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Project: Proposed Development at Páirc Chatháin, Drishane Road, Millstreet, Co. Cork

Project No: 23029

Document Title: Civil Engineering Report

Document No: 23029-XX-XX-XX-XX-RP-WDG-CE-001

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Walsh Design Group is a registered trading name of Browne Asset Solutions Ltd.
Reg. No: 476845
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Directors: Michael Walsh, Jamie Wallace, Patrick Beckett

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Contents

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1.0 Introduction

Walsh design group (WDG) were appointed by Cork County Council to produce a Civil Engineering Report as part of a planning application for the proposed residential development at Páirc Chatháin, Drishane Road, Millstreet, Co. Cork.

The proposed development on the site would consist of 26 dwelling units including 4 No. 1 Bed Apartments, 16 No. 2 Bed 2 Storey Townhouses and 2 No. 3 Bed, 2 Storey Semi Detached Houses. A new vehicular access to the site is proposed through the Old Court Estate. The proposed development also provides for all landscaping and boundary treatments, public lighting and all site development works.

This report is particularly concerned with the following engineering services:

- Flood Risk Assessment,
- Road design,
- Wastewater Drainage,
- Surface Water Drainage & Drainage Impact Assessment,
- Water Supply.

This report should be read in conjunction with the following accompanying drawings submitted with the planning application:

- 23029-XX-XX-XX-XX-DR-WDG-CE-001 Site Layout – Roads & Levels,
- 23029-XX-XX-XX-XX-DR-WDG-CE-002 Site Layout - Drainage,
- 23029-XX-XX-XX-XX-DR-WDG-CE-003 Site Layout – Water Supply,
- 23029-XX-XX-XX-XX-DR-WDG-CE-004 Site Layout – Proposed SuDS Features,
- 23029-XX-XX-XX-XX-DR-WDG-CE-500 Surface Water Drainage Typical Details,
- 23029-XX-XX-XX-XX-DR-WDG-CE-501 Irish Water Standard Details – Wastewater,
- 23029-XX-XX-XX-XX-DR-WDG-CE-502 Irish Water Standard Details – Water Supply (Sheet 1 of 2),
- 23029-XX-XX-XX-XX-DR-WDG-CE-503 Irish Water Standard Details – Water Supply (Sheet 2 of 2),
- 23029-XX-XX-XX-XX-DR-WDG-CE-504 Construction Details.

1.1. Site Description

This site is located to the southeast of Millstreet Town Centre to the rear of Old Court Estate, Drishane Road, Millstreet, Co. Cork, see Figure 1 for the site location. The site area within the application redline boundary is 1.096ha. The ITM grid coordinates at the approximate centre of the site are E527708, N589913.

Figure 1: Google Earth Satellite Photo of Millstreet

Figure 2: Google Earth Satellite Photo of the proposed development site.

The land is mostly grass covered at this time as is evident from the satellite photo of the site shown in Figure 2. The ground slopes upwards from the access point off Old Court Estate near the middle of the site, it then slopes down again towards the north end of the site. The lowest

point on the site is 142.8m on the western boundary of the site near the entrance from the Old Court Estate. This rises to a high point of 147.9m along the eastern boundary of the site.

The western boundary of the site is formed by the boundary wall of the adjoining Old Court Estate. The northern boundary is formed by the rear garden wall of houses in Murphy's Terrace Estate. The eastern and southern boundaries are defined by existing ditches separating the site from agricultural land.

1.2. Proposed Development

The proposed development would consist of 26 dwelling units including 4 No. 1 Bed Apartments, 16 No. 2 Bed 2 Storey Townhouses and 2 No. 3 Bed, 2 Storey Semi Detached Houses. A new vehicular access to the site is proposed through the Old Court Estate, via the L-5219-2 and its junction with the L-5229-0 Drishane Road. The proposed development also provides for all landscaping and boundary treatments, public lighting, drainage, water supply, electricity supply, telecommunications, and all site other development works.

Architectural, Engineering and Landscaping drawings are included in the planning documentation; an outline of the development is shown in the Architect's site layout in Figure 3.

Figure 3: Architect's Site Layout

2.0 Flood Risk

A desktop study of the history of flooding and the probability of flooding at the site was carried out with the intention of assessing the flood risk in accordance with *The Planning System and Flood Risk Management Guideline*s as published by the Department of the Environment, Heritage and Local Government give guidelines on flood risk and development planning.

The guidelines recommend a precautionary, sequential approach to assessing and managing flood risk and, where possible, to avoid development of sites that are at risk.

The sequential approach to flood risk assessment relies on the identification of Flood Zones. These are geographical areas within which the likelihood of flooding is in a particular range. There are three types of flood zones, defined in the guidelines as follows:

Flood Zone A – Where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding),

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1:100 for river flooding and between 0.1% or 1 in 1000 and 0.5% or 1:200 for coastal flooding),

Flood Zone C - where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood zone C covers all areas of the plan which are not in Zones A or B.

When the flood zone applicable to the site has been identified the guidelines describe the developments that would be appropriate within that zone, considering the level of flood risk involved.

2.1. Flood Maps

The OPW's online resource, Floodmaps.ie, was reviewed to assess the history and probability of all types of flooding at the proposed development site. Figure 3 shows an extract from the online flood map of the area around Millstreet Town with the proposed site outlined in red.

