Project

Lucan Road Old Housing, Palmerstown, Dublin 20, Co. Dublin

Report Title

Engineering Services Report

Document Reference

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INFRASTRUCTURE

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1 Introduction

DBFL Consulting Engineers were commissioned by the Applicant to prepare an Engineering Services Report (ESR) for the proposed residential development at Lucan Road, Palmerstown, Co. Dublin. The application site comprises approximately 1 025.25m^2 (0.103 hectares) – see Figure 1 below.

The site is located within Hollyville, Palmerstown, front facing the Lucan Road Old and is currently the site of an old demolished garage/warehouse.

Figure 1: Site Location, Lucan Road Old, Palmerstown, Dublin 20, Co. Dublin

The objective of this report is to provide information on the calculations, estimates and assumptions used to design the foul sewers, surface water sewers, surface water attenuation and Sustainable Drainage Systems (SuDS), watermains and road access for the proposed development.

2 Foul Sewers

2.1 Existing Services

There is an existing 225mm diameter foul line located within Lucan Road Old, to the north of the subject site, as well as to the west, in what seems to be a designated wayleave corridor. The foul line to the west originates from south of the M50. The foul network drains eastward along the Lucan Road Old.

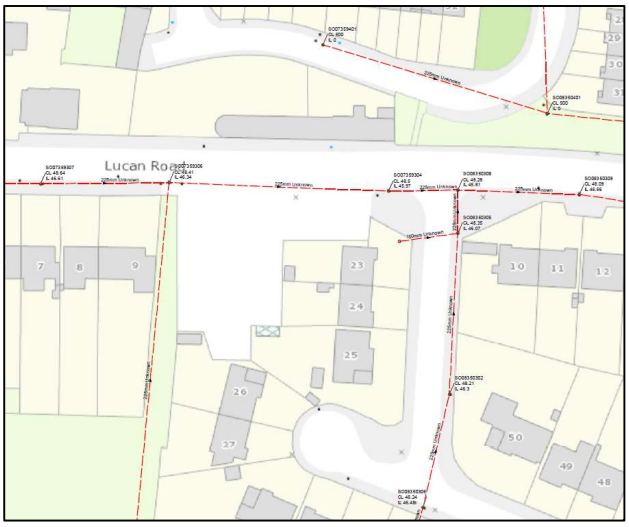

Figure 2: Existing Foul Sewer

Please refer to Appendix A for the Existing Irish Water Services Layout.

2.2 Proposed Services

A pre-application has been made to Irish water to confirm whether there is adequate capacity in the public network to accommodate the proposed development (Ref no. CDS 19008748). Irish Water has confirmed that the proposed wastewater connection is feasible without upgrade. The original application submitted was for 12 no. dwellings on the subject site. The number of dwellings proposed for the development has since been reduced to 4 no. in line with discussions with South Dublin City Council.

The proposed foul sewer network layout for the development is shown on DBFL drawing 190077-DBFL-FW-SP-DR-C-1021.

Foul sewers have been designed and will be constructed in accordance with the Irish Water's 'Standard Details for wastewater infrastructure' and 'Code of practice for wastewater infrastructure'. In addition, foul sewers have been designed to Building Regulations and specifically in accordance with the principles and methods set out in EN 752:2008 and DOE *'Recommendations for Site Development Works'.* In addition, HR Wallingford 'Tables for the hydraulic design of pipes, sewers and channels' and Water UK/WRc 'Sewers for Adoption – 6th Edition' have been applied. Values for roughness of uPVC pipes were obtained from Wallingford "Tables for the Hydraulic Design of Pipes, Sewers and Channels" and Wavinsewer systems catalogue.

Foul sewers were sized using the EN752:2008 method in MICRODRAINAGE where:

$$Q = kDU\sqrt{\sum DU}$$

The following design criteria have been applied in the design of foul sewers:

i. Discharge units (DU), 3 per housing unit (6 litre cistern)

ii. EN 752 Frequency, Factor (kDU) 0.5

iii. Pipe Ks
   a. 1.5 mm (concrete)
   b. 0.6mm (uPVC for flow>0.5D)
   c. 0.15mm (uPVC for flow<0.5D)

iv. Minimum velocity, 0.75 m/s (self-cleansing vel.)

v. Maximum velocity, 3 m/s

vi. Minimum gradients:

No. of Houses	Minimum Pipe Gradient
1	100mm dia. @ 1:60 or self cleansing gradient (private connection)
2-9	150mm dia. @ 1:60 or self cleansing gradient
>10	Min 150mm dia. or self cleansing gradient

Using Irish Water parameters, the peak flow from the site is calculated as 0.12 l/s, however using the EN752 method in MICRODRAINAGE the peak flow is 1.9 l/s.

Sewers and drains shall be laid to comply with the requirements of the Building Regulations 1997 in accordance with the recommendations contained in the Technical Guidance Documents, Section H (revised 2005). Standard drainage details will be in accordance with the Greater Dublin Regional Code of Practice for Drainage Works and Irish Water Standard Details for Wastewater infrastructure.

Please refer to Appendix B for the Irish Water Confirmation of Feasibility letter.

Please refer to Appendix C for the Foul Sewerage calculations.

Refer to drawing number 190077-DBFL-FW-SP-DR-C-1021 for the proposed foul sewer layout.

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3 Surface Water

3.1 Existing Services

There is an existing 225mm diameter surface water line located within Lucan Road Old, to the north of the subject site. This existing surface water network services the houses along Lucan Road Old as well as the road drainage network, gulley's. The surface water network drains eastward along the Lucan Road Old, then down Riverside Drive towards the M50.

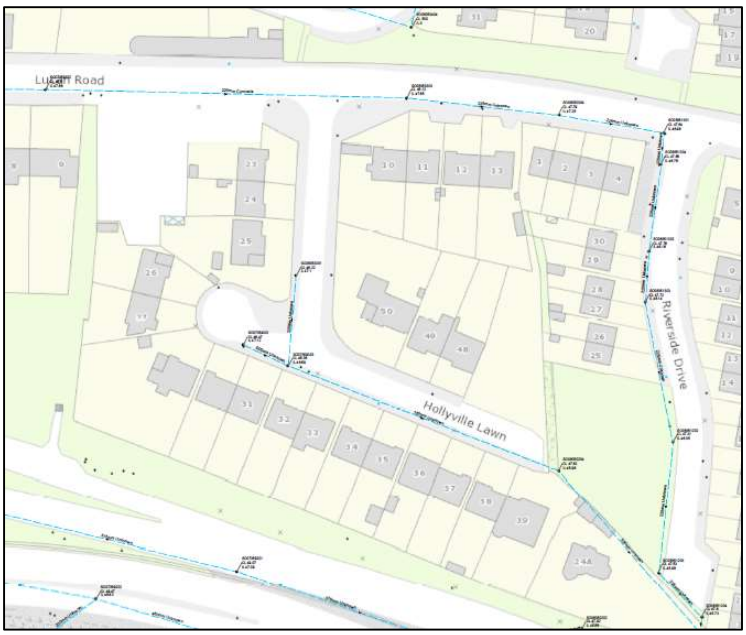

Figure 3: Existing Surface Water

3.2 Proposed Services

Surface water management for the proposed development is designed to comply with the 'Greater Dublin Strategic Drainage Study (GDSDS) Regional Drainage Policies Technical Document – Volume 2, New Developments, 2005' and the 'Greater Dublin Regional Code of Practice for Drainage Works, V6.0 2005'. CIRIA Design Manuals C753, C697 and C609 have also been used to design the surface water drainage system within the site.

