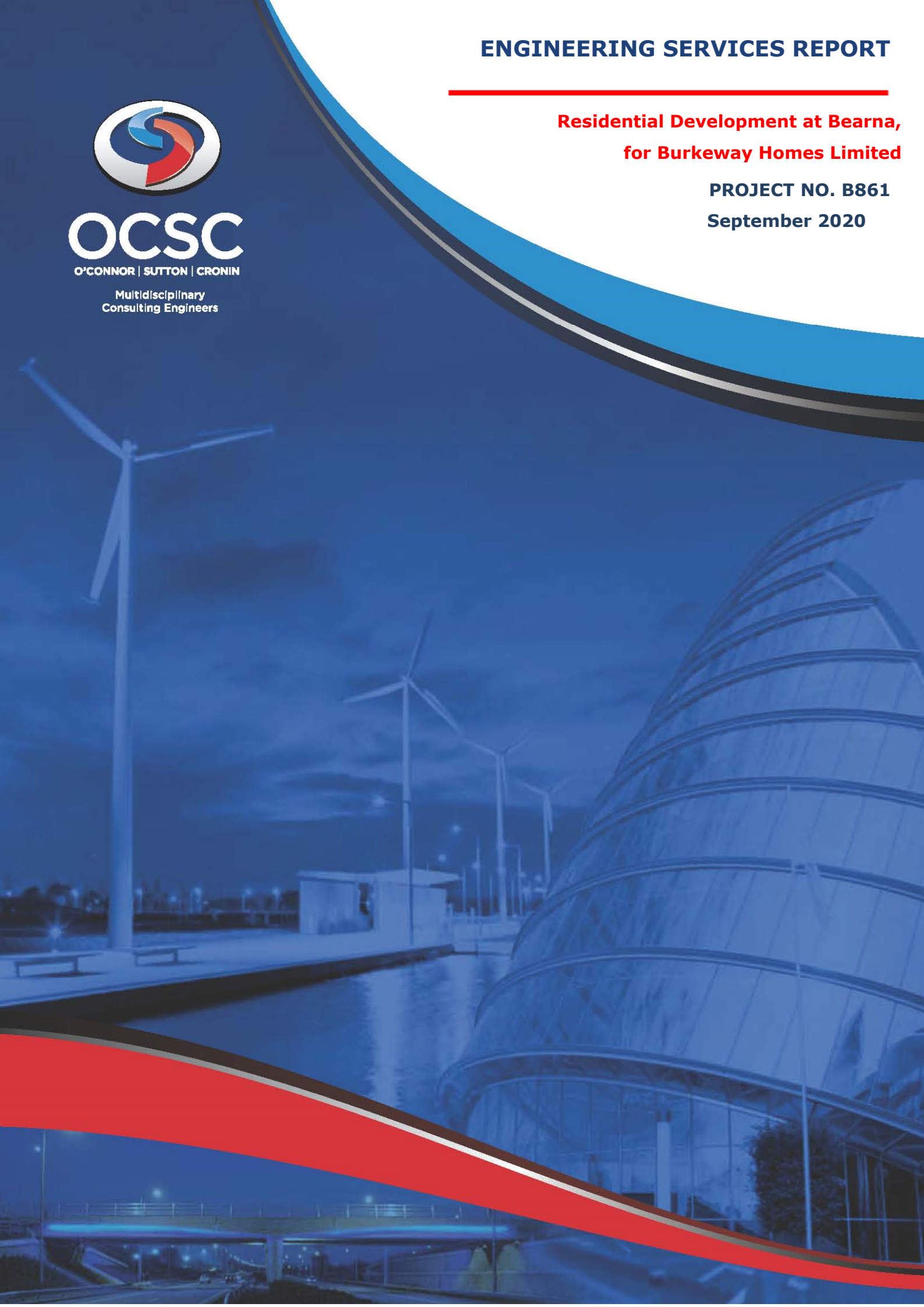
ENGINEERING SERVICES REPORT

Residential Development at Bearna,
for Burkeway Homes Limited

PROJECT NO. B861

September 2020

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary
Consulting Engineers



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1 INTRODUCTION

1.1 Appointment

O'Connor Sutton Cronin & Associates (OCSC) have been appointed by *Burkeway Homes Limited*; to carry out civil and structural engineering design including transportation, roads, drainage, water utilities, and detailed design. The project includes 121 nr. unit residential development and 1nr. crèche and associated services at Bearna, Co. Galway.

1.2 Administrative Jurisdiction

The proposed development is located in the jurisdiction of Galway County Council, and therefore the flood risk assessment was carried out with reference to the following:

- Variation No.2(a) of the Galway County Development Plan (2015 – 2021);
- Greater Dublin Strategic Drainage Study (GDSDS);
- The Planning System and Flood Risk Management Guidelines for Planning Authorities (Department of Environment, Heritage and Local Government and the Office of Public Works);
- Flood Risk Management Plan, Galway Bay North (2018).

It is noted that due to the number of residential units proposed as part of the proposed development, the planning permission is sought through An Bord Pleanála's (ABP) Strategic Housing Development (SHD) application process.

1.3 Site Location

The subject site is located in the northern environs of the Bearna region, which is approximately 7km west of Galway City and approximately 690m north from the Galway Bay northern coastline. The site is immediately bound by:

- Existing residential units to the west and southwest;
- Trusky East Stream, to the east;

- Vacant lands to the north and south.

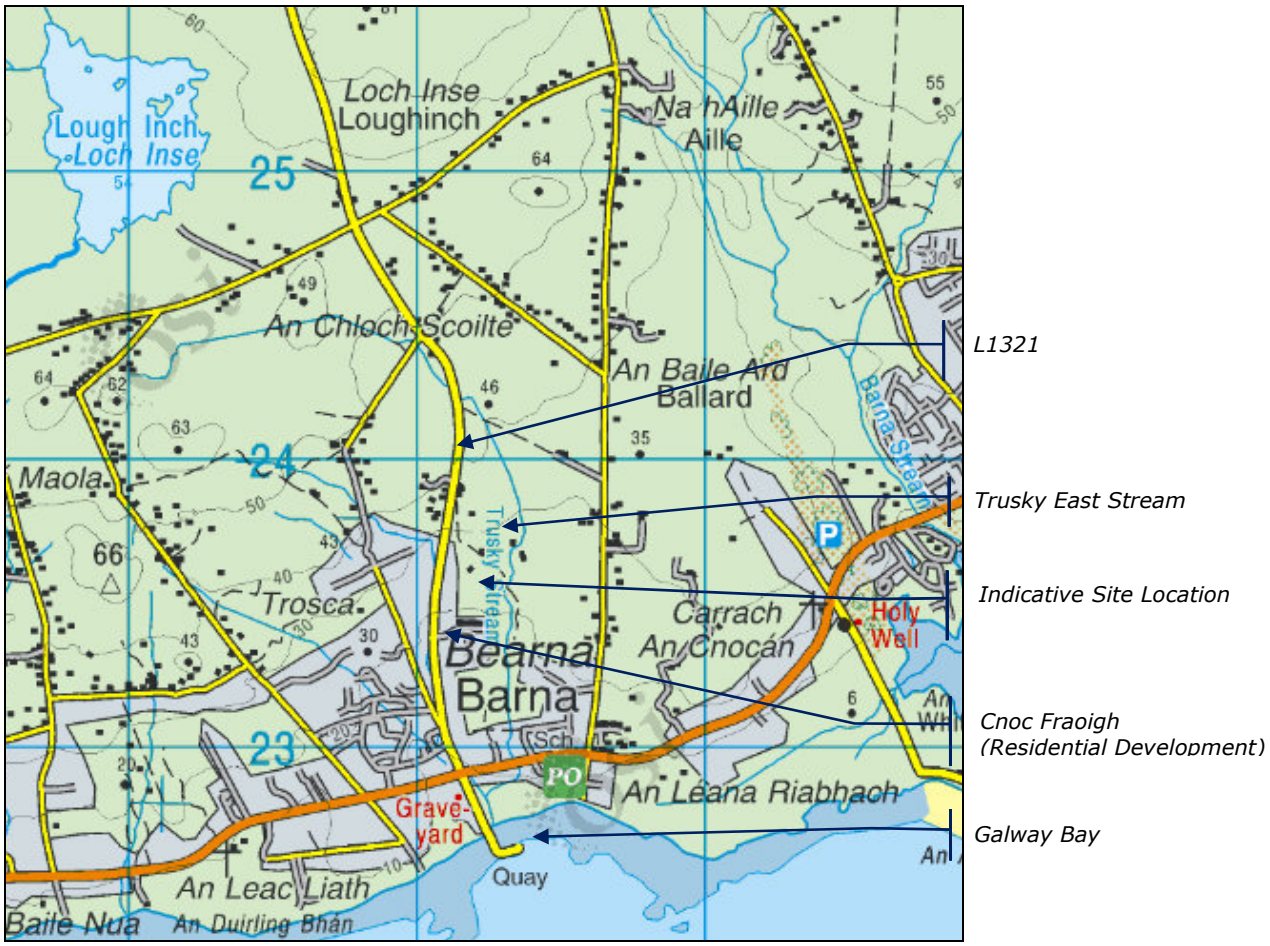


Figure 1.1 - Site Location (www.myplan.ie, discovery series mapping)