Figure 3: Floodmaps.ie extract map of development site and surrounding area.

The interactive flood map allows the following layers to be switched on to illustrate whether any type of flooding impacts an area:

- CFRAM River Flood Extents with AEP of 10%, 1% and 0.1%,
- CFRAM Coastal Flood Extents with AEP of 10%, 1% and 0.1%,
- NIFM National Indicative Fluvial Mapping – Present day with low and medium probability,
- GSI Groundwater flooding probability Maps with low, medium and high probability,
- Past flood events – indicated with hazard signs on the map and the extent of the recorded flood events shown with a blue outline and dotted hatch pattern.

All of these layers are switched on in the extract shown in Figure 3.

Historically flooding occurs to the west of Millstreet town centre at Inchileigh, along the banks of the River Finnow. It is clear from the available CFRAM data and historic records that the proposed development site at Páirc Chatháin to the Southeast of the town has no recorded history of flooding of any kind. It is also clear that the site lies outside any areas that have a probability of flooding in any event, whether fluvial, coastal or groundwater, up to and including a 1 in 1000 year storm. This places the site in flood zone C where residential development is appropriate without requiring a justification test.

3.0 Road Design

The layout of the proposed roads and how they connect with the public access road via the Old Court Estate is shown on WDG drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-001. Vehicular and pedestrian access is proposed to the adjoining Old Court Estate.

3.1. Design Guidelines

The proposed roads within the estate have been designed in substantial compliance with the following:

- Design Manual for Urban Roads and Streets (DMURS) - Dept. of Environment and Dept. of Transport Tourism and Sport-2019,
- Recommendations for Site Development Works for housing areas – DOE 1998,

3.2. Road Hierarchy

There are no *Link* roads or 'through roads' proposed in the development. The proposed roads would be considered to be local roads in the DMURS hierarchy shown in Table 1. Local roads are described as roads that provide access within communities and to *Arterial* and *Link* roads. The Old Court Estate access road (L-5219-2) could be described as local road which provides connection between the residential area and the L-5229-0 Drishane Road which in turn connects to Millstreet town centre and the R582 regional road. The R582 connects Millstreet to the Macroom and the N22 to the south of the site and Rathmore to the west.

DMURS Description	Roads Act/NRA DMRB	Traffic Management Guidelines	National Cycle Manual
Arterial	National	Primary Distributor Roads	Distributor
Link	Regional (see note 1)	District Distributor Local Collector (see Notes 1 and 2)	Local Collector
Local	Local	Access	Access

Notes

Note 1: Larger Regional/District Distributors may fall into the category of *Arterial* where they are the main links between major centres (i.e. towns) or have an orbital function.

Note 2: Local Distributors may fall into the category of *Local* street where they are relatively short in length and simply link a neighbourhood to the broader street network.

Table 1: DMURS Table 3.1 - Terminology used in DMURS compared with other publications.

It is proposed to use a road width of 6.0m throughout the development as most parking spaces/driveways are perpendicular to the carriageway. All roads shall be served by at least one footpath with a minimum width of 2.0m and all estate roads shall have a sign posted speed limit of 30km/h.

3.3. Shared surfaces and Surface Materials

DMURS encourages the use of raised and shared surfaces which promote integration between pedestrians, cyclists, and drivers. This has been shown to be effective where pedestrian activities are high and vehicle movements are mainly due to lower-level access requirements and circulatory purposes.

DMURS recommends that, where design speeds of 30km/h are desired, periodic changes in the colour and/or texture of the street surfaces should be employed. In this development, shared surfaces are introduced through raised tables and the use of material changes in the street surface treatments.

Shared surfaces in the form of raised tables for traffic calming will be finished in bituminous surfacing with beige coloured chippings to differentiate these features from the normal street surfaces finished in standard black bituminous surfacing, see WDG drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-504 for construction details.

The proposed locations and extent of these features are shown on WDG drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-001.

3.4. Traffic Calming

It is proposed to limit the vehicle speeds within the development to 30km/h using standard signage and traffic calming measures as recommended by DMURS and the Traffic Management Guidelines (DoELG 2003) to help improve driver behaviour and reduce vehicle speeds.

The more visible traffic calming measures proposed are raised tables with the proposed locations shown in WDG drawing No. 23029-XX-XX-XX-XX-DR-WDG-CE-001. These are positioned to reduce the lengths of straight and level roads that would allow a build-up of vehicle speed while also providing designated non-signalised, crossing points for pedestrians.

Raised tables shall be constructed in accordance with Diagram 6.34 of The Traffic Management Guidelines. The street level is raised 75mm and finished using bituminous surfacing with beige coloured chippings with 1:15 ramps at each side painted with white triangles (M112) to warn drivers of the elevation change (see Figure 4).