The GDSDS guidelines require the following 4 main criteria to be provided by the development's surface water design;

- Criterion 1: River Water Quality Protection - satisfied by providing interception storage and treatment of run-off within the SuDS features e.g. permeable paving, tree pits, swales and detention basins.
- Criterion 2: River Regime Protection – satisfied by attenuating run-off with flow control device prior to discharge to the outfall.
- Criterion 3: Level of Service (flooding) for the site – satisfied by the site being outside the 1000 year coastal and fluvial flood levels. Pluvial flood risk addressed by development designed to

accommodate a 100-year storm as per GDSDS. Planned flood routing for storms greater than 100-year level considered in design and development run-off contained within site.

- Criterion 4: River flood protection – attenuation provided within the SuDS features e.g. permeable paving construction, swales, tree pits and detention basin.

3.3 Sustainable Drainage Systems (SuDS)

SuDS are a requirement of 'The Greater Dublin Strategic Drainage Study' and are recommended under the 2009 guidelines, 'The Planning System and Flood Risk Management'.

There are a number of SuDS features proposed which have been designed in accordance with CIRIA documents C753, C697 and C609 as follows:

- Filter Drains: Trenches filled with permeable stone material and a perforated collection pipe at the invert with an optional permeable 'sandy' topsoil at surface. These can treat, convey and attenuate runoff, at source, and can infiltrate too the ground where the subgrade is suitable. These systems will allow some form of storage for small rainfall events and can result in water evaporation and adsorption in small quantities, therefore there will be less runoff from these areas in small rainfall events thus mimicking the natural response for this catchment. These will be located in the rear gardens of each unit and will result in an improvement in the quality of surface water draining from roofs of houses and paved areas in rear gardens and will also allow groundwater to recharge to its natural state.

- Tree Pits: Trees can be planted within a range of infiltration SuDS components to improve their performance, as root growth and decomposition increase soil infiltration capacity. Alternatively, they can be used as standalone within soil-filled tree pits, tree planters or structural soils, collecting and storing runoff and providing treatment via filtration and phytoremediation. Tree pits and planters will be designed to collect and attenuate runoff by providing additional storage within the underlying structure. The soils around trees can also be used to filter out pollutants from runoff directly. Tree pits are proposed to be included adjacent to car parks in required green space provision to treat and control runoff, while at the same time providing amenity value to car park users and adjacent pedestrian, commercial and residential zones.

- Permeable Pavers: Porous surfacing (paving block or open graded material) which can treat rainwater, at source, and allow infiltration through to an underlying porous subbase where water can be stored within the voids of the subbase before being slowly released to the drainage collection system through natural flow via the porous medium. Partial infiltration systems are proposed to be used as existing subgrade (ground) is not capable of absorbing all the water through infiltration. This type of permeable paving system includes a permeable geotextile at its base as well as an outlet to the surface water system. These systems will allow some form of storage for small rainfall events and will result in infiltration, water evaporation and adsorption in small quantities, therefor there will be less runoff from these areas in small rainfall event thus mimicking the natural response for this catchment. As well as reducing the amount of runoff

from the surface, permeable paving will slow down the rate of runoff from the pavement in extreme rainfall events contributing to attenuation flows. In addition, permeable paving will increase the quality of water which is intercepted by the system through filtration, biodegradation, pollutant adsorption and settlement and retention of solids, also the reduction in peak flows to the outfall will enhance settlement and biodegradation of pollutants. It is proposed to use these systems in private driveways and surface water storage within these systems will be further mobilised by providing a 225mm diameter pipe at outlet to the site drainage system. This pipe outlet will restrict flow to its capacity of 2 l/s (Ks=0.15 and gradient at 1 in 100) thereby reducing the runoff rate from the permeable paving even further.

Refer to Appendix D for the SuDS calculations and SuDS summary.

Refer to drawing number 190077-DBFL-SW-SP-DR-C-1011 for the proposed surface water layout.

3.3.1 Site Investigation

A site investigation on the subject site was carried out by IGSL and concluded in February 2020. The site investigation comprised 10 number trial pits which included infiltration tests, 2 number boreholes and 2 number California Bearing Ratio tests.

The trial pits and boreholes revealed made ground, composed largely of gravelly clay containing some extraneous matter. The depth of the made ground varies from 0.65m to 2.3m.

Based on the SPT N values, the deposits are typically medium dense and become dense with depth although loose deposits were recorded in places.

Groundwater ingress was confined largely to seepages through the made ground. Groundwater observations varied between 0.2m and 1.1m.

Soil infiltration rates were assessed as part of the site investigation, the assessment was undertaken by excavating trial pits based on the requirements of BRE Digest 365 and CIRIA SuDS Manual C753. The FSR (Winter Rain Acceptance) SOIL value determined was used to calculate the pre-development characteristics of the in-situ soil and the corresponding greenfield run-off of the site, mentioned previously.

Neither of the infiltration tests showed any measurable fall in water level, it is evident that soakaways will not function in these ground conditions. The site investigation advises to discharge storm water to an existing surface water system.

Refer to the site investigation report by IGSL included as part of this planning application.

3.3.2 Permissible Site Discharge

According to the GDSDS, the method used for determining peak flow rates for small greenfield catchments is the UK 'Institute of Hydrology Report 124, Flood Estimation for Small Catchments'. This method calculates $QBAR_{rural}$ which is the mean annual flood flow from a rural catchment.

Where long-term storage can be provided or is not necessary, surface water can be discharged at a higher value than $QBAR_{rural}$, this discharge rate ($QBAR_{growth}$) is dependent on the design return period and the corresponding growth factor from the GDSDS Table 6.6. However, if long-term storage cannot be provided on-site the discharge rate from the site should be kept to $QBAR_{rural}$ or 2 l/s/ha, which is the case for this development.

The IH124 method calculates $QBAR_{rural}$ which is the mean annual flood flow from a rural catchment. As the subject site area is less than 50 hectares, the calculated QBAR is to be linearly interpolated from the calculated value to produce a reduced allowable outflow based on the actual site area, as per GDSDS section 6.6.1.

$$QBAR_{rural} = 0.00108 \times (Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$$

where:-

$QBAR_{rural}$ = Mean Annual Flood (m3/s)
Area = Catchment Area (km2)
SAAR = Standard Average Annual Rainfall (mm)
SOIL = SOIL index from Flood Studies Report

Using data received from Met Eireann for Irish Grid co-ordinates E 307000, N 235000 (site co-ordinates are: E 307941, N 235370), the SAAR is determined as 776mm.

The soil value can be determined from the Flood Studies Report - Winter Rainfall Acceptance Maps (WRAP). A more accurate approach is to use the 'The Classification of Soils from Winter Rainfall Acceptance Rate, Flood Studies Report Table 4.5' to determine soil type and determine the soil value from from Table 6.7 from the GDSD. The latter method is adopted for this site.

Permissible site discharge for the site has been determined as follows:

Total Application Site Area = 0.103 Ha
Actual Catchment Area = 0.103 Ha
SAAR = 776mm
SOIL Value= 0.47 (for soil type 4 from Table 6.7 from the GDSD)

Therefore the permissible site discharge for the development (QBARrural) is 2 l/s.

