24-hour storage

6.3 Wastewater Design

The foul sewer drainage services have been designed to take account of the requirements of the Civil Engineering Specification for the Water Industry (CESWI), subject to the requirements applied to it by Irish Water, as outlined in the Irish Water Code of Practice for Wastewater Infrastructure. Other design guidelines adhered to include the Department of Environment "Recommendations for Site Development Works for Housing Areas", 1998, and "Sewers for Adoption" published by WRC, UK.

The pipework for the drainage system has been designed to provide for six times the dry weather flow in accordance with the Recommendations for Site Development Works as published by the Department of the Environment and Local Government and to Irish Water

Code of Practice and Standard Details. The proposed foul sewer networks have been designed using Innovyze MicroDrainage 2018.1.1 modelling software. The results and outputs from the modelling can be found in **Appendix A**.

It is proposed that all pipes will be thermoplastic structured wall pipes. The maximum pipe diameter is to be 225mm, with a maximum and minimum gradient of 1/60 and 1/200.

All sewers have been designed so that the velocities achieved fall within the limits of 0.75 and 3m/sec as set out in Irish Water Code of Practice for Wastewater Infrastructure and "Recommendations for Site Development Works" as published by the Department of Environment.

A pre-connection enquiry (CDS22000604) has been submitted to Irish Water based on the envisaged wastewater discharge volumes from the development. Irish Water have reviewed this pre- connection enquiry and have advised that the proposed loading can be facilitated, and a Confirmation of Feasibility was received. A statement of design acceptance was also received from Irish Water.

Please refer to **Appendix D** for details of the Confirmation of Feasibility letter and Statement of Design acceptance.

7 STORM WATER DRAINAGE DESIGN

7.1 Existing Storm Drainage

There is currently no existing storm drainage in the vicinity of the site which will be suitable for serving the proposed development. As a result, all surface water run-off from the site will need to be discharged to ground water.

7.2 Proposed Storm Drainage

The storm water drainage design has been designed to cater for all surface water runoff from all hard surfaces in the proposed development including roadways, roofs etc. The proposed residential development has been divided into 2 no. catchment areas that will be discharge to soakaways and percolate to the ground. Each soakaway has been strategically located to optimally cater for the associated catchment area.

The storm water drainage network was designed using Innovyze MicroDrainage Design software and the following parameters formed the basis of the design:

- The surface water run-off is calculated using the Modified Rational Method (Wallingford Procedure),

$Q = 2.78 \times Cv \times Cr \times I \times A$

Where,

Q = rate of run-off, l/s

Cv = Volumetric run-off coefficient

Cr = Routing coefficient

I = Intensity of rainfall, mm/hr

A = Impermeable Area, ha

- A design return period of 1 year has been adopted for the sewer network in accordance with good design practice.
- The rainfall intensity is based on rainfall data for County Galway
- Minimum self-cleansing velocity of 0.75m/s
- An allowable discharge of 2l/s/ha for the site
- M5-60 = 15.7
- Ratio R = 0.27

A dedicated storm water drainage system will be provided for the development and will pick up surface water run-off from impermeable surfaces such as roadways, footways, and roofs. Precast concrete gullies including lockable cast iron grating and frame connected to a piped system will be provided to collect run-off from these areas. The proposed pipe diameter will range between 225mm and 375mm and will be laid at gradients varying between 1/40 and 1/200.

All velocities within said gradients fall within the limits of 0.8 and 3m/sec as set out in 'Recommendations for Site Development Works' as published by the Department for the Environment.

As noted above, the storm drainage for the entire development has been designed using the Innovyze MicroDrainage Design Software in accordance with the Recommendations for Site Development Works for Housing Areas and also the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS). It is noted that this software considers both a 10% and 20% increase in flows to account for climate change. The details of the Micro Drainage Outputs and associated long sections for each network are outlined at Appendix B of this report.

The proposed storm sewer network is presented graphically on Drawing No. 11171-2002.

7.3 Sustainable Urban Drainage Systems

The existing site is primarily a greenfield site with no existing drainage or SuDS measures in place. To maintain surface water runoff from the site to those of the current state, the surface water drainage for the proposed development will be designed in accordance with the principles of Sustainable Urban Drainage Systems (SuDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS). The GDSDS addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimise the impact of urbanisation by replicating the runoff characteristics of the greenfield site.