1.4 Existing Site Overview

The overall site area is c.5.38 -hectares, the net site area is c.3.47-hectares and is accessed through Cnoc Fraoigh residential estate road, with an approximate level of 16.1m AOD at the entrance. The site is quite steeply graded from the north (+24.0m AOD) to the southeast (+14.5m AOD), with levels along the western boundary typically +22.5m AOD to +15.1m AOD. The Trusky stream is immediately east of the site's boundary, which is similarly steeply graded, from north to south.

The proposed site is currently a green field and is not in use.

1.5 Proposed Development Context

The proposed development will consist of the construction of 121 nr. residential units, a crèche, and associated landscaping and infrastructure. The new residential units are to comprise:

- 52 nr. houses;
- 36 nr. duplexes;
- 33 nr. apartments.

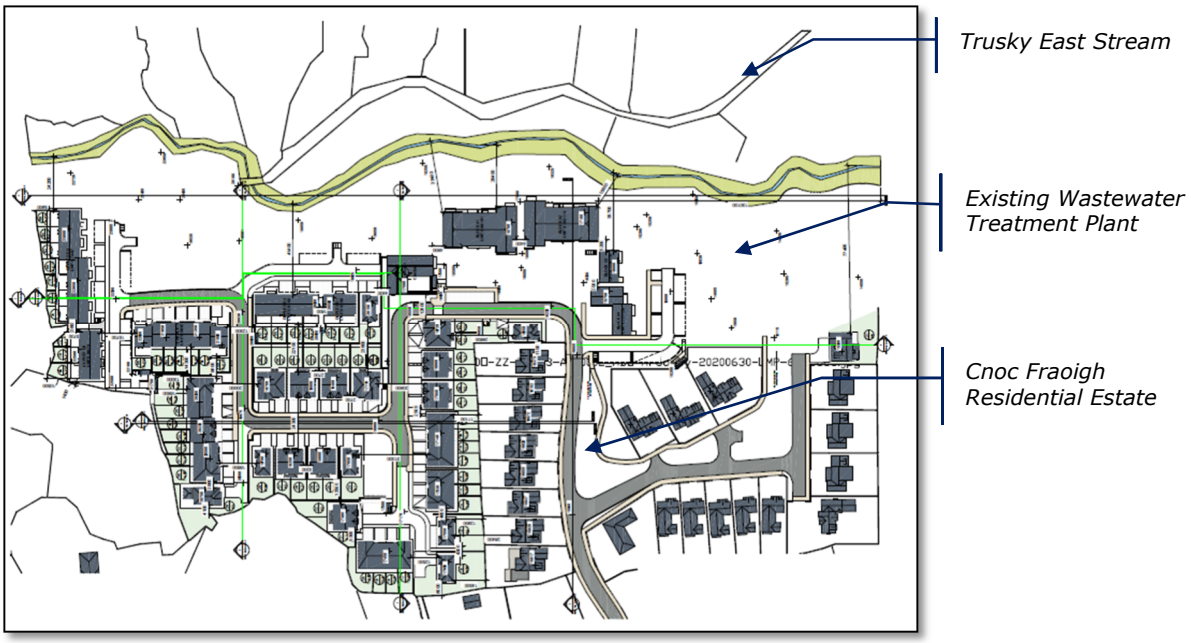


Figure 1.2 - Proposed Site Layout

2 SCOPE OF SERVICES REPORT

This Engineering Services Report was prepared by reviewing the available data from the Local Authority sources and national bodies *i.e.* Galway County Council, Irish Water, The OPW, and the wider design team. The report addresses the following services with respect to the proposed development:

- Surface Water Drainage;
- Wastewater Drainage;
- Potable Water Supply;
- Road Design.

This report should be read in conjunction with the OCSC Civil Engineering design drawings that accompany this submission. The proposed design, for the aforementioned services, have been carried out in accordance with the following technical guidelines and information:

- Galway County Development Plan 2015 - 2021
- Variation No.2(a) Galway County Development Plan 2015-2021;
- Greater Dublin Strategic Drainage Study (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works (GDRCOP);
- Irish Water Code of Practice for Wastewater, IW-CDS-5030-03;
- Irish Water Code of Practice for Water Supply, IW-CDS-5020-03;
- The Building Regulations – Technical Guidance Document Part H;
- BE EN 752 – Drainage Outside Buildings;
- BS 7533-13 – Guide for Design of Permeable Pavements;
- The Office of Public Works, The Planning System & Flood Risk Management;
- Galway County Council and Irish Water Drainage and Water main Records;
- Department of Transport, Design Manual for Urban Streets
- Department of Transport, Traffic Signs Manual.
- DN-PAV-03021: Pavement & Foundation Design;
- GE-STY-01024: Road Safety Audit;
- NRA Design Manual for Roads and Bridges (NRA DMRB);

Members of the wider design team cover all other elements of the application pertaining to traffic, flood risk, sustainability, landscaping, planning and architectural detail.

3 SURFACE WATER DRAINAGE

3.1 Overview

Any planning permission sought on the subject lands are required to adhere to the Local Authority requirements, the Galway County Development Plan 2015-2021 and as such, the Greater Dublin Strategic Drainage Study (Dublin City Council, 2005).

New development must ensure that a comprehensive Sustainable Drainage System, SuDS, is incorporated into the development. SuDS requires that post development run-off rates be maintained at equivalent, or lower, levels than pre-development levels. Thus, the development must be able to retain, within its boundaries, surface water volumes from extreme rainfall events up to a 1 in 100-year rainfall event, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability), *while also allowing for an additional climate change factor of 20% increase in rainfall intensity*. Any new development must also have the physical capacity to retain surface water volumes as directed under the Greater Dublin Strategic Drainage Strategy (GDSDS) and, if necessary, release these attenuated surface water volumes to an outfall at a controlled flow rate.

A further component of the SuDS protocol is to increase the overall water quality of surface water runoff before it enters a natural watercourse or a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of surface water quality.

3.2 Existing Site Drainage

3.2.1 Existing Site Catchment Areas

As detailed in *Section 1.4*, the existing c.3.48-hectare site is currently green field. Refer to Figure 3.1 for aerial image of the proposed site, for context. The site is steeply graded from north to southeast with the prominent Trusky East Stream located alongside the eastern site boundary.

Figure 3.1 - Existing Site, Aerial Overview (Google Earth)