Refer to Appendix E for the permissible site discharge calculations.

3.3.3 Surface Water Runoff Coefficients

As a large proportion of runoff is routed through SuDS features these will have an attenuating effect which reduce the rate of stormwater runoff for every rainfall event. Also, SuDS features would reduce the runoff volume through evaporation, transpiration, infiltration and depression storage of the water within each system.

The runoff coefficients that has been utilised for this site and have been applied are as follows:

Roofs – Type 2 (Draining to SuDS features) = 0.70

Roads and Footpaths - Type 2 (Draining to SuDS features) = 0.70

Permeable Paving = 0.50

Grassed Areas = 0.47 (soil type 4 SPR- Flood Studies Report)

3.3.4 Surface Water Attenuation Design

The Site Investigation confirmed that soakaways will not function in the ground conditions present on the subject site. The site investigation advises to discharge storm water to an existing surface water system.

The design intention is to utilise as many SuDS features as possible and allow for partial infiltration within the design. Roofs, footpaths and grassed areas will drain into tree pits, located to the rear of the development. The tree pits will have a high level overflow in the case of saturation that will drain towards the drainage stone layer below the permeable paver entrance road and parking area to the front of the development. Similar to the tree pits, the drainage stone layer will have a high level overflow in the case of saturation that will discharge to the existing surface water system in Lucan Road Old.

During extreme rainfall storm events, discharge from the site will be limited to greenfield runoff rates. Attenuation storage volume for the design 100-year return period storm event has been provided in the tree pits and drainage layer below the permeable pavers.

As required under the GDSDS, a climate change allowance of 20% will be applied surface water drainage design.

This surface water system has been hydraulically modelled in MICRODRAINAGE to ensure that the overall discharge at the end of the hydraulic system is at, or below, the greenfield rate that discharges to the stream, as mentioned in section 3.3.2. A MICRODRAINAGE Simulation model has been created for the entire site.

The MICRODRAINAGE Simulation uses the Wallingford Procedure, time/area full hydrograph methodology, including energy and momentum equations for dynamic analysis of surface water networks. The site drainage network is modelled as one system where all flows, capacities, water levels, surcharged manholes etc are determined throughout the network for each critical storm duration. Therefore, the final combined discharge rate to the stream from the outlet will be kept at (or below) the total permissible discharge rate defined above.

Maximum rainfall data from Extreme Rainfall Return Period values produced by Met Eireann was used to input into MICRODRAINAGE to determine maximum flood volumes. Rainfall data for the site was sourced from an Annual Average Rainfall (AAR) Grid (1981-2010) and a Depth Duration Frequency model produced by Met Éireann (Available from: http://www.met.ie/climate/products03.asp). This data was input into MICRODRAINAGE to determine the maximum flood volume for the 1 in 100-year rainfall event.

SAAR = 776 mm

Ratio M560/M52d	=	0.276
M560	=	16.30 mm

The total attenuation volume required (as calculated) for the site is 16.20 m3. The volume provided for the site by means of tree pits and the drainage layer below the permeable pavers are 34.80 m3.

Refer to Appendix D for the SuDS calculations and SuDS summary.

Refer to drawing number 190077-DBFL-SW-SP-DR-C-1011 for the proposed surface water layout.

3.3.5 Interception Volume

The GDSDS requires that no run-off should directly pass to the receiving watercourse for rainfall depths of 5mm, therefore interception should be provided at source where practicable. The volume of interception required is based on 5mm of rainfall depth from 80% of the runoff from impermeable areas as defined in the GDSDS (Appendix E section E2.1.1).

The interception volume attributable to each SuDS feature consists of the volume of water that can infiltrate to the ground, what will evaporate into the atmosphere and what can transpirate through plants and vegetation. Additionally, there will some losses of water due to absorption and wetting of stone and soil media.

Not all SuDS features will be able to achieve infiltration, evaporation, transpiration and losses due to absorption/wetting. The limits for each SuDS feature type are taken into account when calculating interception volumes.

The interception storage attributable to the losses in stone and soil media, such as the stone media used in filter drains was not included in the calculations.

The total interception volume required (as calculated) for the site is 2.9 m3. For this calculation roofs, roads, footpaths and paved areas although draining to SuDS features was taken as impermeable surfaces in order to ensure the maximum required volume of interception is calculated. The volume provided for the site by means of tree pits and the drainage layer below the permeable pavers are 5 m3 which exceeds the required treatment volume calculated.

Refer to Appendix F for the Interception Volume Requirement.

Refer to drawing number 190077-DBFL-SW-SP-DR-C-1011 for the proposed surface water layout.

3.3.6 Treatment Volume

The GDSDS requires that a “treatment volume” (Vt) be provided in order to prevent any pollutants or sediments discharging into river systems, additionally a ‘treatment train’ stormwater runoff management system is required. According to CIRIA document C697 the following treatment train approach is necessary:

Roofs – 1 Treatment Stage

Road Areas – 2 Treatment Stages

Paved Areas excluding Roads - 1 Treatment Stage

The treatment volume is based on treatment 15mm of rainfall depth from 80% of the runoff from impermeable areas as defined in the GDSDS (Appendix E section E2.1.2).

All run-off areas will pass through the required number of treatment stages prior to discharging to the downstream outfall.

The total treatment volume required (as calculated) for the site is 8.8m3. For this calculation roofs, roads, footpaths and paved areas although draining to SuDS features was taken as impermeable surfaces in order to ensure the maximum required volume of treatment is calculated The volume provided for the site by means of tree pits and the drainage layer below the permeable pavers are 10 m3.

Refer to Appendix F for the Treatment Volumes Calculations.

Refer to drawing number 190077-DBFL-SW-SP-DR-C-1011 for the proposed surface water layout.

3.3.7 Surface Water Sewers

Surface water from the proposed development will be discharged after attenuation to the existing surface water network within the Lucan Road Old.

Surface water sewers are designed in MICRODRAINAGE using the Modified Rational Method. The return period for sizing pipes is based on the following;

- Department of Environment – Recommendations for Site Development Works for Housing Areas (1998), Table 3.1;
- GDSDS – Regional Drainage Policies – Volume 2 – New Development (2005), Section 6.5;
- IS EN 752:2008 - Drain and Sewer Systems Outside Buildings, Table 2;
- Building Regulations (2005) – Section H - Drainage and Wastewater Disposal, Section 1.5.7.

The surface water network has been designed for the 30-year return period to minimise the risk of flooding.

The following parameters applied:

Return period	30 year
Time of entry	4 minutes
Pipe Ks	0.6mm (concrete); 0.15mm (uPVC)
Minimum velocity	0.75 m/s
Maximum velocity	3.0 m/s

Effective runoff coefficients for each pipe catchment have been determined based on the runoff characteristics for each surface contributing to flows within the catchment.

The minimum pipe diameter for public surface water sewers is 225mm.

Values for roughness of uPVC pipes were obtained from Wallingford “Tables for the Hydraulic Design of Pipes, Sewers and Channels” and Wavinsewer systems catalogue.

Refer to Appendix F for the surface water network calculations.

Refer to drawing number 190077-DBFL-SW-SP-DR-C-1011 for the proposed surface water layout.