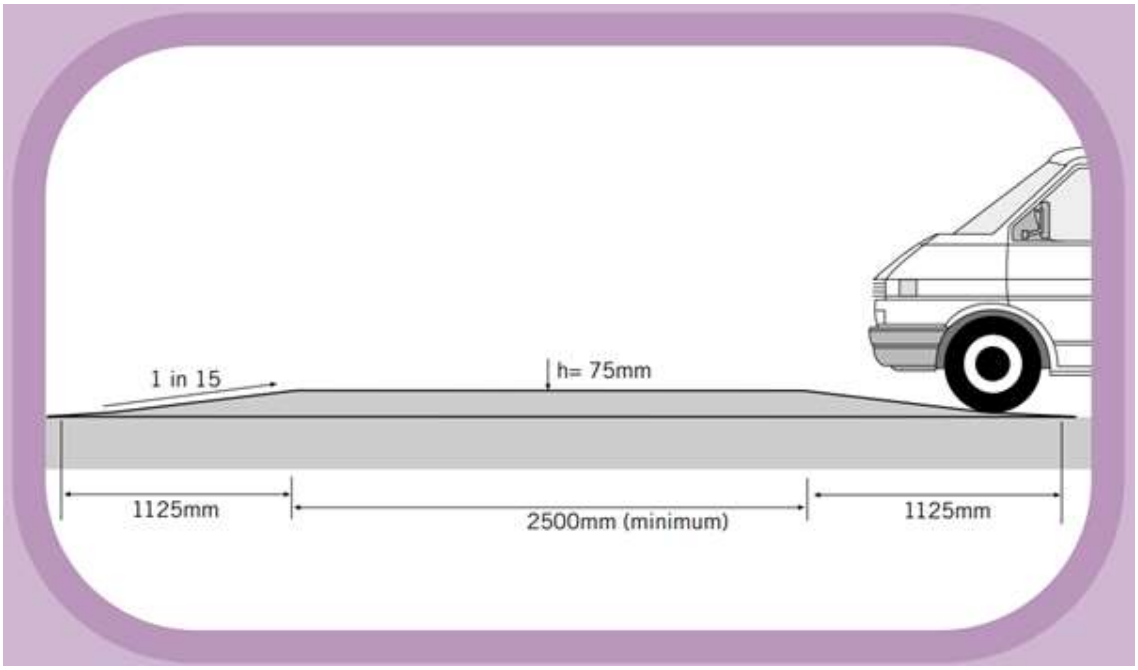

Figure 4: Traffic Management Guidelines, Diagram 6.34 - Raised Tables

3.5. Street Gradients

In accordance with DMURS guidelines, roads have been limited as far as possible, to gradients of 5% or less. A section of the hill up to the residential area of the development from the existing Old Court estate will have a gradient of 7% but this is for a short distance of between 40-50m. As this access road meets the L-5219-2 in the Old Court estate and the junction with the other new estate road it will have a gradient of 2% for 7.0m in accordance with section 2.7 of the *Recommendations for Site Development Works for housing areas – DOE 1998.*

All proposed roads shall have a cross fall of 2.5%. Vertical alignment has been carefully considered to minimise the amount of cut and fill on site.

3.6. Pedestrian Crossings

Pedestrian crossings will be placed in the 2 points of the development where the footpaths from the development entrance meet the estate road perpendicularly, see WDG drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-001. The proposed pedestrian crossings are uncontrolled crossing points. Each crossing point shall be at a raised table as described in section 3.4 and constructed using dished kerbs in accordance with Diagram 13.1 of the Traffic Management Guidelines 2013, see Figure 5.