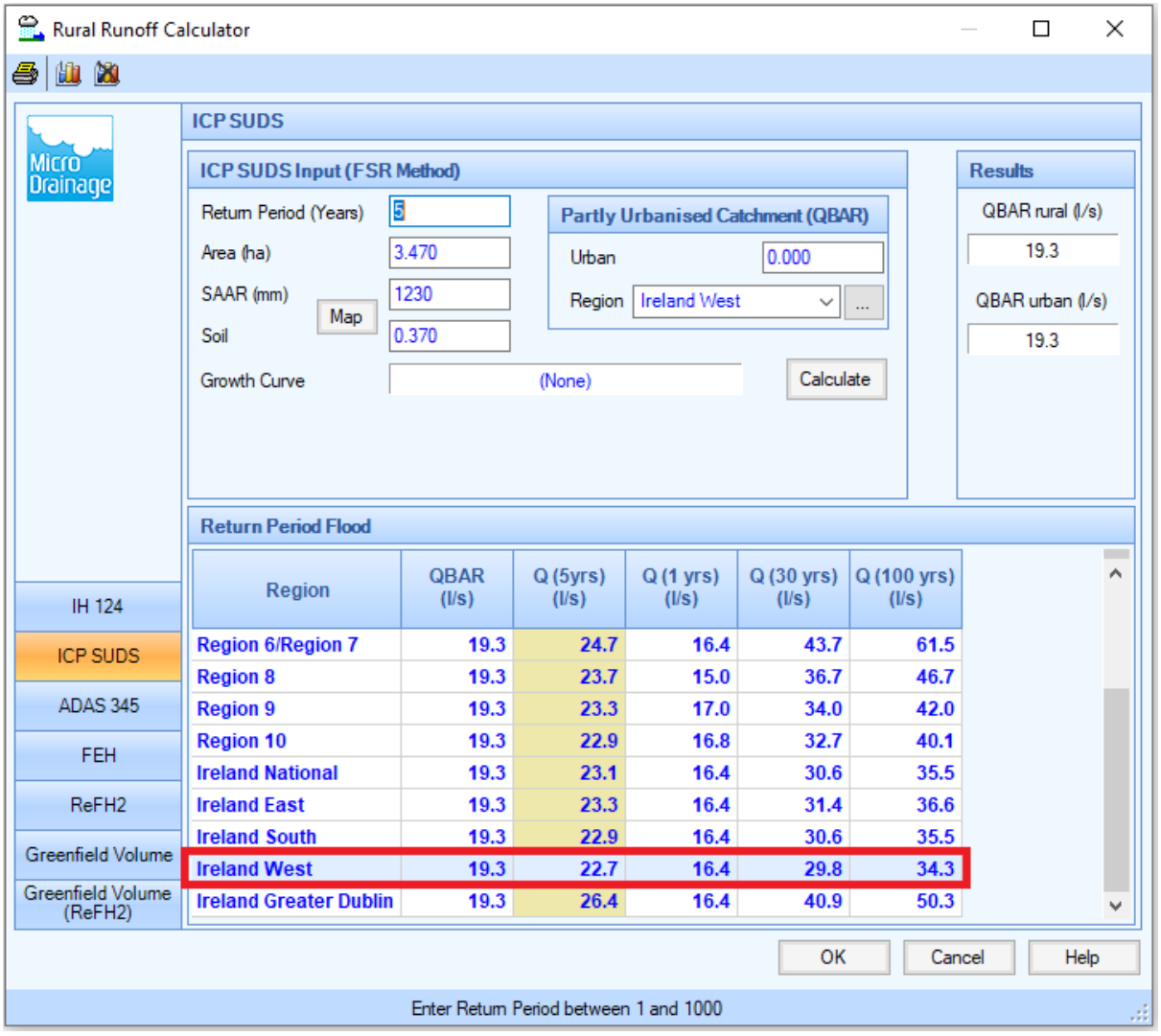
3.2.2 Existing Surface Water Drainage Infrastructure

There is no available existing surface water drainage infrastructure in the vicinity of the proposed development. However, the Trusky East Stream aligns the eastern boundary of the proposed development, which discharges to the sea at the northern coastline of Galway Bay, approximately 690m south from the proposed development site.

3.2.3 Existing Site Rainfall Runoff

All surface water runoff, on the existing site, currently infiltrates to the natural ground or discharges to the Trusky East Stream, which in turn discharges to sea at Galway Bay, approximately 500m south from the proposed development. Refer to *Section 1.4* and *Section 3.3.1* for further details of existing site context.

Using the ICPSuDS Input, (Flood Studies Report (FSR) Method, the rainfall runoff discharging from the greenfield site area that is to be developed in its existing condition has been estimated at $QBAR_{RURAL}$ = 19.3 l/s (**5.5 l/s/ha**). Refer to *Figure 3.2* for an excerpt of the results from the MicroDrainage Runoff Calculator, which also provides the calculated QBAR runoff rate along with the discharge rate for varying Annual Recurrence Intervals (ARI).



Region	QBAR (l/s)	Q (5yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 6/Region 7	19.3	24.7	16.4	43.7	61.5
Region 8	19.3	23.7	15.0	36.7	46.7
Region 9	19.3	23.3	17.0	34.0	42.0
Region 10	19.3	22.9	16.8	32.7	40.1
Ireland National	19.3	23.1	16.4	30.6	35.5
Ireland East	19.3	23.3	16.4	31.4	36.6
Ireland South	19.3	22.9	16.4	30.6	35.5
Ireland West	19.3	22.7	16.4	29.8	34.3
Ireland Greater Dublin	19.3	26.4	16.4	40.9	50.3

Figure 3.2 - Existing Site Runoff Calculator Results (MicroDrainage Excerpt)

3.3 Proposed Surface Water Drainage Design Strategy

3.3.1 Proposed Surface Water Strategy Overview

It is proposed to separate the surface water and wastewater drainage networks, which will serve the proposed development, and provide independent connections to the adjacent watercourse and local wastewater sewer network respectively. Refer to *Section 4* for details of the proposed wastewater drainage design.

3.3.2 Proposed Surface Water Design Criteria

The proposed surface water network has been designed in accordance with the regulations and guidelines outlined in *Section 2*. Rainfall design data, such as return period rainfall depths for sliding durations and the standard annual average rainfall (SAAR) value were sourced from Met Éireann.

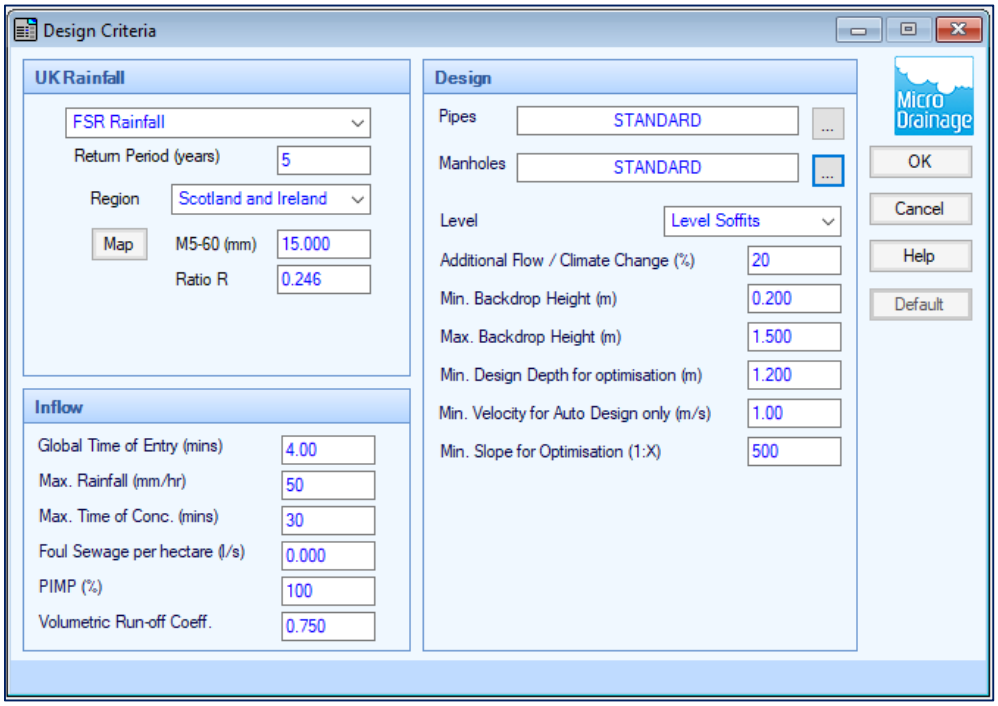


Figure 3.3 – Surface Water Design Criteria (MicroDrainage Excerpt)

As indicated in *Figure 3.3*, the proposed network was designed to allow for an additional 20% increase in rainfall intensity, to allow for Climate Change, in accordance with the Galway County Council Development Plan and the GDSDS.

3.3.3 Proposed Surface Water Catchment Areas

Due to the natural topography of the existing site, the proposed development has been divided into two independent surface water catchments (Catchment 1 and Catchment 2), each discharging attenuated flows to the Trusky East Stream. Refer to design layout drawing **B861-OCSC-XX-XX-C-DR-0501** for information.

For the purpose of the surface water network design simulation, we have considered all external (roads, pavement, and roofs) areas as being 100% impermeable, with car parking bays that are comprised of permeable paving with a drainage layer base course being assigned 80% impermeability. A *winter* global runoff coefficient, C_v, of 0.84, in accordance with the HR Wallingford and Modified Rational Method for runoff is applied.

3.3.4 Proposed Development Rainfall Runoff

It is proposed to reduce and restrict the rainfall runoff, discharging from the proposed development, to the greenfield equivalent, $QBAR_{RURAL}$, runoff rate, as per the FSR ICP SuDS method, which is based on the IH124 method for catchments smaller than 25km^2 in area.