4 Watermains

4.1 Existing Services

There is an existing 6-inch diameter Cast Iron watermain located within Lucan Road Old, to the north of the subject site, as well as a 6-inch uPVC watermain to the west, in what seems to be a designated wayleave corridor.

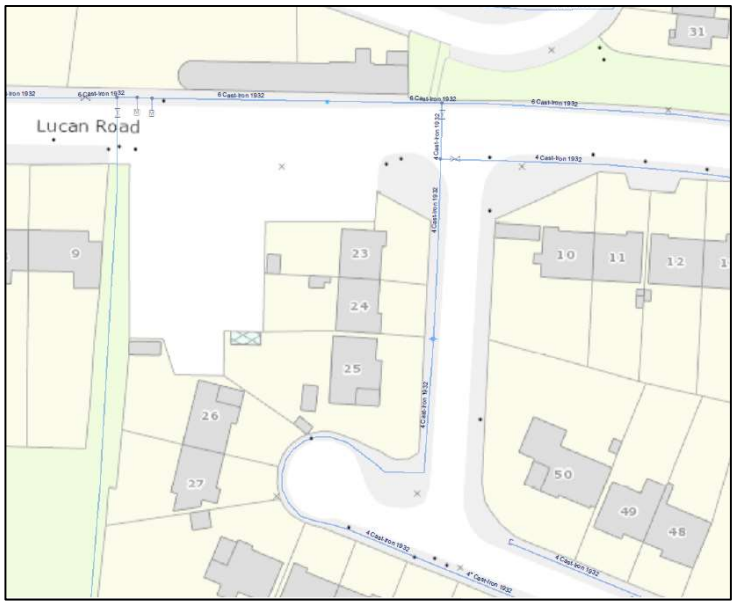

Figure 4: Existing Water

4.2 Proposed Services

A pre-application has been made to Irish water to confirm whether there is adequate capacity in the public network to accommodate the proposed development (Ref no. CDS 19008748). Irish Water has confirmed that the proposed water connection is feasible without upgrade. The original application submitted was for 12 no. dwellings on the subject site. The number of dwellings proposed for the development has since been reduced to 4 no. in line with discussions with South Dublin City Council.

The proposed water main network layout for the development is shown on DBFL drawing 190077-DBFL-WM-SP-DR-C-1031.

The subject development will connect to the existing 6-inch uPVC watermain within the designated wayleave corridor by means of a 100mm diameter watermain. This will negate the issue of crossing the Lucan Road Old for installation of services.

The individual dwellings will be serviced by individual 25mm diameter pipe and boundary boxes in accordance with the Irish Water Code of Practice and Standard Details.

There is an existing fire hydrant located to the north of the subject site within Lucan Old Road which sufficiently covers the subject site in accordance with the Irish Water Code of Practice. It is proposed to install a new hydrant to the front of the development to serve as a scour valve at the dead end left.

The estimated peak demand from the development will be 0.13 l/s with the average daily demand being 0.02 l/s.

Refer to Appendix G for the Water Demand Calculations.

Refer to drawing number 190077-DBFL-WM-SP-DR-C-1031 for the proposed water main layout.

5 Flood Risk

5.1 Objective

The objective of this section of the report is to inform the planning authority regarding flood risk for the development of residential units on the subject site. This section assesses the site and development proposals in accordance with the requirements of "The Planning System and Flood Risk Management Guidelines for Planning Authorities".

The report clarifies the site's flood zone category and presents information which would facilitate an informed decision of the planning application in the context of flood risk. The report also outlines appropriate flood risk mitigation and management measures for any residual flood risk.

5.2 Planning System & Flood Risk Management Guidelines

5.2.1 General

"The Planning System and Flood Risk Management Guidelines for Planning Authorities", November 2009 and its technical appendices outline the requirements for a site specific flood risk assessment.

Residential development is classified as "highly vulnerable development" according to Table 3.1 of the Guidelines. Table 3.2 of the Guidelines indicates that this type of development is appropriate and compatible with flood zone C i.e. outside the 1000 year (0.1% AEP) flood extents.

Highly vulnerable development may also be compatible with Flood Zone Category B depending on its performance in a site justification test. Therefore, as part of the sequential approach mechanism of the Guidelines, a justification test is only required if 'highly vulnerable development' is proposed in Flood Zone B.

5.2.2 Flood Risk Assessment Stages

This site-specific flood risk assessment will initially use existing flood risk information to determine the flood zone category of the site and to check if the Guidelines Sequential Approach has been applied or if a justification test is required; - refer to Figure 5 below for details. Flood risk is normally assessed by a flood risk identification stage followed by an initial flood risk assessment. A more detailed flood risk assessment stage may then follow which includes an assessment of surface water management, flood risk and mitigation measures to be applied.

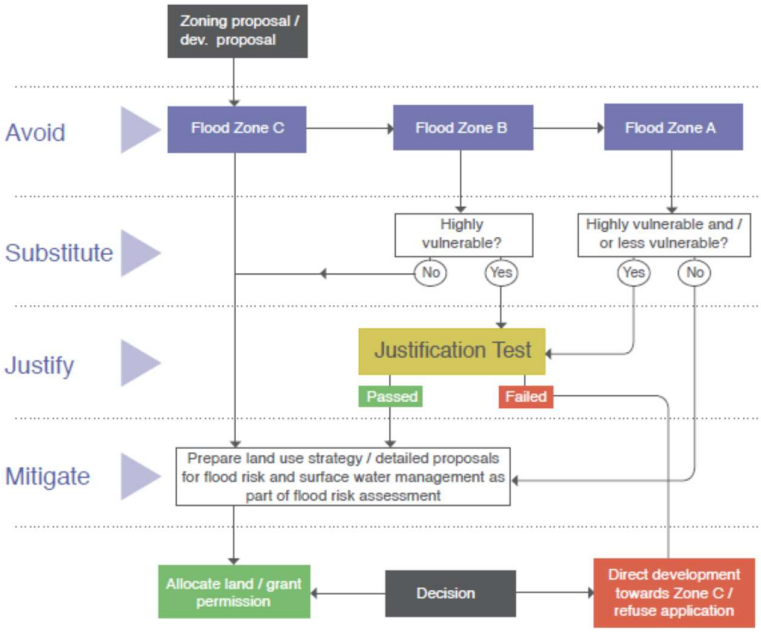

Figure 5: Existing Water

5.3 FLOOD RISK IDENTIFICATION STAGE

5.3.1 General

The initial flood risk identification stage uses existing information to identify and confirm whether there may be flooding or surface water management issues for the lands in question that warrant further investigation.

5.3.2 Information Sources Consulted

Information sources consulted for the identification exercise are outlined in Table 1 below.

Table 1: Information Sources Consulted

Information	Source
Predictive and historic flood maps, and benefiting lands maps, such as those available on http://www.floods.ie;	OPW www.floodmaps.ie website consulted.
Predictive fluvial, coastal, pluvial and groundwater flood maps.	ECFRAMS (refer Figure 3.1 below)
Topographical maps, in particular digital elevation models produced by aerial survey or ground survey techniques;	OSI Maps consulted, site topographic survey undertaken and analysed.
Information on flood defence condition and performance;	No defences are present within the subject site or in the vicinity of the site.
Information on existing public sewerage condition and performance;	GDSDS performance maps for existing sewerage in the vicinity of the subject site examined.
National, regional & local spatial plans, such as the National Spatial Strategy, regional planning guidelines, development plans & local area plans provide key information on existing and potential future receptors.	SDCC Development Plan 2016-2022 Strategic Flood Risk Assessment consulted.