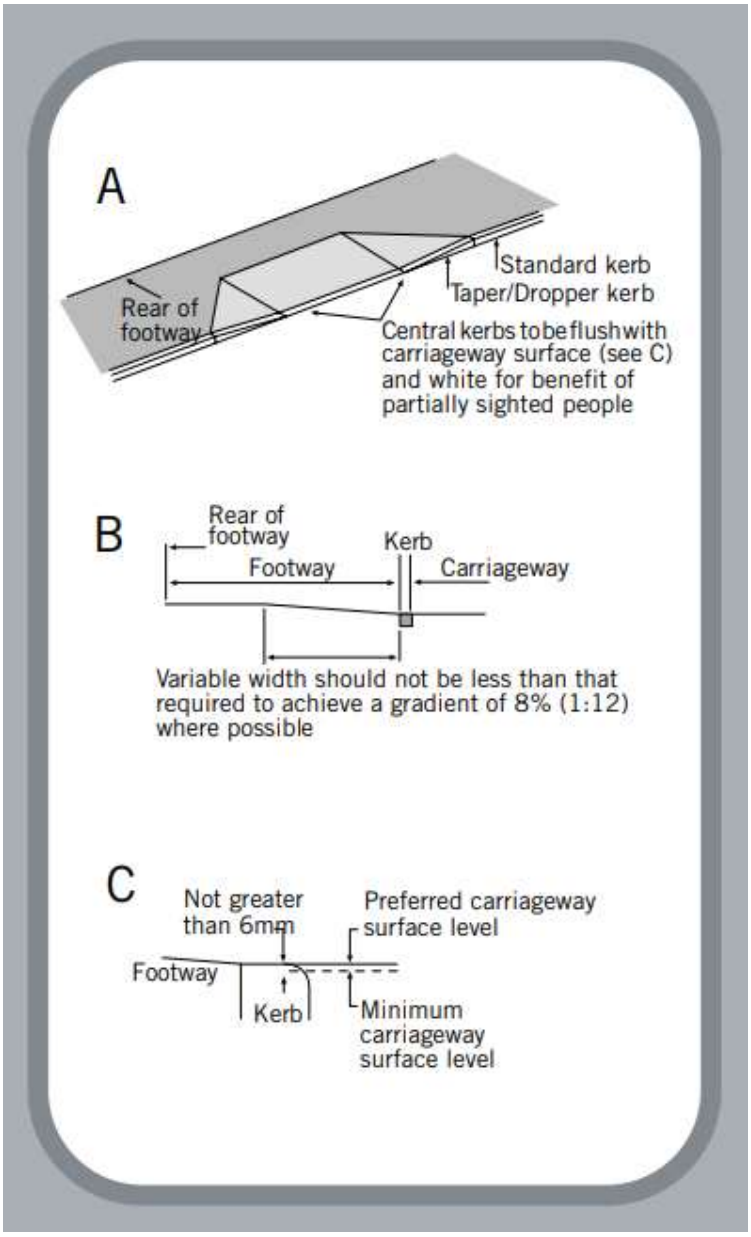

Figure 5: Diagram 13.1 Dished Crossing - Traffic Management Guidelines; DOT, 2013

Buff coloured tactile paving in accordance with Table 13.1 of the Traffic Management Guidelines shall be set in the footpath at each crossing point. Paving slabs measure 400mm x 400mm and shall be laid in a pattern of 3 wide by 2 deep (1200mm wide x 800mm deep) at each crossing point, as illustrated on drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-001.

3.7. Pavement Construction

Street pavement and footpath construction shall be carried out in accordance with the recognised standard; 'Recommendations for Site Development Works for Housing Areas; DoELG 1998'. Roads will be finished in bituminous surfacing and footpaths will be constructed in concrete. See WDG construction details drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-504 for road, footpath, and kerb details.

Road construction assumes a minimum design CBR for the existing ground. The appointed main contractor will be obliged to carry out testing to establish the actual CBR prior to final road design and commencement of road construction.

3.8. Private Driveways & Paving

Each private dwelling plot with car parking included shall have driveway slopes in compliance with Technical Guidance Document M of the Building Regulations. Footpaths across all driveway entrances will be dished and incorporate dropped kerbs. All parking bays shall be constructed with permeable paving. The permeable paving will allow for some of the surface water to soak into the subsoil and ground water rather than leaving the site via the sewer network which is preferable in terms of SuDS.

3.9. Site Cut and Fill

Prior to any construction works on site the topsoil (approx. 200mm deep) will be stripped from the surface in all areas apart from the large green areas. This topsoil will be stockpiled, according to best practice, on site to be reused in private gardens and landscaped areas.

Stockpiles are to be located, formed and maintained according to best practice. Vegetation and any waste materials are to be removed from storage areas prior to stockpiling. Soils shall be stockpiled in the driest condition possible. Soil will be banked with a maximum side slope of 1 in 2 and grass seeded with a grass/clover mix to minimise soil erosion and help reduce infestation by nuisance weeds. Stockpiles are to be fenced off and have their contents identified using clear signage. No vehicles shall be allowed to pass over stockpiles.

Fill imported onto the site to be placed under buildings shall comply with Technical Guidance Document D of the Building Regulations and NSAI Standard Recommendation 21 (S.R.21). Fill imported for use under roadways shall comply with the Tii Specification for Roadworks Series 600 documents.

4.0 Surface Water Drainage

The proposed storm sewer collection system consists of a 100mm diameter pipe collection network around each house in accordance with TGD part H discharging to 225mm diameter uPVC sewer or larger in the public areas of the development. The surface water network layout is shown in drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-002 and the typical details for the surface water infrastructure are shown on drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-500.

The surface water sewers have been designed using the Causeway Flow design software and the Wallingford procedure for the design and analysis of urban drainage. The surface water system for the development is a single network falling generally from south to north and finishing in an open detention basin in the northeast corner of the site.

4.1. Surface Water Design and Simulation Criteria

The storm network's design criteria included:

- maximum rainfall of 50 mm/hr,
- maximum time of concentration of 30 minutes,
- minimum cover of 1.2m to pipes under roads,
- M5-60 of 17mm (https://www.uksuds.com/tools/members/greenfield-runoff-rate-estimation-members),
- SPR of 0.47, (https://www.uksuds.com/tools/members/greenfield-runoff-rate-estimation-members).

The storm networks were tested by simulating both summer and winter storms with durations of between 15 minutes and 24 hours and return periods of 1, 30 and 100 years with the following criteria:

- Summer volumetric runoff coefficient of 0.75,
- Winter volumetric runoff coefficient of 0.84,
- Areal runoff factor of 1.0,
- Additional flow for climate change of 20%.

The surface water sewer networks have been modelled and each individual pipe run has been designed such that no flooding will occur to individual elements during any storm up to and including 24-hour 100-year return period, summer, and winter storms. In all storm simulations an additional flow of 20% was added to account for future climate change.

(See detailed design in Appendix A to this document).