The requirements of SuDS are typically addressed by provision of the following:

- Interception storage
- Treatment storage (not required if interception storage is provided)
- Attenuation storage
- Long term storage (if this is not required growth rates should not be applied to QBar)

In the case of the subject site interception storage can be achieved by implementing infiltration storage tank. Growth factors will be applied to the allowable discharge for the 100-year event. This means that both treatment storage and long-term storage, neither of which would be practical on this site, are not required. All SuDS measures will be designed in accordance with the recommendation set out in the EPA's document entitled "Guidance on Authorisation of Discharges to Groundwater 2011"

7.4 Petrol Interceptor

It is proposed to install a Bypass Petrol Interceptor upstream of the connection into each of the proposed soakaways. Locations of the interceptors can be seen graphically on Drawing No. 11171-2002. Storm water entering each soakaway will include run-off from the roadways and parking areas throughout the site and therefore may have hydrocarbons within their flow. These hydrocarbon pollutants require removal and are not to be discharged back into the environment. The separator has been sized to cater for roads, footways, and driveway areas of each catchment area.

The selection tables in the Separator Product Brochure can be found in **Appendix C**.

7.5 Soakaways (BRE 365)

Storm water from roof run-off and impermeable areas will discharge to 2No. soakaways on the site. The stormwater discharges to groundwater and will be off cellular storage for 95% porosity. The soakaways are designed to hold water for the largest storage required over a 48-hour storm period with rainfall depths taken for the 100-year return period + 20% for climate change for sliding durations obtained from Met Eireann. The soakaway locations are shown graphically on Drawing No. 11171-2002.

Infiltration tests were carried out in accordance with BRE Digest 365:2016 to establish the achievable infiltration rates on site and these rates were used in drainage calculations to determine suitable soakaway volumes and invert levels. The infiltration rate calculated from the test is as follow.

Infiltration Test – f = 0.108 m/hr

The locations of the soakaways, along with the volumes and invert levels of each is shown on Drawing No. 11171-2002 and a Typical Soakaway detail is shown on Drawing No. 11171-2012.

Results of the calculations and long sections can be found in **Appendix B**.

Soakaway Network A – 504m3

Soakaway Network B – 540m3

8 WATERMAIN DESIGN

The water supply services have been designed to take account of the requirements of the Civil Engineering Specification for the Water Industry (CESWI), subject to the requirements applied to it by Irish Water, as outlined in the Irish Water Code of Practice for Water Infrastructure. Other design guidelines adhered to include the Department of Environment "Recommendations for Site Development Works for Housing Areas", 1998.

The water supply required for the proposed development shall be via a ø 100mm watermain as per Irish Water requirements. It is proposed to connect to the existing ø 150mm diameter uPVC watermain located in the R381, west of the residential element of the development, as can be seen on Drawing No. 11171-2001. The ø 100mm watermain will be brought to the proposed site entrance, and into the development as a 'spine' watermain to service the cluster of houses/apartments within the development.

In accordance with Local authority standards, a water meter, and Logging Device (Larson Type) are proposed at the connection into the proposed residential development. A sluice valve, strainer and ø 100mm by-pass arrangement is also proposed to allow for possible disconnection of water meters by the Local Authority/Irish Water.

Refer to Drawing No. 11171-2102 which outlines the details of the existing and proposed water supply network.

9 FIRE FIGHTING FLOWS

In order to meet required fire flow requirements, it is proposed to install a below ground static storage capacity within the site, Figure 3. This is being provided as, on general, Irish Water will not guarantee available fire flow within the hydrants located on site. It is proposed to provide an underground storage tank capable of supplying 20 l/s of flow for a 1-hour period. This equates to a minimum volume required for the site of 72,000 litres.

The flow rate of 20 l/s is derived from the 'National Guidance Document on the provisions of water for Firefighting – Water UK 3rd Edition'. The tank is located within the grassed area and easily accessible by fire tenders and tankers should they need access. An 80mm diameter top-up supply for tank will be provided from the main watermain which will include a shut-off valve should the supply need to be switched off for maintenance or in an emergency. The location of the tank is shown graphically on Drawing No. 11171-2001.