5.3.3 OPW Predictive, Historic & Benefiting Lands Maps & Flood Hazard Information

The OPW website www.floods.ie indicates that there were no OPW land commission schemes or benefitting land zones within the boundary of the subject site.

The website indicates a flood event at the Liffey River, 0.6km west of the subject site, which occurred in June 1993. A recurring flood event has been noted on the website to the east of the subject site at Mill lane. Neither of the flood events noted can be considered as being in close proximity to the subject site and does not affect the proposed development.

Figure 6: Historic Flood Events

Refer to Appendix H for the ECFRAMS flood maps.

5.3.4 Previous Flood Risk Assessments & Predictive Flood Maps

The OPW recently completed the Eastern Catchment Flood Risk and Management Study (ECFRAMS) to fulfil the requirements of the EU Floods Directive (2007/60/EC). The ECFRAM was commissioned in June 2011 with the aim of the study to identify areas at risk from flooding and hence develop flood risk management options for 'at risk' areas. The ECFRAM Programme included three main stages; the Preliminary Flood Risk Assessment (2011), Flood Risk and Hazard Mapping (late 2014) and Flood Risk Management Plans (2016).

The Flood Risk Assessment maps do not indicate any flood risk in the residential site. The residential site is outside the estimated 1000yr (0.1% AEP) flood plain of this river as defined by the ECFRAMS mapping.

Refer to Appendix H for the ECFRAMS flood maps.

5.3.5 Tidal Flood Maps

The site is located approximately 14km west of the coast and 0.5km from the Liffey River. The residential site is outside the estimated 1000yr (0.1% AEP) flood plain of this river as defined by the ECFRAMS mapping. The therefore is not at risk of tidal flooding.

5.3.6 Other Sources

Other information sources were consulted to determine if there was any additional flood risk to the site, these included;

Topographical surveys of the area – no evidence based on topography.

Flood defence information – there are no flood defences in the vicinity of the site.

Existing Local Authority Drainage Records:- no evidence based on the existing drainage records.

5.4 Source-Pathway-Receptor Model

A Source-Pathway-Receptor model was produced to summarize the possible sources of floodwater, the people and assets (receptors) that could be affected by potential flooding (with specific reference to the proposals) and the pathways by which flood water from an event exceeding 1%AEP (Annual Exceedance Probability) would follow - see Table 2. It provides the probability and magnitude of the sources, the performance and response of pathways and the consequences to the receptors in the context of the commercial development proposal. These sources, pathways and receptors will be assessed further in the initial flood risk assessment stage.

Table 2: Source-Pathway-Receptor Analysis

Source	Pathway	Receptor	Likelihood	Impact	Risk
Tidal	Tidal flooding from coast 14km away.	-	Remote	-	-
Fluvial	Flooding from the nearest watercourse (Liffey River 0.5km away)	-	Remote	-	-
Surface Water - Pluvial	Flooding from surcharging of the development's drainage systems	Low points in the roads within the development and green areas. Residents and visitor's property including buildings and vehicles parked in the development.	Possible	High	Low – The surface water network is designed to provide attenuation for a 1 in 100 year flood event.
Surface Water - Pluvial	Flooding from internal sources – overland flows	Low points in the roads within the development and green areas. Residents and visitor's property including buildings and vehicles parked in the development.	Possible	High	Low – Overland flow paths are designed to direct surface water away from properties.
Surface Water - Pluvial	Flooding from external sources – overland flows	Low points in the roads within the development and green areas. Residents and visitor's property including buildings and vehicles parked in the development. External downstream roads.	Possible	High	Low – Localised flood events sre downstream and downhill of the development site and do not pose a risk to the development.
Groundwater flooding	Rising GWL on the site	-	Remote	-	-

It is clear from the above flooding analysis that the proposed site is not at risk from tidal or fluvial flooding due to its geographic location and topography.

Due to the existing and proposed levels, should flooding of the road (Lucan Road Old or internal) occur, any water will be directed away from the houses. The proposed final floor levels of the houses has been set to be above the existing ground levels. Thus, the type of development proposed is appropriate for this flood zone category. The Guidelines Sequential Approach is therefor met and the 'Avoid' principal achieved and an initial flood risk assessment not required.

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APPENDIX A

Existing Irish Water Services Layout

UISCE ÉIREANN : IRISH WATER

Legend

- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Overflow
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Syphon - Overflow
- Overflow
- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Overflow
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Syphon - Overflow
- Overflow
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Riversdale Avenue
Riversdale Grove
Riverdale Park
Riverside Drive
Lucan Road
Hollyville Lawn
M50
N
0 12.5 25 50 75 100 Meters
Ordnance Survey Ireland 2018

UISCE ÉIREANN : IRISH WATER

Legend

- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Overflow
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Syphon - Overflow
- Overflow

0 12.5 25 50 75 100 Meters

Ordnance Survey Ireland 2018

UISCE ÉIREANN : IRISH WATER

SHALLOW ROADS DRAINAGE

SITE

Riversdale Grove

Riversdale Avenue

Riversdale Park

Riverside Drive

Hollyville Lawn

Lucan Road

M50

N

0 12.5 25 50 75 100 Meters

Ordnance Survey Ireland 2018

Legend

- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

UISCE ÉIREANN : IRISH WATER

Legend

- Pump Stations
- Irish Water
- Private
- Irish Water
- Non IW

APPENDIX B

Irish Water Confirmation of Feasibility

Ben Mong
Ormond House
Upper Ormond Quay
Dublin
D07W704

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

19 December 2019

Dear Ben Mong,

Re: Connection Reference No CDS19008748 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 12 unit(s) at Lucan Road, Palmerstown, Co. Dublin.

Irish Water has reviewed your pre-connection enquiry in relation to a water connection at Lucan Road, Palmerstown, Co. Dublin.

Based upon the details that you have provided with your pre-connection enquiry and on the capacity currently available in the network(s), as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network(s) can be facilitated.

This Confirmation of Feasibility to connect to the Irish Water infrastructure does not extend to your fire flow requirements. Please note that Irish Water can not guarantee a flow rate to meet fire flow requirements and in order to guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development.

In order to determine the potential flow that could be delivered during normal operational conditions, an on site assessment of the existing network is required.

All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details. A design proposal for the water and/or wastewater infrastructure should be submitted to Irish Water for assessment. Prior to submitting your planning application, you are required to submit these detailed design proposals to Irish Water for review.

You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed at a later date.

A connection agreement can be applied for by completing the connection application form available at **www.water.ie/connections**. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities.