4.1.1. Allowable Discharge

In accordance with the recommendations of sustainable urban drainage systems (SuDS) the allowable stormwater discharge from the surface water network was calculated by means of the QBAR equation for small rural catchments (< 25 km^2) as indicated in the institute of Hydrology, UK Report No. 124. QBAR is calculated using the following formula:
$QBAR = (0.00108\ [AREA]^{0.89}\ [SAAR]^{1.17}\ [SOIL]^{2.17})$

Where,

QBAR (m^3/sec)	=	Annual peak flow
AREA (km^2)	=	Catchment area
SAAR (mm)	=	Standard annual average rainfall
SOIL	=	Index with values between 0.15 and 0.50

The variables for the sewer network are as follows:

AREA The catchment area of the estate that will have its runoff attenuated is 1.096ha = 0.01096km^2,

SAAR The standard average rainfall for the site for the period from 1941 to 1970 was obtained from the UKSUDS website and is approximately 1416 mm/year,

SOIL This index was obtained using the UKSUDS greenfield runoff map which places the site in an area of Type 2 soil with a Standard Percentage Runoff (SPR) of 0.47.

For developments smaller than 50ha, the allowable discharge is linearly interpolated from the QBAR value obtained for a 50ha site. Inputting the above data into the QBAR equation, QBAR Actual is calculated as follows:

QBAR = $(0.00108\ [0.5]^{0.89}\ [1416]^{1.17}\ [0.47]^{2.17})$
= 0.550 m3/sec
= 550 l/sec

By linear interpolation => Adjusted QBAR = 12.06 l/sec.

4.1.2. Network Design

The design of a surface water network generally relies on having an outfall at its downstream end. In this case there is no viable outfall manhole in the Old Court Estate that would be able to accommodate the discharge from the proposed sewer. An outfall was considered to the small watercourse to the east of the site, but the distance of the connection required, approximately 250m, would have been longer than the sewer itself and was considered excessive. For these reasons and to improve the SuDS performance of the proposal, the network was designed so that all surface water runoff could percolate into the soil rather than leaving the site. This type of design is reliant upon soil infiltration rates and groundwater levels. IGSL Ltd. carried out a site investigation for Cork County Council and the results of their BRE Digest 365 infiltration rate testing is shown in Table 2.

Millstreet Infiltration Rates				
	(m/min)			m/hr
	Stage 1	Stage 2	Average	Average
SK01	0.033	0.023	0.028	1.68
SK02	0.031	0.026	0.0285	1.71
SK03	0.063	0.063	0.063	3.78
SK04	0.0596	0.00432	0.03196	1.91
SK05	0.0161	0.013	0.01455	0.87
SK06	0.00294	0.00256	0.00275	0.165

Table 2: Summary of IGSL Ltd. Soil Infiltration Rates

These infiltration rate figures were used in the design of the sewer network and infiltration features such as the underdrained roadside swales and the final detention pond, see Appendix A to this report for the design calculations and the drainage impact assessment in section 4.2 for further details of the SuDS features. It is important to note that groundwater was not encountered in any of the 10no. trial pits that were excavated.

To incorporate underdrained roadside swales into the design, the roads are designed to have a single crossfall towards the verge containing the swale.

In accordance with the Wallingford Procedure, using only impermeable areas in the modified rational method, a Cv (Volumetric Runoff Coefficient) of 0.75 was used for summer events and 0.84 for winter. For the purpose of calculating the volume and rate of flow in the network, the maximum hardstanding area contributing to each pipe run was measured. The hardstanding consists of all driveways, parking spaces, roads, footpaths and other paved sections within the contributing area. It is intended to construct raingarden soakaways to the rear of each dwelling to receive the runoff from the roofs.

The proposed surface water network has been tested with the Causeway Flow software, simulating rainfall events up to and including the 24-hour, 100 year storm with a 20% addition allowed for climate change. Modelling shows that no flooding occurs in any rainfall event tested.

4.1.3. Road Gullies

Gullies are only used on the lower, western section of the new road as it approaches its tie-in with the existing L-5219-2. This part of the site is too low to be drained by the main sewer and so the surface water collected by the gullies shall be channelled to a soakaway. There shall be 2 sets of double gullies to prevent runoff from the new development flowing onto the existing estate's roadway.

All gullies will be precast concrete complying with the requirements of BS 5911: Part 230. The outlet from the gullies will be 150mm diameter pipe set a minimum of 375mm off the floor of the chamber. This allows for debris and silt that falls through the grating to settle below the invert of the outlet pipe. The silt in gullies must be regularly cleaned out as part of the silt

management and maintenance schedule in the operational phase of the housing development.

The class of gully grating required will be D400 as per the manhole covers. Gully gratings in roads will be set with the direction of the openings at right angles to the direction of traffic.

4.2. Drainage Impact Assessment

SuDS measures are proposed for the development in both public and private areas in accordance with the guidance from the County Development Plan 2022 Advice Note 1 on Surface Water management and the CIRIA SuDS Manual C753.

The Measures proposed will decrease the impact of the development on the receiving environment and also provide amenity and biodiversity in many cases. Regular maintenance of the SuDS measures will be required to ensure that they are effective throughout their design life. The following paragraphs describe the following SuDS features proposed: a detention basin, permeable paving, underdrained roadside swales, bio-retention tree pits, bio-retention raingardens and water butts.