This is to be achieved with the provision of a flow restrictor (Hydro-Brake Optimum by Hydro-International, or similar approved) prior to discharging to the existing open drains at the north western corner of the site, with the appropriate measures of attenuation provided. Sub-catchment flow-control devices and associated attenuation are also to be strategically provided, in order to maximise SuDS benefits and avail of the central open space for preliminary attenuation.

Refer to *Figure 3.2* for an excerpt from the results MicroDrainage Runoff Calculator for the development catchment area (c.3.47-hectares), which indicates the greenfield equivalent, $QBAR_{RURAL}$, value of **19.3 l/s** (5.5 l/s/ha)

along with the calculated runoff for varying Average Recurrence Intervals (ARI).

3.3.5 Proposed Surface Water Pipe Network Design

The overall surface water drainage system, serving the proposed development, is to consist of a gravity sewer network that will convey runoff from the roofs and paved areas to the outfall manholes, which will discharge controlled flow rates to the Trusky East Stream, to the east of the proposed development.

The proposed piped-network has been designed in accordance with BS EN 752 and all new infrastructure is to be compliant with the requirements of the GDSDS and the GDRCOP for Drainage Works, with minimum full bore velocities of 1.0 m/s achieved throughout.

All main surface water carrier pipes have been sized to ensure no surcharging of the proposed drainage network for rainfall events up to, and including, the 1 in 5-year ARI event, with a projected climate change allowance of 20% increase in rainfall intensity.

3.3.6 Proposed Surface Water Attenuation Storage

Temporary underground attenuation is to be provided at two separate locations, in order to restrict discharge rates from the development's surface water network to the greenfield equivalent flow rate. The attenuation has been designed to temporarily store the surface water runoff for design rainfall events up to, and including, the 1% AEP with a 20% increase in rainfall intensity.

This is to be provided in the form of underground cellular storage units, such as the Stormtech DC-780 Storage Chambers, with cl/503 material surround, or similar approved. An isolator row and manifold pipe will be provided as part of the attenuation system, in order which provide for a more efficient system and quality access for inspection and maintenance.

3.4 Specific SuDS Measures Proposed

The proposed development is to contain the following measures of Sustainable Drainage Systems:

Limiting discharge. The design outflow from the overall development (c.3.47ha development catchment) is to be restricted to a maximum total outflow rate of **19.3 l/s** (5.5 l/s/ha), which is the equivalent greenfield runoff. Refer to *Section 3.2.3 and Section 3.3.4* for further details.

Attenuation Storage will be provided using underground proprietary storage units, as outlined in *Section 3.4.6*. this is to be provided at two strategic locations, in order to temporarily store excessive surface water, due to the restricted flow rates, during rainfall events up to, and including the design 1% AEP with a 20% additional allowance for climate change.

Pervious Paving is to be provided for all in-curtilage car parking (i.e. driveways), which will have a layer of drainage stone underneath. This will attenuate rainfall runoff from each property prior to entering the main surface water drainage network. This is to comprise permeable paviours, or alternative pervious finish.

The car parking area, located in the southern end of the site, is to comprise pervious paving finish, which will be allowed free drain naturally to the underlying soil. This is to be finished at a level similar, or lower, than existing, so as not to affect the floodplain.

Water Quality of the surface water, discharging from site, is to be improved with the following provisions:

- Pervious Paving in all private driveways, as described above;
- Intensive landscaping, where practical;
- Trapped gullies on all roads, to trap silt and gross pollutants;
- Silt traps to be provided on manholes immediately upstream of attenuation systems, as a further preventative measure to trap silt and other gross pollutants;
- Bypass fuel separator to be provided prior to discharging from site.

3.5 Taking in Charge

It is proposed that all new surface water infrastructure, **is** to be offered to be taken in charge by Galway County Council. Refer to the architect's design drawings for confirmation of extent of areas to be taken in charge.

3.6 Maintenance

Road gullies, flow control devices and attenuation systems, should be maintained, as appropriate and in accordance with manufacturer's recommendations and guidelines.

3.7 Surface Water Impact Assessment

The design criteria for the drainage system are established in GDSDS-RDP Volume 2, Section 6.3.4 and explained further in GDSDS-RDP Volume 2, Appendix E. There are four design criteria, each of which has been considered for the subject site:

- River Water Quality Protection;
- River Regime Protection;
- Level of Service (flooding) for the site and;
- River Flood Protection.

3.8 Criterion 1 – River Water Quality Protection

It is proposed that the overall drainage system, serving this development, will contain a range of surface water treatment methods, as outlined previously in *Section 3.4,* which will improve the quality of surface water being discharged from the proposed development.

Gross pollutants, sediments, hydrocarbons, and other impurities, will be removed at source with the following provisions:

a) Permeable Paving to all in-curtilage car parking areas;
b) Intensive landscaping, where practicable;
c) Silt-traps prior to attenuation storage area.
d) All road gullies are to be trapped;
e) Fuel separator prior to discharge from the development.

3.9 Criterion 2 – River Regime Protection

Surface water discharge from the overall development will be restricted to the greenfield equivalent rural runoff rate of **19.3 l/s** (5.5 l/s/ha), as per the Galway County Council Development Plan and the GDSDS. Refer to *Section 3.3.4* for further details.

This will be achieved with the provision of a flow restrictor (Hydro-Brake Optimum, by Hydro-International, or similar approved) upstream of the outfall manhole.

Refer also to **Appendix A** for results $QBAR_{RURAL}$ calculation results, which have been carried out using the ICP SUDS Method on MicroDrainage software.

3.10 Criterion 3 – Level of Service (Flooding) Site

There are four sub-criteria for the required level of service, for a new development; as set out in the *GDSDS Volume 2, Section 6.3.4 (Table 6.3).*

- No flooding on site except where planned (30-year high intensity rainfall event);
- No internal property flooding (100-year high intensity rainfall event);
- No internal property flooding (100-year river event and critical duration for site) and;
- No flood routing off site except where specifically planned. (100-year high intensity rainfall event).

3.10.1 Sub-Criterion 3.1

The surface water drainage systems, serving the proposed development, have been designed to accommodate the 100-year return period rainfall event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding. Therefore, the system has capacity for the 30-year return period rainfall event without flooding.

The performance of the proposed drainage system has been analysed for design rainfall events up to, and including, the 1% AEP event (incl. 20% climate change allowance) using the *MicroDrainage Network Design*

Software, by Innovyze Inc. Refer to **Appendix B** for details of design criteria, calculations and results. The analyses indicate that no flooding will occur for design rainfall events up to, and including, the 1% AEP.

3.10.2 Sub-Criterion 3.2

The surface water drainage systems, serving the proposed development, have been designed to accommodate the 100-year return period rainfall event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding.

The performance of the proposed drainage system in 100-year return period storm events (incl. 20% climate change allowance) has been analysed – Refer **Appendix B** for calculations. The analyses show that no flooding will occur in 100-year return period storm events.

3.10.3 Sub-Criterion 3.3

Details of the potential flood risk associated with the proposed development is outlined in a Site Specific Flood Risk Assessment, which is submitted under separate cover, as part of this application. The assessment indicates that there is no apparent risk of internal property flooding for a design 100-year return period pluvial rainfall event (including 20% climate change allowance).

3.10.4 Sub-Criterion 3.4

The surface water drainage systems, serving the proposed development, have been designed to accommodate the 100-year return period rainfall event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding, so no flood routing off site will be experienced for such a rainfall event.

The performance of the proposed drainage system in 100-year return period storm events (incl. 20% climate change allowance) has been analysed – Refer **Appendix B** for calculations. The analyses show that no flooding will occur in 100-year return period storm events.

Details of the flood risk assessment associated with the proposed development is reviewed in the Site Specific Flood Risk Assessment, which is submitted under separate cover, as part of this application. This assessment, along with the network design simulation results, from the MicroDrainage Network Analysis, indicates that no internal property flooding will occur in a 100-year return period fluvial flood event (including 20% climate change allowance).

3.11 Criterion 4 – River Flood Protection

As outlined in *Section 3.10* (Criterion 2), the surface water runoff from the development's catchment will be limited to **19.3 l/s** (5.5 l/s/ha).