If you have any further questions, please contact Marko Komso from the design team on (022) 54611 or email mkomso@water.ie. For further information, visit **www.water.ie/connections.**

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

APPENDIX C

Foul Sewer Calculations

TITLE		**Job Reference**	
OGP Lucan Road Palmerstown		190077	
SUBJECT		**Calc. Sheet No.**	
Wastewater Hydraulic Load - Irish Water-Post Development		1	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
	DH	BM	06/05/2020

Foul Drainage

Housing Units	4	no.
Dry Weather Flow (DWF)[1]	150	litres/person/day
Average Occupancy Ratio[2]	2.7	person/unit
Total Site Occupancy (i.e. population)	11	person
Total Daily Wastewater Discharge + 10% Unit Consumption Allowance[3]	1,782	l/day
Peak Flow Factor[4]	6.0	

Post Development Average Discharge	**0.02**	l/s	Note: This value may be lower than value calculated using MICRODRAINAGE EN752 method for pipe sizing
Post Development Peak Discharge[5]	**0.12**	l/s	

Foul Sewer Organic Loading

	Average Concentration[6]	Maximum Concentration[7]
BOD (mg/l)	168	422
SS (mg/l)	163	435
N (mg/l)	40.6	78.6
P (mg/l)	7.1	15.5
COD (mg/l)	389	1000

Notes:

1. Dry Weather Flow (DWF) is 150 litres/person/day
2. Occupancy ratio of 2.7 persons per dwelling from Irish Water Code of Practice for Wastewater Infrastructure.
3. The unit consumption allowance is 10% in accordance with the Irish Water Code of Practice for Wastewater Infrastructure.
4. The Peak Flow factor is taken as 6 times Dry Weather Flow (0 to 750 population), 4.5 DWF for 751 to 1000 and 3.0 DWF for 1001 to 5000
5. The peak discharge is equal to the Total Wastewater Discharge multiplied by the peak flow factor, expressed in litres/second.
6. The average concentrations of wastewater parameters taken from EPA "Wastewater Treatment Manuals, Treatment Systems for Small Communities, Business, Leisure Centres and Hotels".
7. Assumed Maximum concentration is equal to the average concentration plus 2 times the standard deviation (for the 95%ile) taken from EPA "Wastewater Treatment Manuals, Treatment Systems for Small Communities, Business, Leisure Centres and Hotels".

FOUL SEWERAGE DESIGN

Design Criteria for FS

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	10
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.500
Calculation Method	EN 752	Maximum Backdrop Height (m)	2.000
Frequency Factor	0.50	Min Design Depth for Optimisation (m)	0.000
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	150

Designed with Level Inverts

Network Design Table for FS

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	8.227	0.137	60.1	0.000	12.0	0.0	0.600	o	100	Pipe/Conduit	
1.001	4.060	0.068	60.0	0.000	0.0	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	47.265	0.000	0.0	12.0	0.2	34	0.82	1.00	7.8	1.9
1.001	47.128	0.000	0.0	12.0	0.2	34	0.82	1.00	7.8	1.9

APPENDIX D

SuDS Calculations and SuDS Summary

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 124 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	48.009	0.089	0.0	0.0	6.4	O K
30 min Summer	48.043	0.123	0.0	0.0	8.9	O K
60 min Summer	48.078	0.158	0.0	0.3	11.4	O K
120 min Summer	48.094	0.174	0.0	0.8	12.5	O K
180 min Summer	48.100	0.180	0.0	1.2	13.0	O K
240 min Summer	48.104	0.184	0.0	1.4	13.3	O K
360 min Summer	48.108	0.188	0.0	1.6	13.5	O K
480 min Summer	48.108	0.188	0.0	1.7	13.6	O K
600 min Summer	48.108	0.188	0.0	1.6	13.5	O K
720 min Summer	48.107	0.187	0.0	1.6	13.5	O K
960 min Summer	48.106	0.186	0.0	1.5	13.4	O K
1440 min Summer	48.102	0.182	0.0	1.3	13.1	O K
2160 min Summer	48.097	0.177	0.0	1.0	12.8	O K
2880 min Summer	48.094	0.174	0.0	0.8	12.5	O K
4320 min Summer	48.088	0.168	0.0	0.6	12.1	O K
5760 min Summer	48.085	0.165	0.0	0.5	11.8	O K
7200 min Summer	48.083	0.163	0.0	0.4	11.7	O K
8640 min Summer	48.081	0.161	0.0	0.4	11.6	O K
10080 min Summer	48.080	0.160	0.0	0.3	11.5	O K
15 min Winter	48.020	0.100	0.0	0.0	7.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	85.443	0.0	0.0	19
30 min Summer	59.144	0.0	0.0	34
60 min Summer	38.461	0.0	1.4	62
120 min Summer	24.294	0.0	4.4	104
180 min Summer	18.409	0.0	6.4	124
240 min Summer	15.092	0.0	8.0	154
360 min Summer	11.373	0.0	10.3	216
480 min Summer	9.292	0.0	12.2	276
600 min Summer	7.939	0.0	13.7	336
720 min Summer	6.979	0.0	15.0	394
960 min Summer	5.692	0.0	17.2	510
1440 min Summer	4.270	0.0	20.6	738
2160 min Summer	3.202	0.0	24.5	1100
2880 min Summer	2.607	0.0	27.4	1468
4320 min Summer	1.950	0.0	32.0	2204
5760 min Summer	1.585	0.0	35.5	2928
7200 min Summer	1.349	0.0	38.5	3640
8640 min Summer	1.183	0.0	41.0	4408
10080 min Summer	1.058	0.0	43.2	5040
15 min Winter	85.443	0.0	0.0	19

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	48.058	0.138	0.0	0.0	9.9	O K
60 min Winter	48.091	0.171	0.0	0.7	12.3	O K
120 min Winter	48.105	0.185	0.0	1.5	13.3	O K
180 min Winter	48.111	0.191	0.0	1.9	13.7	O K
240 min Winter	48.112	0.192	0.0	1.9	13.8	O K
360 min Winter	48.111	0.191	0.0	1.9	13.8	O K
480 min Winter	48.109	0.189	0.0	1.7	13.6	O K
600 min Winter	48.107	0.187	0.0	1.6	13.5	O K
720 min Winter	48.105	0.185	0.0	1.5	13.3	O K
960 min Winter	48.102	0.182	0.0	1.3	13.1	O K
1440 min Winter	48.097	0.177	0.0	1.0	12.7	O K
2160 min Winter	48.091	0.171	0.0	0.7	12.3	O K
2880 min Winter	48.088	0.168	0.0	0.6	12.1	O K
4320 min Winter	48.083	0.163	0.0	0.5	11.7	O K
5760 min Winter	48.081	0.161	0.0	0.4	11.6	O K
7200 min Winter	48.079	0.159	0.0	0.3	11.4	O K
8640 min Winter	48.078	0.158	0.0	0.3	11.4	O K
10080 min Winter	48.077	0.157	0.0	0.3	11.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	59.144	0.0	0.0	34
60 min Winter	38.461	0.0	2.8	60
120 min Winter	24.294	0.0	6.2	92
180 min Winter	18.409	0.0	8.4	124
240 min Winter	15.092	0.0	10.1	158
360 min Winter	11.373	0.0	12.8	220
480 min Winter	9.292	0.0	14.8	280
600 min Winter	7.939	0.0	16.5	342
720 min Winter	6.979	0.0	18.0	398
960 min Winter	5.692	0.0	20.5	512
1440 min Winter	4.270	0.0	24.3	738
2160 min Winter	3.202	0.0	28.6	1124
2880 min Winter	2.607	0.0	31.9	1472
4320 min Winter	1.950	0.0	37.0	2188
5760 min Winter	1.585	0.0	41.0	2976
7200 min Winter	1.349	0.0	44.3	3688
8640 min Winter	1.183	0.0	47.1	4408
10080 min Winter	1.058	0.0	49.6	5000