4.2.1. Detention Basin

The primary means of attenuating runoff prior to its infiltration into the soil shall be the proposed detention basin. The basin is designed to have a depth of 0.8m, side slopes with a gradient of 4 horizontal to one vertical, a base area of approximately 20m^2 and a surface area, when full, of 103m^2. This will provide temporary attenuation storage volume of approximately 49m^3. The infiltration rate if 0.028m/min or 1.68m/hr was recorded by IGSL at the adjacent test location SK01 during soakaway testing in accordance with BRE Digest 365. This infiltration rate was used to calculate the size of the basin such that no flooding would occur in the drainage network in any event up to and including the 24-hour 100-year storm.

It is worth noting that the basin is designed to be dry most of the time and will only hold water temporarily, during heavy rainfall events. With its shallow depth and relatively gentle side slopes it is basically a shallow depression in the green area that fills with water quite rarely and for a short period. At all other times it will be dry and can function as green open space containing planting and/or furniture that is compatible with getting wet occasionally.

Figure 6: Examples of detention basins by Peterborough City Council in the UK (CIRIA SuDS Manual C753)

Grassed slopes of 1:3 or less can be mowed with ride-on lawn mowers for ease of maintenance. The 1:4 side slopes are also important in terms of safety as the change of water depth is gradual rather than sudden should someone enter the basin. See WDG drawings no. 23029-XX-XX-XX-XX-DR-WDG-CE-002 and 504 for the proposed layout and details.

4.2.2. Underdrained Roadside Swales

Traditionally storm sewers were constructed under roadways for the most part. It is proposed here to move the storm sewer into road verges as far as possible. It is proposed to construct linear swales parallel with the roads and to have dropped kerbs at the adjacent road edges to allow runoff to fall evenly into the swale. Where swales are in place the road will be constructed with a single 1:40 crossfall to allow the full surface width to drain towards that side of the road. Under the swale the sewer pipe will be perforated and the trench that the pipe is laid in will be filled with suitable filter material. Runoff from the road surface will be gathered in the shallow swale, drain down through the fill material and enter the sewer pipe having been slowed down and filtered in the process.

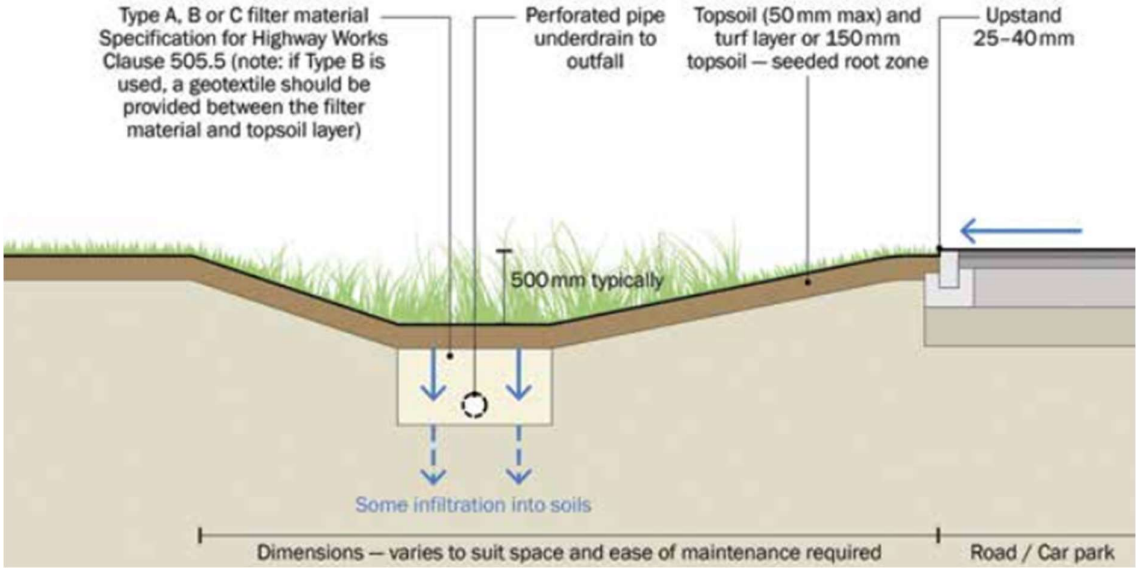

Figure 7: Underdrained Roadside Swale (CIRIA C753 SuDS Manual)

Swales shall be constructed in accordance with the guidance in the CIRIA SuDS Manual Chapter 16 and the detail on the accompanying drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-504. The dimensions of the swale can be variable to suit the available space but the depth will be a maximum of 500mm and the side slopes will be at a maximum gradient of 1:3. The swales shall be set with grass and/or wildflowers which can be mown normally due to the shallow side slopes, see example in Figure 8. The longitudinal gradient of the swale should be maintained at 1:100 or less in order to slow flows and allow full interception.

Figure 8: Example of roadside swale from the CIRIA SuDS Manual (C753)

CIRIA C753 (The SuDS Manual) Table 24.6 notes that filter swales can be considered to provide Interception when draining the runoff from impermeable surfaces, i.e. it can be assumed that there will be zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter. The stone filled trenches also provide temporary attenuation storage as there is up to 30% voids in the filter material.

4.2.3. Permeable Paving

Permeable paving is proposed for all car parking spaces in the development. The permeable paving will allow surface water to soak into the subsoil and ground water rather than leaving the site via the sewer network which is preferable in terms of SuDS. See the accompanying WDG drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-504 for the construction details of the permeable paving, see example in Figure 9.