Refer to *Section 3.4.3* and *Section 3.7* for further details on the limiting discharge rates. The *GDSDS Volume 2, Appendix E* states that this practice ensures *"that sufficient stormwater runoff retention is achieved to protect the river during extreme events".*

Attenuation storage is to be provided for the 100-year return period rainfall event (including an increased 20% rainfall intensity; to allow for climate change). Discharge from site is to be achieved through the use of a vortex flow control device (e.g. Hydro-Brake Optimum, by Hydro-International, or similar approved), which will reduce the risk of blockage present with other flow devices.

Refer to **Appendix B** for details of hydraulic modelling calculations of attenuation and flow control facilities, as carried out using MicroDrainage software by Innovyze Inc.

4 WASTEWATER DRAINAGE

4.1 Overview

All proposed wastewater sewer design has been carried out in accordance with Irish Water's Code of Practice for Wastewater Infrastructure. The existing site is currently a green field, with no existing wastewater discharge to the public wastewater infrastructure.

A Pre-Connection Enquiry Form *(**IW Ref Nr. CDS19008110**)* was submitted to Irish Water for a total of 120nr. domestic units, with confirmation of feasibility confirmed by return of letter. Refer to **Appendix D** for a copy of the Confirmation of Feasibility letter, as issued on 21st November 2019.

Following further detailed design and correspondence with Irish Water, a Statement of Design Acceptance for the proposed development's wastewater network was issued by Irish Water on 10th July 2020, approving the proposed development's wastewater network. Refer to **Appendix D** for a copy of the Statement of Design Acceptance letter.

4.2 Existing Wastewater Drainage

The Cnoc Fraoigh residential development is currently served by a gravity network that discharges to a wastewater treatment plant and percolation area, located to the south of the proposed development.

4.3 Proposed Wastewater Drainage Network

It is proposed to separate the wastewater and surface water drainage networks, which will serve the proposed development, and provide independent connections to the local public foul sewer and existing open ditch watercourse respectively. Please refer to *Section 3* for details of the proposed surface water drainage design strategy.

The wastewater drainage from each dwelling is to connect to a gravity pipe network that will extend through Cnoc Fraoigh, to the public wastewater infrastructure located at L1321.

Following the connection of the development's wastewater drainage network to the public infrastructure on the L1321, as described, it is proposed to decommission the existing public wastewater treatment plant that is currently serving Cnoc Fraoigh residential development, by directing the existing wastewater network to a new wastewater pumping system.

This proposed wastewater pumping system will be a Type 3 system (greater than 20nr. houses), which will be designed and installed in accordance with Irish Water's Code of Practice for Wastewater Infrastructure, and is to serve the existing 21nr. residential units along with the proposed single residential unit nr. 121.

The pumping system is to be sited at a distance greater than 15m from any residential property, as noted on the design drawings, and in accordance with Irish Water's requirements. It is noted that the proposed location is within the indicative extent of the Trusky East Stream's Flood Extent, as per Variation 2(a) of the Galway County Development Plan, however, a more detailed flood study of the Trusky East Stream's catchment and predicted flood extent indicates that this location is outside of the predicted flood extent. Therefore, the proposed location of the wastewater pumping system is not considered susceptible to flooding, and has no also impact on the floodplain.

The above design proposal is to ensure that all residential units in the local area (proposed and existing) are to be served by public infrastructure and allow for the decommissioning of the existing wastewater treatment plant.

All proposed wastewater infrastructure is to be carried out in accordance with the Building Regulations Part H and Irish Water's Code of Practice for Wastewater Infrastructure.

4.4 Taking In Charge

All new wastewater drainage infrastructure installed to serve the proposed development **is** to be offered to Irish Water for to be taken-in-charge.

4.5 Calculations

As outline earlier, it is proposed to discharge the wastewater flows, from the proposed development, to the existing wastewater sewer at Cnoc Fraoigh, adjacent to the proposed development, with a short section of the existing to be realigned at a lower level to accommodate the connection.

The **total peak design flow** from this proposed development has been calculated as **3.7 l/s**. Refer to **Appendix C** for wastewater loading calculations and network design tables.

Please refer to **Appendix C** for details of foul drainage flow rate calculations, which have been carried out in accordance with Irish Water's Code of Practice for Wastewater Infrastructure, IW-CDS-5030-03.

5 POTABLE WATER SUPPLY

All proposed potable water design has been carried out in accordance with Irish Water's Code of Practice for Water Infrastructure, IW-CDS-5020-03.

A Pre-Connection Enquiry Form *(**IW Ref Nr. CDS19008110**)* was submitted to Irish Water for a total of 120nr. domestic units, with confirmation of feasibility confirmed by return of letter. Refer to **Appendix D** for a copy of the Confirmation of Feasibility letter, as issued on 21st November 2019.

Following further detailed design and correspondence with Irish Water, a Statement of Design Acceptance for the proposed development's water main network was issued by Irish Water on 10th July 2020, approving the proposed development's water main network. Refer to **Appendix D** for a copy of the Statement of Design Acceptance letter.

5.1 Connection to the Existing Network

It is proposed to provide a 150mm high density polyethylene connection to the existing water main at Cnoc Fraoigh, in order to serve the development.

Unit Nr. 121 (only), which is isolated from the main development, is to connect independently, via a 25mm service connection, to the existing water main network at Cnoc Fraoigh.

The proposed connection is to be carried out in accordance with Irish Water's Code of Practice for Water Infrastructure, following agreement with Irish Water, with a bulk water meter to be provided at the development's entrance.

5.2 Water Saving Devices

Water saving devices are to be considered for use within the proposed development units, in order to conserve water, as part of the internal fit-out.

5.3 Water Meters

A bulk water meter is to be provided at the connection to the public water main, at the development entrance, with individual boundary box meters provided at the connection to each individual property.

6 ROAD DESIGN

6.1 Road Design Standards

The roads elements of this project are designed to comply with the following standards. It is noted that the Design Manual for Urban Roads and Streets (DMURS) is the principle design guideline for this scheme. The list of the main standard documents relied upon, using the most up to date available version, is as follows:

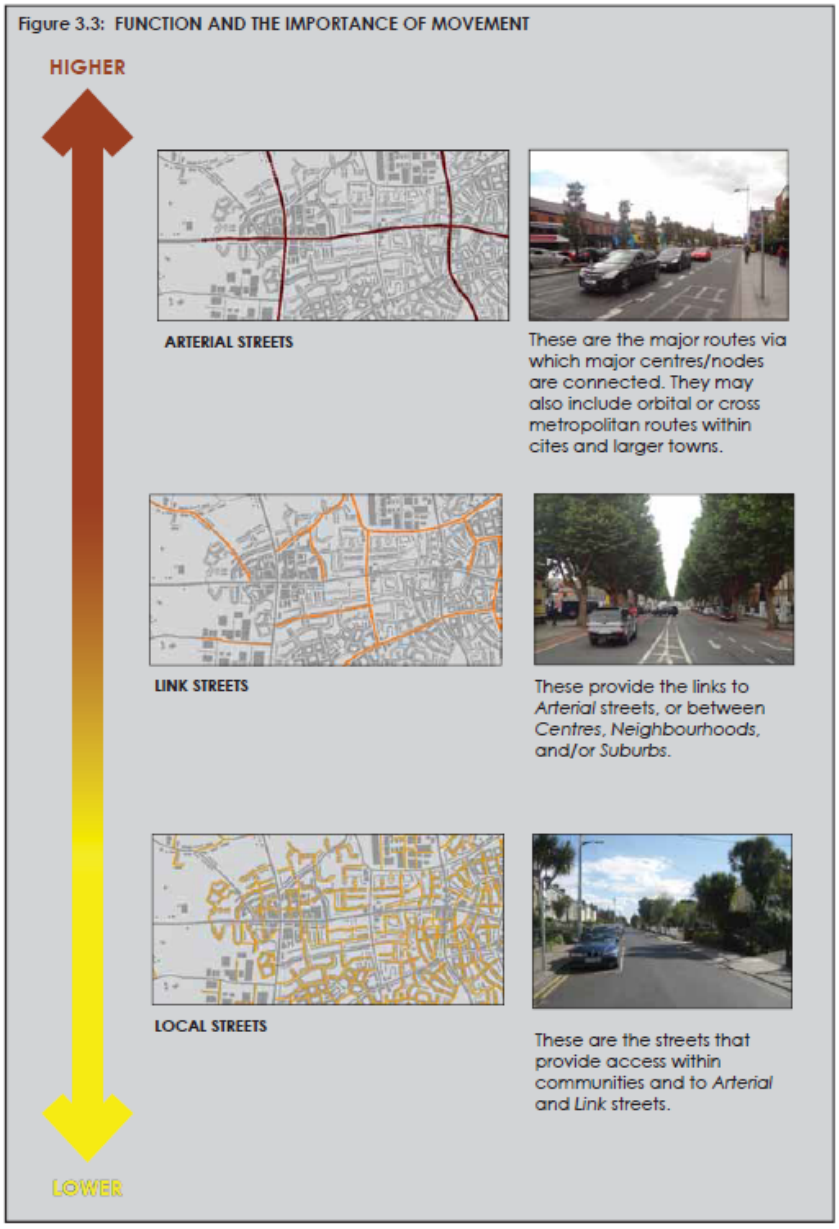
- DMURS;
- National Cycle Manual;
- Traffic Signs Manual 2010 with Amendments (July 2013);
- DN-PAV-03021: Pavement & Foundation Design;
- GE-STY-01024: Road Safety Audit;
- NRA Design Manual for Roads and Bridges (NRA DMRB);

6.2 Road Classification

The movement function of a street is described on DMURS using a hierarchy system that classifies streets into the following categories, as shown in DMURS *(refer excerpt in Figure 6.1)*:

- Arterial Streets;
- Link Streets;
- Local Streets.