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.300	Shortest Storm (mins)	15
Ratio R	0.276	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.040

Time (mins) From:	To:	Area (ha)
0	4	0.040

Model Details

Storage is Online Cover Level (m) 48.550

Cellular Storage Structure

Invert Level (m) 47.920 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	240.0	0.0	0.400	240.0	0.0
0.100	240.0	0.0	0.500	240.0	0.0
0.200	240.0	0.0	0.501	0.0	0.0
0.300	240.0	0.0			

Pipe Outflow Control

Diameter (m) 0.225 Entry Loss Coefficient 0.500
Slope (1:X) 200.0 Coefficient of Contraction 0.600
Length (m) 6.000 Upstream Invert Level (m) 48.060
Roughness k (mm) 0.150

APPENDIX E

Permissible Site Discharge Calculations

PROJECT			JOB REF.
Lucan Road Residential Development, Old Lucan Road, Palmerstown, Dublin 20			190077
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Permissible Site Discharge			1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
190077	DCH	BJM	06/05/2020

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the overall catchment area? **0.10** Hectares (ha) Site is Less than 50 Hectares

Pre-Development Catchment Soil Characteristics

Are there different soil types present on the pre-developed site? No

Catchment (This refers to the entire site area)	1	
Area	0.10	Hectares (ha)
Drainage Group	2	Class
Depth to Impermeable Layers	3	Class
Permeability Group above Impermeable Layers	3	Class
Slope [o]	1	Class
SOIL Type	4	From FSR Table
[1]SOIL Index	0.45	

SOIL	SOIL Value	SPR
1	0.15	0.10
2	0.30	0.30
3	0.40	0.37
4	0.45	0.47
5	0.50	0.53

Site SOIL Index Value **0.45**

Site SPR Value **0.47**

Post-Development Catchment Characteristics

Is the development divided into sub-catchments? No

What is the overall site area for catchment? 0.10 Hectares (ha)

Catchment 1	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roofs - Type 1 (Traditional)	0	1.00	0.0
Roofs - Type 2 (Draining to SUDS features)	200	0.70	140.0
Green Roofs	0	0.70	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	0	0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	98	0.70	68.6
Paved Areas	0	0.80	0.0
Permeable Paving	202	0.50	101.0
Bioretention Areas	0	0.95	0.0
Grassed Areas	235	0.37	87.0
Public Open Space (Non Contributary)	310	0.37	114.7

Include Public Open Space in Effective Catchment Area? No — Assumed open space area does not drain to surface water network

Effective Catchment Area **396.6** m^2

Effective Catchment Runoff Coefficient **0.54**

Long-Term Storage

Is long-term Storage provided? No

Permissible Site Discharge

What is the Standard Average Annual Rainfall (SAAR)? 776.0 mm — From Met Eireann, Co-ordinates 307000/235000

Is the overall site area less than 50 hectares? Yes

[5]$QBAR_{Rural}$ calculated for 50 ha and linearly interpolated for area of site 0.5 Litres/sec

[7]Site Discharge = **2.0** Litres/sec

Notes and Formulae

1. SOIL index value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).
2. SPR value calculated from GDSDS - Table 6.7.
3. Rainfall depth for 100 year return period, 6 hour duration with additional 10% for climate change.
4. Long-term storage Vol_{ac} (m^3) = Rainfall.Area.10.[(PIMP/100)(0.8.α)+(1-PIMP/100)(β.SPR)-SPR]. (GDSDS Section 6.7.3).
   Where long-term storage cannot be provided on-site due to ground conditions, Total Permissible Outflow is to be kept to $QBAR_{(Rural)}$.
5. Total Permissible Outflow - $QBAR_{(Rural)}$ calculated in accordance with GDSDS - Regional Drainage Policies
   (Volume 2 - Chapter 6), i.e. $QBAR(m3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ - For catchments greater than 50 hectares in area. Flow rates are linearly interpolated for areas samller than 50hectares.
6. Where Total Permissible Outflow is less than 2.0l/s and not achievable, use 2.0 l/s or closest value possible.
7. QBAR multiplied by growth factors of 0.85 for 1 year, 2.1 for 30 year and 2.6 for 100 year return period events, from GDSDS Figure C2.

APPENDIX F

Interception and Treatment Volume

PROJECT			JOB REF.
Lucan Road Residential Development, Old Lucan Road, Palmerstown, Dublin 20			190077
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Interception Volume			3
Drawing ref.	**Calculations by**	**Checked by**	**Date**
190077	DCH	BJM	15-May-20

SURFACE WATER CALCULATIONS

Site Area

Total Site Area =	0.10	Hectares (ha)

Interception Volume (Post-Development)

Impermeable Area =	0.074	Hectares (ha)
Rainfall Depth =	5	mm
[1]Interception Volume =	2.9	m^3

Notes

1. Interception Volume (m^3) = Impermeable Area (ha) x 5mm x 10 (GDSDS Section 6.3.1.2.1). For sites where a pond is applicable.

80% runoff from impermeable areas assumed.

PROJECT			JOB REF.
Lucan Road Residential Development, Old Lucan Road, Palmerstown, Dublin 20			190077
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Treatment Volume			2
Drawing ref.	**Calculations by**	**Checked by**	**Date**
190077	DCH	BJM	15-May-20

SURFACE WATER CALCULATIONS

Site Area

Total Site Area =	0.10	Hectares (ha)

Treatment Volume (Post-Development)

Impermeable Area =	0.074	Hectares (ha)
Rainfall Depth =	15	mm
[1]Treatment Volume (Vt) =	8.8	m^3

Notes

1. Treatment Volume Vt (m^3) = Impermeable Area (ha) x 15mm x 10 (GDSDS Section 6.3.1.2.1). For sites where a pond is applicable.

80% runoff from impermeable areas assumed.

APPENDIX G

Water Demand Calculations

TITLE		Job Reference	
OGP Lucan Road Palmerstown		190077	
SUBJECT		Calc. Sheet No.	
Water Demand for Irish Water		1	
DRAWING NUMBER	Calculations by	Checked by	Date
	DH	BM	06/05/2020

DEMAND

Housing Units	4	no.
Daily Demand per person[8]	165	litres/person/day
Average Occupancy Ratio[1]	2.7	person/unit
Total Site Occupancy	11	people
Average Daily Demand	1,782	l/day
Average Day in Peak Week[2]	2,228	l/day
Normal Length of Day[3]	24	hours
Peak Factor[4]	5.0	

Post Development Peak Water Demand[5]	**0.13**	l/s
Post Development Average Water Demand	**0.02**	l/s
Normal Demand[6]	**0.02**	l/s

Notes:

1. Occupancy ratio of 2.7 persons per dwelling from Irish Water Code of Practice for Water Infrastructure
2. Average Day in Peak Week is 1.25 times the average daily demand.
3. Assumed normal demand is the total daily demand during the normal length of day.
4. Peak Factor for pipe sizing from Irish Water Code of Practice for Water Infrastructure
5. Peak Factor multiplied by Average Day in Peak Week flow
6. Normal demand is the total daily demand during the normal length of day.
7. Fire flow is required at 25l/s as per B.S. 5306-1:1976.
8. 150 litres/person/day along with a 10% unit consumption