CIRIA C753 (The SuDS Manual) notes that studies have shown that runoff typically does not occur from permeable pavements for rainfall events of up to 5 minutes in length. The paving's substrate intercepts and stores the runoff before some of it percolates into the surrounding soil and any overflow is piped to the sewer network. The substrate shall be a minimum of 300mm deep and formed with washed, coarse, graded aggregate with 30% voids for water storage.

Figure 9: Example of permeable paving.

4.2.4. Roadside Bioretention Tree Pits

Bioretention tree pits, constructed in accordance with CIRIA SuDS Manual Chapter 19 and the detail provided in drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-504, are proposed in roadside green areas of the site where a proportion of the surface water from the hard road and footpath surfaces can be channelled towards the tree base for temporary storage and percolation to ground water. The tree pits can be placed in isolated green planters where gaps in the kerbing or kerb drains allow surface water to fall to the base of the trees as per the examples in Figure 10 or tree pits can be arranged to fill an available green space. In all cases, an overflow pipe will carry any overflow back to the sewer in heavier rainfall events. This prevents the tree's roots from being inundated for long periods, causing damage or disease.

Figure 10: Examples of tree pits in isolated green planters from the CIRIA SuDS Manual

Whilst the grass along the top of the roadside verges will most likely be mowed the local area around the base of each tree pit is to be set with a variety of planting including native wildflower grass seed mixes to promote urban biodiversity - providing habitat and food for

native insects, invertebrates, and birds. This planting scheme will not be mowed regularly but occasionally cleaned and weeded. The bioretention tree pits offer runoff interception, filtration and water storage as well as offering further benefits such as evapotranspiration, cooling of runoff in the shade and the promotion of biodiversity.

CIRIA C753 (The SuDS Manual) Table 24.6 notes that, regarding interception design of tree root system (bio retention areas), pavements drained by tree root systems can be considered to provide Interception, i.e. it can be assumed that there will be zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter.

See the accompanying WDG drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-002 for the proposed locations of the tree pits.

4.2.5. Rain Garden Soakaways

It is proposed that dwelling roofs will discharge to rain gardens in back yards where they will provide treatment to roof runoff through evapotranspiration within the filter media of the rain garden structure and also perform as soakaways given the appropriate soil infiltration rates recorded on this site, see Table 2. Rain gardens shall be constructed with a 500mm depth of compost/sand mix (engineered soil) under a thin layer of clean stone chippings, see Figure 11. They will have simple inflows over larger stones to slow down the flow and prevent erosion of the soil. The raingardens shall be set at a level to allow a maximum standing water depth of 150mm, and an overflow pipe will be linked to the sewer system. It is proposed to set the rain gardens with varieties of water-based plant species that will thrive in the wet conditions whilst promoting biodiversity along with the other SuDS measures proposed.

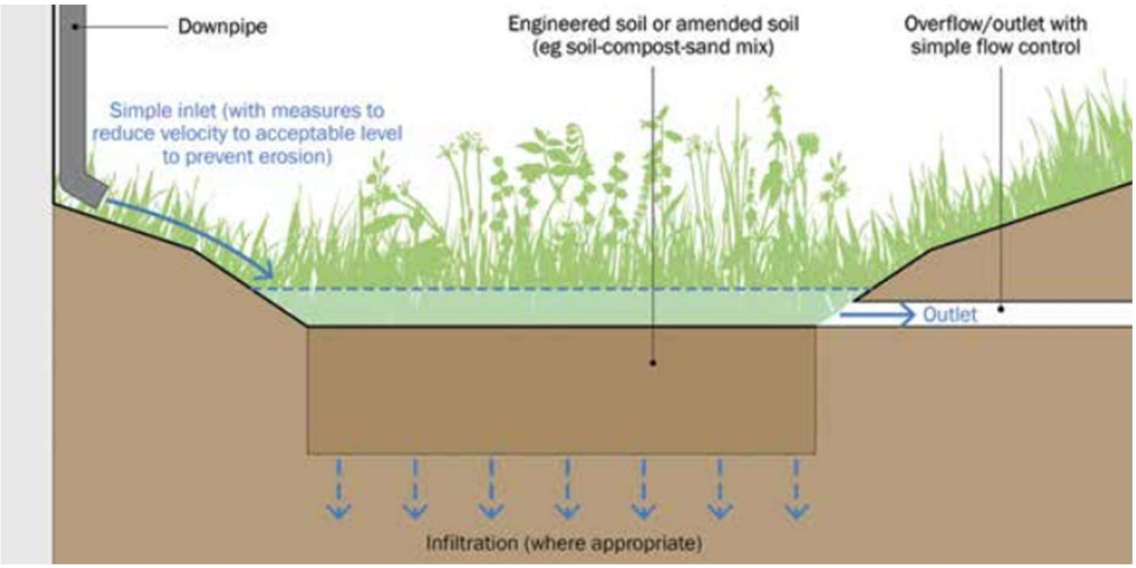

Figure 11: Section through a simple rain garden with outlet pipe (CIRIA C753)

CIRIA C753 (The SuDS Manual) Table 24.6 notes that regarding interception design of rain gardens (bio retention areas), pavements drained by rain gardens can be considered to provide Interception, i.e. it can be assumed that there will be zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter.