Refer also to **Appendix E** for a technical note on proposed road works associated with the new footpath to be constructed alongside the L1321, towards Bearna Village.



Based on the above, the internal roads will be classified as **Local Streets** as they provide access to the dwellings within the proposed development and to Cnoc Fraoigh.

Table 3.1 of DMURS illustrates how this road hierarchy relates to other relevant documents.

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 3.1: Terminology used within this Manual compared with other key publications.

6.3 Road Design Speeds

The design speed is the maximum speed at which it is envisaged/intended that the majority of vehicles will travel under normal conditions.

The Design Speed for the internal network will be 10-30kph in compliance with Table 4.1 of DMURS that illustrates the broader application of design speeds according to Context and Function.

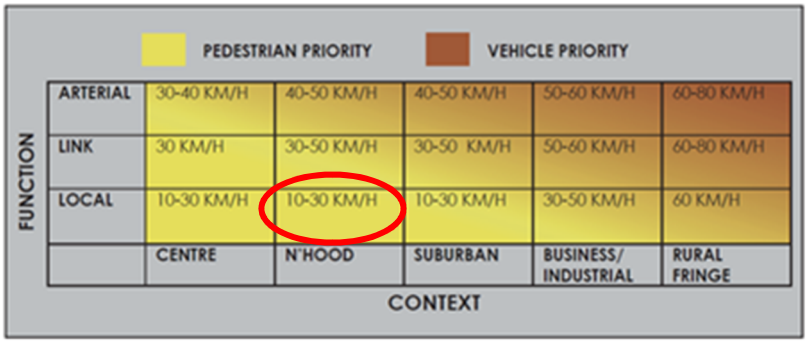


Table 4.1: Design speed selection matrix indicating the links between place, movement and speed that need to be taken into account in order to achieve effective and balanced design solutions.

Figure 6.3.1 – Design Speed Selection Matrix (DMURS)

It should be noted that 30 Kph speed limit signs have been included at each entrance to warn drivers accessing the development about new speed zone.

6.4 Horizontal and Vertical Geometry

The road alignments will be designed so that the geometric elements, including horizontal and vertical curvature, super elevation and sight distance will be in line with DMURS, having values consistent with the design speeds.

The relevant horizontal and vertical geometric design values are highlighted in DMURS *Table 4.3* below. A standard carriageway cross fall of 2.5% will be adopted throughout with super elevation applied if necessary, noting that adverse camber is allowable under DMURS designs in accordance with *Table 4.3,* copied below.

HORIZONTAL CURVATURE

Design Speed (km/h)	10	20	30	40	50	60
Minimum Radius with adverse camber of 2.5%	-	11	26	56	104	178
Minimum Radius with superelevation of 2.5 %	-	-	-	46	82	136

VERTICAL CURVATURE

Design Speed (km/h)	10	20	30	40	50	60
Crest Curve K Value	N/A	N/A	N/A	2.6	4.7	8.2
Sag Curve K Value	N/A	N/A	2.3	4.1	6.4	9.2

Table 4.3: Carriageway geometry parameters for horizontal and vertical curvature.

Figure 6.4.1 – Curvature Minimums for Alignment Design (DMURS)

6.5 Cross Section

The carriageway widths have been selected in accordance with *Section 4.4.1* and *Figure 4.55* of DMURS (refer excerpt overleaf). The carriageway width varies from 5.5m for the main access to 4.8m for the remaining local roads.

Refer to **Appendix E** for a technical note on proposed road width associated with the new footpath to be constructed alongside the L1321, towards Bearna Village.

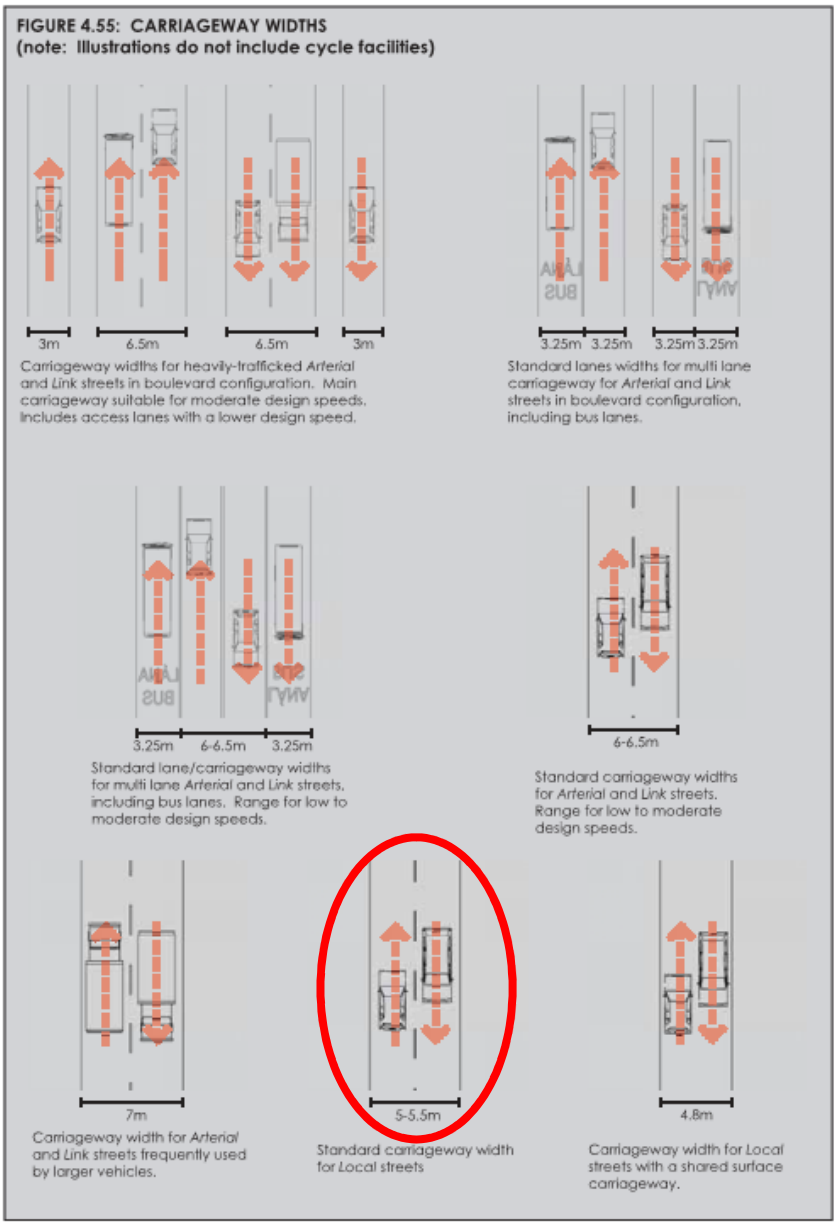


Figure 6.5.1 – Carriageway Width Selection Table (DMURS)

The width of the footpaths is determined by reference to DMURS *Section 4.3.1* with a minimum required width of 1.8m based on the space needed for two wheelchairs to pass each other. However, in most cases a footpath width of 2m has been provided throughout the development. Refer to design drawing B861-OCSC-XX-XX-C-DR-0702 for typical section detail.

6.6 Proposed Development Access

The development is to be accessed via the existing Cnoc Fraoigh residential development as a continuation of an existing temporary Cul de Sac. Therefore, sightlines are not an issue.