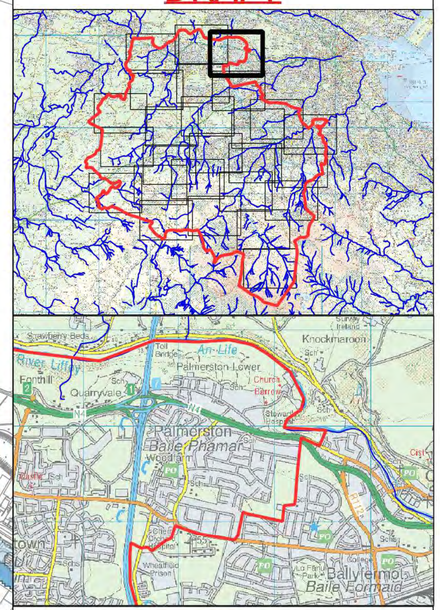
APPENDIX H

OPW and ECFRAMS Flood Maps

Legend

- Flood Zone A - 1% AEP Flood Extent (1 in 100 chance in any given year)
- Flood Zone B - 1% AEP Flood Extent (1 in 1000 chance in any given year)
- Defended Area
- Watercourse Centreline
- Indicative Flood Extents
- County Boundary

DRAFT



0 200 400 600 800 1000 m

Comhairle Contae
Átha Cliath Theas
South Dublin County Council

Project: Strategic Flood Risk Assessment

Title: Fluvial Flood Zone Mapping

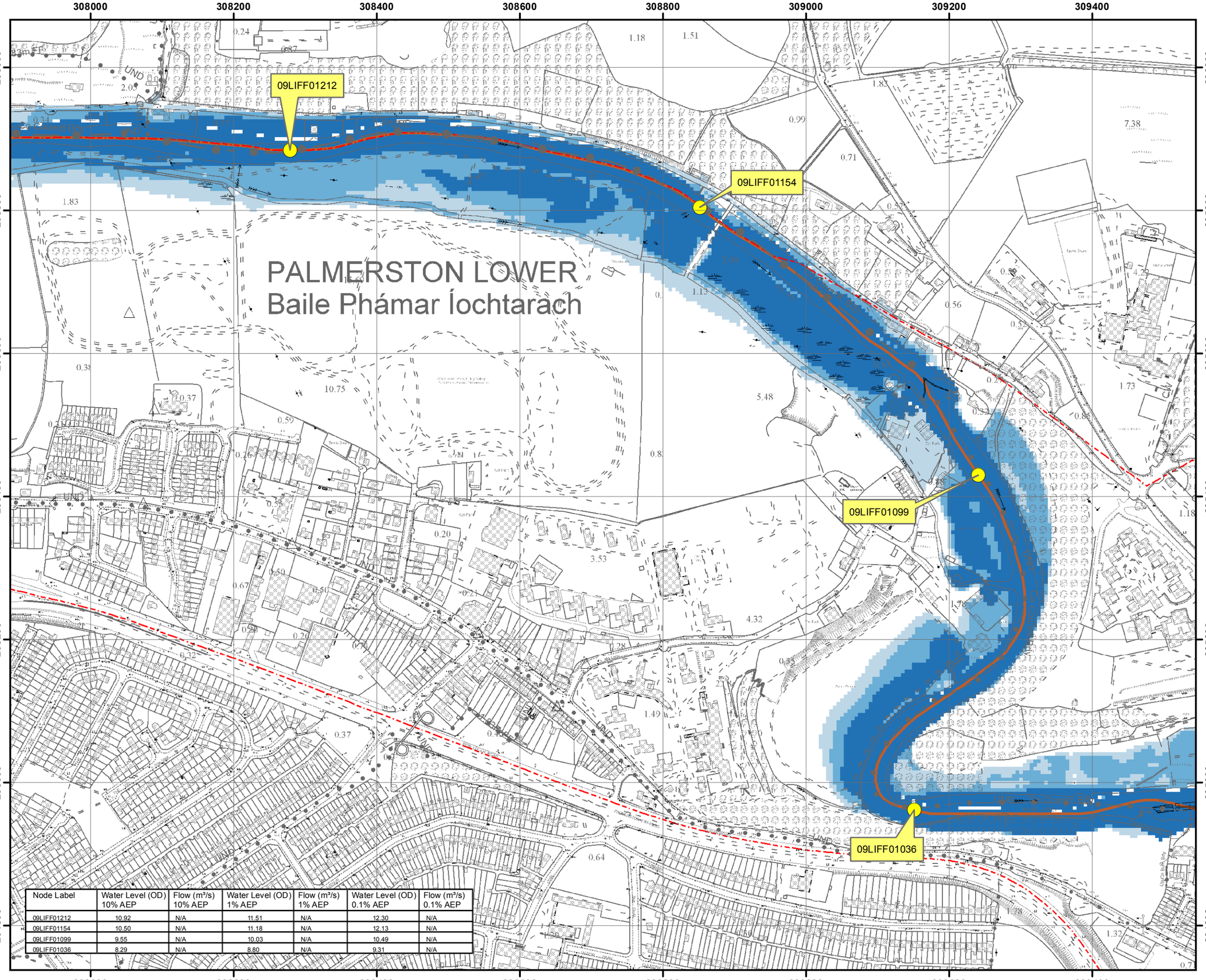
Figure: MDW657_0003

RPS®
RPS Consulting Engineers
West Pier Business Campus
Dun Laoghaire
Co. Dublin
Tel: +353 1 488 2900
Fax: +353 1 462 0814

Issue Details

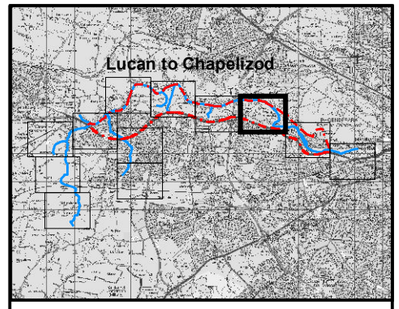
Drawn:	BT	Project No.	MDW0657
Checked:	JH	File Ref	MDW0657QG0010F02
Approved:	JH		
Scale:	1:6000 @ A1	Drawing No.	Projection
Date:	14/01/2016	3 of 26	IG

Notes
1. The viewer of this map should refer to the SFRA Report and Disclaimer



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09LIFF01212	10.92	N/A	11.51	N/A	12.30	N/A
09LIFF01154	10.50	N/A	11.18	N/A	12.13	N/A
09LIFF01099	9.55	N/A	10.03	N/A	10.49	N/A
09LIFF01036	8.29	N/A	8.80	N/A	9.31	N/A

0 50 100 200 300 400 500 Metres



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

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Map:
Lucan to Chapelizod Fluvial Flood Extents

Map Type:	**EXTENT**	
Source:	**FLUVIAL**	
Map Area:	**HPW**	
Scenario:	**CURRENT**	
Drawn By :	**C.C.**	**Date : 27 July 2016**
Checked By :	**S.P.**	**Date : 27 July 2016**
Approved By :	**G.G.**	**Date : 27 July 2016**

Drawing No. :
E09LUC_EXFCD_F0_10

Map Series : Page 10 of 12

Drawing Scale : 1:5,000 @ A3