4.2.6. Water Butts

It is proposed to install a 300-litre water butt to the rear of each dwelling that has a rear garden. The water butt shall be designed to collect water from the downpipes with a bypass system so that they do not overtop and flood the yard/garden. The overflows shall be connected back to the raingarden soakaways in this development. A tap on the water butt will allow the water to be used for gardening or car washing etc. and reduce demand on the local authority water supply whilst also slightly reducing the roof runoff entering the surface water sewer. See the accompanying WDG drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-002 for an example of a water butt.

5.0 Wastewater Drainage

The layout of the proposed wastewater drainage network for the development is shown on WDG drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-002 and the typical details for the wastewater infrastructure are shown on drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-501. 1 conventional piped, gravity sewer network is proposed. The network will fall from the north and the south towards the centre of the development where it will follow the access road to its proposed connection with the existing Irish Water infrastructure in the Old Court estate.

All sewers within the curtilage of individual houses are to be installed in accordance with TGD Part H (2010) and will consist of 100 mm diameter uPVC Sewers from individual houses laid to falls of min 1:60 to connect to a 150mm and 225mm uPVC sewer to be laid under the estate road. Inspection chambers will be constructed within 1m of the boundary of each private property in accordance with Irish Water Standard Details.

All wastewater sewers in the public realm have been designed in compliance with Irish Water's Code of Practice for Wastewater Infrastructure – A Design and Construction Guide for Developers (Revision 2) July 2020. All construction details within the public realm will be in accordance with Irish Water, Wastewater Infrastructure Standard Details (Revision 4), July 2020.

A pre-connection enquiry was submitted to Irish Water to assess the feasibility of providing a connection to the site and Irish Water subsequently issued a confirmation of feasibility for the development (see Appendix C). In order to accommodate the proposed development, the applicant shall be required to fund an upgrade to the local wastewater sewer for a distance of approximately 105m from the proposed connection point, see Figure 12 for a map of the local Irish Water infrastructure.

Figure 12: Map of Irish Water wastewater infrastructure in the vicinity of the site.

5.1. Wastewater Design Criteria

For the purposes of clarity, the wastewater sewer system has been designed using the following parameters, as required in Irish Water document IW-CDS-5030-03 Section 3.6:

- Flow per person: 150 L/day
- Average persons per household: 2.7 persons
- Unit consumption allowance (infiltration) 10%
- Minimum velocity for pipe running full: 0.75 m/sec
- Peak flow: 6 DWF

The population equivalent (PE) for the development is: 26 dwellings x 2.7 = 70.

The detailed hydraulic design parameters and calculations for the wastewater network are included in Appendix B to this document.

6.0 Water Supply

It is proposed that a connection to the existing Irish Water infrastructure will be made in the Old Court Estate just outside the development entrance. The water main layout is shown on WDG drawing no. 23029-XX-XX-XX-XX-DR-WDG-CE-003 and the water main typical details are shown on drawings 23029-XX-XX-XX-XX-DR-WDG-CE-502 and 23029-XX-XX-XX-XX-DR-WDG-CE-503.

A pre-connection enquiry was submitted to Irish Water to assess the feasibility of providing a connection to the site. Irish Water issued a confirmation of feasibility for the development confirming that a connection is feasible once the applicant agrees to fund approximately 45m of upgrades to the existing Irish Water infrastructure, (see Appendix C). See Figure 13 for a map of the local Irish Water infrastructure.

Figure 13: Map of Irish Water - water supply infrastructure in the vicinity of the site.

Private properties will each have a separate service connection, fitted with an Irish Water approved boundary box immediately outside the boundary. Fire hydrants are placed so that no domestic property within the development is more than 46m from a hydrant. All potable water infrastructure will be constructed in accordance with the following Irish Water documents:

- IW-CDS-5020-03 Code of Practice for Water Infrastructure – Connections and Developer Services, July 2020 (Revision 2),
- IW-CDS-5020-01 Water Infrastructure Standard Details - Connections and Developer Services, July 2020 (Revision 4).

6.1. Water Demand

The mains water demand for the development is calculated, according to Irish Water criteria, using the following parameters:

- 150 litres/person/day,
- 2.7 persons per housing unit,
- Domestic ADPW = 1.25,
- 26 Housing Units.

7.0 Utilities

7.1. Electricity

ESB networks were contacted regarding power lines running in the vicinity of the site. There are buried cables on site. There are no overhead lines running through the site. The map provided by the ESB (see Appendix D).

Any works on site shall be carried out in accordance with the following ESB document:

- Safe Construction with Electricity.

7.2. Gas

Gas Networks Ireland was contacted regarding the gas supply services in the vicinity of the proposed development site. GNI responded with a map to show that there are no gas mains in the vicinity, *s*ee Appendix D.

Appendix A

Surface Water Design

- Surface Water Sewer Network Design (see drawing 23-29-XX-XX-XX-XX-DR-WDG-CE-001).

Appendix B

Wastewater Design

- Wastewater Sewer Network Design (see drawing 23-29-XX-XX-XX-XX-DR-WDG-CE-001).

Appendix C

Irish Water Documents

Irish Water Documents:

- Confirmation of feasibility Letter.

Appendix D

Utilities

- ESB Map
- Gas Networks Ireland Map