6.7 Road Safety Audit

A Road Safety Audit Stage 1 (or 1/2) has been carried out and the Road Safety Audit report is attached in **Appendix F** of this report. The Engineer's response to the Audit is also attached in the same appendix, this has been signed off and agreed with the RSA Audit team. Items 1, 2, and 4 of the RSA have been addressed in the drawings. It is confirmed that item 3 of the RSA will be incorporated in the compliance and "For Construction" drawings

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APPENDIX A. QBAR RUNOFF CALCULATIONS

Appendix A

QBAR Runoff Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	5	SAAR (mm)	1230	Urban	0.000
Area (ha)	3.470	Soil	0.370	Region Number	Ireland West

Results l/s

QBAR Rural	19.3
QBAR Urban	19.3
Q5 years	22.7
Q1 year	16.4
Q30 years	29.8
Q100 years	34.3

APPENDIX B. SURFACE WATER DESIGN & ATTENUATION CALCULATIONS

- Design Criteria;
- Area Summary;
- Network Design & Results Table;
- Simulation Criteria;
- Hydrobrake / Controls & Storage Design;
- Summary of Results.

Appendix B

Surface Water Design and Attenuation Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Water

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	15.000	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.246	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	20	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Time Area Diagram for Surface Water at outfall SW-OUTFALL A (pipe SW-1.004)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.372	4-8	0.387

Total Area Contributing (ha) = 0.760

Total Pipe Volume (m³) = 20.493

Time Area Diagram at outfall SW-OUTFALL B (pipe SW-6.012)

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.037	4-8	0.724	8-12	0.268

Total Area Contributing (ha) = 1.029

Total Pipe Volume (m³) = 47.022

Network Design Table for Surface Water

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SW-1.000	31.772	0.187	170.0	0.081	4.00	0.0	0.600	o	225	Pipe/Conduit	
SW-2.000	25.769	0.385	67.0	0.085	4.00	0.0	0.600	o	225	Pipe/Conduit	
SW-1.001	8.568	0.306	28.0	0.082	0.00	0.0	0.600	o	225	Pipe/Conduit	
SW-1.002	16.637	0.098	170.0	0.033	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-1.003	33.002	0.066	500.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-3.000	40.834	0.167	245.0	0.133	4.00	0.0	0.600	o	300	Pipe/Conduit	
SW-3.001	15.686	0.064	245.0	0.047	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-4.000	83.356	0.340	245.0	0.197	4.00	0.0	0.600	o	300	Pipe/Conduit	
SW-3.002	19.091	0.078	245.0	0.030	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SW-1.000	50.00	4.53	21.446	0.081	0.0	0.0	2.2	1.00	39.8	13.1
SW-2.000	50.00	4.27	21.309	0.085	0.0	0.0	2.3	1.60	63.6	13.8
SW-1.001	50.00	4.59	20.924	0.247	0.0	0.0	6.7	2.48	98.7	40.1
SW-1.002	50.00	4.82	20.377	0.280	0.0	0.0	7.6	1.20	85.0	45.4
SW-1.003	50.00	5.61	18.296	0.280	0.0	0.0	7.6	0.70	49.2	45.4
SW-3.000	50.00	4.68	19.072	0.133	0.0	0.0	3.6	1.00	70.7	21.6
SW-3.001	50.00	4.94	18.905	0.180	0.0	0.0	4.9	1.00	70.7	29.2
SW-4.000	50.00	5.39	19.320	0.197	0.0	0.0	5.3	1.00	70.7	32.0
SW-3.002	50.00	5.71	18.841	0.407	0.0	0.0	11.0	1.00	70.7	66.1

Network Design Table for Surface Water

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SW-5.000	20.310	0.472	43.0	0.074	4.00	0.0	0.600	o	225	Pipe/Conduit	
SW-3.003	3.798	0.012	305.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
SW-1.004	47.579	0.280	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SW-6.000	12.212	0.113	108.0	0.056	4.00	0.0	0.600	o	225	Pipe/Conduit	
SW-6.001	8.188	0.048	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SW-7.000	14.637	0.505	29.0	0.091	4.00	0.0	0.600	o	225	Pipe/Conduit	
SW-6.002	35.102	0.143	245.0	0.138	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-6.003	9.670	0.039	245.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SW-5.000	50.00	4.17	20.040	0.074	0.0	0.0	2.0	2.00	79.5	12.0
SW-3.003	50.00	5.77	18.688	0.480	0.0	0.0	13.0	1.03	114.0	78.1
SW-1.004	50.00	4.79	18.230	0.000	4.2	0.0	0.7	1.00	39.8	4.2
SW-6.000	50.00	4.16	15.724	0.056	0.0	0.0	1.5	1.26	50.0	9.1
SW-6.001	50.00	4.30	15.611	0.056	0.0	0.0	1.5	1.00	39.8	9.1
SW-7.000	50.00	4.10	16.157	0.091	0.0	0.0	2.5	2.44	97.0	14.8
SW-6.002	50.00	4.88	15.488	0.285	0.0	0.0	7.7	1.00	70.7	46.3
SW-6.003	50.00	5.04	15.344	0.285	0.0	0.0	7.7	1.00	70.7	46.3

Network Design Table for Surface Water

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SW-8.000	60.738	2.641	23.0	0.280	4.00	0.0	0.600	o	225	Pipe/Conduit	
SW-6.004	46.095	0.151	305.0	0.131	0.00	0.0	0.600	o	375	Pipe/Conduit	
SW-6.005	7.116	0.023	305.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
SW-6.006	19.473	0.097	200.0	0.063	0.00	0.0	0.600	o	375	Pipe/Conduit	
SW-9.000	10.992	0.045	245.0	0.053	4.00	0.0	0.600	o	300	Pipe/Conduit	
SW-9.001	46.894	0.191	245.0	0.068	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-6.007	20.345	0.050	405.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
SW-10.000	4.531	0.027	170.0	0.063	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SW-8.000	50.00	4.37	17.830	0.280	0.0	0.0	7.6	2.74	108.9	45.4
SW-6.004	50.00	5.79	15.039	0.695	0.0	0.0	18.8	1.03	114.0	113.0
SW-6.005	49.94	5.90	14.888	0.695	0.0	0.0	18.8	1.03	114.0	113.0
SW-6.006	49.15	6.16	14.664	0.759	0.0	0.0	20.2	1.28	141.1	121.2
SW-9.000	50.00	4.18	14.798	0.053	0.0	0.0	1.4	1.00	70.7	8.7
SW-9.001	50.00	4.96	14.753	0.121	0.0	0.0	3.3	1.00	70.7	19.7
SW-6.007	48.15	6.50	14.412	0.880	0.0	0.0	22.9	1.00	159.7	137.6
SW-10.000	50.00	4.08	16.899	0.063	0.0	0.0	1.7	1.00	39.8	10.2

Network Design Table for Surface Water

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SW-6.008	59.235	0.118	500.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
SW-11.000	14.506	0.059	245.0	0.087	4.00	0.0	0.600	o	300	Pipe/Conduit	
SW-6.009	25.897	0.106	245.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-6.010	31.628	0.129	245.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-6.011	37.322	0.152	245.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-12.000	12.146	0.050	245.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
SW-12.001	44.000	0.180	245.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-6.012	48.013	0.196	245.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SW-6.008	45.23	7.59	14.361	0.942	0.0	0.0	23.1	0.90	143.5	138.5
SW-11.000	50.00	4.24	14.400	0.087	0.0	0.0	2.3	1.00	70.7	14.1
SW-6.009	50.00	4.43	14.243	0.000	15.0	0.0	2.5	1.00	70.7	15.0
SW-6.010	50.00	4.96	14.137	0.000	15.0	0.0	3.0	1.00	70.7	18.0
SW-6.011	50.00	5.58	14.008	0.000	15.0	0.0	3.0	1.00	70.7	18.0
SW-12.000	50.00	4.20	14.085	0.000	0.0	0.0	0.0	1.00	70.7	0.0
SW-12.001	50.00	4.94	14.035	0.000	0.0	0.0	0.0	1.00	70.7	0.0
SW-6.012	48.48	6.38	13.856	0.000	15.0	0.0	3.0	1.00	70.7	18.0