It is noted that in addition to the static storage tank, a significant volume of water will still be available from hydrants located throughout the development. Any specific requirements as requested by the local fire authority when applying for the Fire Certification will be incorporated at the detail design stage. It is also noted that should the hydrants supply the sufficient amount of water of 20l/s or over for a 1-hour period the tank may be omitted from the development at the discretion of the local fire authority.

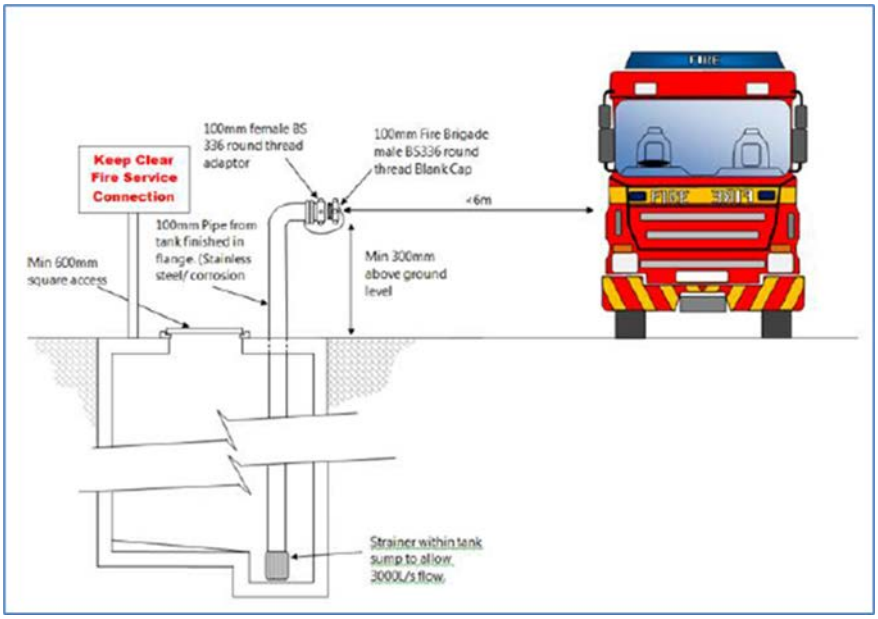

Figure 4- Typical Detail of a ground static storage tank

10 ROAD DESIGN

All internal roads have been designed in accordance with the requirements of Design Manual for Urban Roads and Streets and the Recommendations for Site Development Works for Housing Areas. The proposed internal roads servicing the residential clusters are 6.0m wide.

Auto track vehicle swept path analysis has been completed for the proposed site layout for Large Car, Refuse Vehicle and Pumping Appliance, Drawing No. 11171-2004,2005 and 2006, respectively, to ensure the vehicles can safely manoeuvre around the site.

Road levels for the site have been designed taking cognisance of the existing topography and ground conditions. All roads shall be constructed on a suitable bearing with a road construction makeup as per detail shown on drawing 11171-2003. All roads will include a 1:40 camber from the centre of the road and longitudinal gradients of road sections lie between 1:21 and 1:200 to ensure adequate surface water drainage is achieved.

Gullies are located, at a minimum, every 200m^2 with local low points allowing for double gullies as per Recommendations for Site Development Works for Housing Areas to ensure surface water drainage will not be blocked.

The use of raised junction and pedestrian crossing points along with strategically positioned drop kerbs and tactile paving will allow for full linkage for visually impaired and less-able pedestrians while also prioritising pedestrian movements over vehicular movements.

A visibility splay of 65m sightlines were achieved at the proposed entrances of the site as per Design Manual for Urban Roads and Streets section 4.4.5. The 65m sightlines are required from the design speed of the R381 and Lakeview Road – 60km/h. This is for the Stopping Site Distances of forward visibility on bus routes, section 4.4.4 of the Design Manual for Urban Roads.

As part of this application, a Traffic and Transport Assessment has been prepared. Refer to these separate documents for further details.

APPENDIX A

Foul Sewer Design and Calculation

APPENDIX B

Storm Sewer Design and Calculation

APPENDIX C

Bypass Petrol Interceptor

APPENDIX D

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