Area Summary for Surface Water

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Hardstanding	100	0.081	0.081	0.081
2.000	Classification	Hardstanding	100	0.085	0.085	0.085
1.001	Classification	Hardstanding	100	0.082	0.082	0.082
1.002	Classification	Hardstanding	100	0.033	0.033	0.033
1.003	-	-	100	0.000	0.000	0.000
3.000	Classification	Hardstanding	100	0.033	0.033	0.033
	Classification	Hardstanding	100	0.099	0.099	0.133
3.001	Classification	Hardstanding	100	0.047	0.047	0.047
4.000	Classification	Hardstanding	100	0.072	0.072	0.072
	Classification	Hardstanding	100	0.090	0.090	0.162
	Classification	Hardstanding	100	0.035	0.035	0.197
3.002	Classification	Hardstanding	100	0.030	0.030	0.030
5.000	Classification	Hardstanding	100	0.074	0.074	0.074
3.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
6.000	Classification	Hardstanding	100	0.056	0.056	0.056
6.001	-	-	100	0.000	0.000	0.000
7.000	Classification	Hardstanding	100	0.091	0.091	0.091
6.002	Classification	Hardstanding	100	0.138	0.138	0.138
6.003	-	-	100	0.000	0.000	0.000
8.000	Classification	Hardstanding	100	0.280	0.280	0.280
6.004	Classification	Hardstanding	100	0.131	0.131	0.131
6.005	-	-	100	0.000	0.000	0.000
6.006	Classification	Hardstanding	100	0.063	0.063	0.063
9.000	Classification	Hardstanding	100	0.018	0.018	0.018
	Classification	Hardstanding	100	0.035	0.035	0.053
9.001	Classification	Hardstanding	100	0.068	0.068	0.068
6.007	-	-	100	0.000	0.000	0.000
10.000	Classification	Hardstanding	100	0.063	0.063	0.063
6.008	-	-	100	0.000	0.000	0.000
11.000	Classification	Hardstanding	100	0.069	0.069	0.069
	Classification	Hardstanding	100	0.018	0.018	0.087
6.009	-	-	100	0.000	0.000	0.000
6.010	-	-	100	0.000	0.000	0.000
6.011	-	-	100	0.000	0.000	0.000

Area Summary for Surface Water

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
12.000	-	-	100	0.000	0.000	0.000
12.001	-	-	100	0.000	0.000	0.000
6.012	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.789	1.789	1.789

Free Flowing Outfall Details for Surface Water

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SW-1.004	SW-OUTFALL A	18.890	17.950	17.950	0	0

Free Flowing Outfall Details for Surface Water

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SW-6.012	SW-OUTFALL B	15.380	13.660	13.660	0	0

Online Controls for Surface Water

Hydro-Brake® Optimum Manhole: SW-12, DS/PN: SW-1.004, Volume (m³): 6.6

Unit Reference	MD-SHE-0087-4200-1700-4200	Sump Available	Yes
Design Head (m)	1.700	Diameter (mm)	87
Design Flow (l/s)	4.2	Invert Level (m)	18.230
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	100
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	4.2	Kick-Flo®	0.777	2.9
Flush-Flo™	0.381	3.6	Mean Flow over Head Range	-	3.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.6	0.600	3.5	1.600	4.1	2.600	5.1	5.000	6.9	7.500	8.4
0.200	3.4	0.800	3.0	1.800	4.3	3.000	5.5	5.500	7.3	8.000	8.7
0.300	3.6	1.000	3.3	2.000	4.5	3.500	5.9	6.000	7.6	8.500	8.9
0.400	3.6	1.200	3.6	2.200	4.7	4.000	6.3	6.500	7.9	9.000	9.2
0.500	3.6	1.400	3.8	2.400	4.9	4.500	6.6	7.000	8.1	9.500	9.4

Hydro-Brake® Optimum Manhole: SW-28, DS/PN: SW-6.009, Volume (m³): 12.3

Unit Reference	MD-SHE-0171-1500-1300-1500	Sump Available	Yes
Design Head (m)	1.300	Diameter (mm)	171
Design Flow (l/s)	15.0	Invert Level (m)	14.243
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1500
Application	Surface		

Hydro-Brake® Optimum Manhole: SW-28, DS/PN: SW-6.009, Volume (m³): 12.3

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	15.0	Kick-Flo®	0.854	12.3
Flush-Flo™	0.388	15.0	Mean Flow over Head Range	-	12.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1	0.600	14.6	1.600	16.5	2.600	20.9	5.000	28.5	7.500	34.7
0.200	13.9	0.800	13.2	1.800	17.5	3.000	22.3	5.500	29.9	8.000	35.8
0.300	14.8	1.000	13.2	2.000	18.4	3.500	24.0	6.000	31.2	8.500	36.9
0.400	15.0	1.200	14.4	2.200	19.3	4.000	25.6	6.500	32.4	9.000	37.9
0.500	14.8	1.400	15.5	2.400	20.1	4.500	27.1	7.000	33.6	9.500	38.9

Storage Structures for Surface Water

Cellular Storage Manhole: SW-12, DS/PN: SW-1.004

Invert Level (m) 18.230 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.60
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	365.0	0.0	2.150	365.0	0.0	2.151	0.0	0.0

Cellular Storage Manhole: SW-28, DS/PN: SW-6.009

Invert Level (m) 14.243 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.60
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	430.0	0.0	1.210	430.0	0.0	1.211	0.0	0.0

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Water

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 15.000 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.246 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
SW-1.000	SW-1	15 minute 1 year Winter I+20%	22.421	21.526	-0.145	0.000	0.27		0.085	0.8	10.2	OK
SW-2.000	SW-2	15 minute 1 year Winter I+20%	22.734	21.373	-0.161	0.000	0.18		0.067	1.1	10.7	OK
SW-1.001	SW-3	15 minute 1 year Winter I+20%	22.350	21.019	-0.130	0.000	0.37		0.143	1.8	28.9	OK
SW-1.002	SW-4	15 minute 1 year Winter I+20%	21.878	20.518	-0.159	0.000	0.44		0.153	1.0	31.9	OK
SW-1.003	SW-5	720 minute 1 year Winter I+20%	22.223	18.773	0.177	0.000	0.10		0.534	0.3	4.7	SURCHARGED
SW-3.000	SW-6	15 minute 1 year Winter I+20%	20.122	19.174	-0.198	0.000	0.24		0.110	0.8	16.1	OK
SW-3.001	SW-7	15 minute 1 year Winter I+20%	20.799	19.058	-0.147	0.000	0.33		0.764	0.6	19.5	OK
SW-4.000	SW-8	15 minute 1 year Winter I+20%	20.370	19.445	-0.175	0.000	0.35		0.136	0.9	23.6	OK
SW-3.002	SW-9	15 minute 1 year Winter I+20%	20.887	19.036	-0.105	0.000	0.74		0.818	0.9	45.4	OK

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Water

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
SW-5.000	SW-10	15 minute 1 year Winter I+20%	21.465	20.093	-0.172	0.000	0.13		0.055	1.3	9.3	OK
SW-3.003	SW-11	15 minute 1 year Winter I+20%	20.998	18.911	-0.152	0.000	0.65		0.707	0.8	52.7	OK
SW-1.004	SW-12	720 minute 1 year Winter I+20%	21.074	18.771	0.316	0.000	0.10		121.576	0.6	3.6	SURCHARGED
SW-6.000	SW-13	15 minute 1 year Summer I+20%	17.386	15.785	-0.164	0.000	0.17		0.063	0.8	7.1	OK
SW-6.001	SW-14	15 minute 1 year Summer I+20%	17.197	15.684	-0.152	0.000	0.23		0.125	0.6	7.1	OK
SW-7.000	SW-15	15 minute 1 year Winter I+20%	17.255	16.212	-0.170	0.000	0.14		0.056	1.5	11.5	OK
SW-6.002	SW-16	15 minute 1 year Winter I+20%	17.205	15.638	-0.150	0.000	0.49		0.222	0.9	31.8	OK
SW-6.003	SW-17	15 minute 1 year Winter I+20%	16.839	15.508	-0.137	0.000	0.57		0.839	0.8	31.3	OK
SW-8.000	SW-18	15 minute 1 year Winter I+20%	19.455	17.920	-0.135	0.000	0.33		0.096	2.4	35.2	OK
SW-6.004	SW-19	15 minute 1 year Winter I+20%	16.798	15.281	-0.133	0.000	0.71		0.360	1.0	74.6	OK
SW-6.005	SW-20	15 minute 1 year Winter I+20%	16.564	15.178	-0.085	0.000	0.95		3.239	0.8	72.6	OK
SW-6.006	SW-21	15 minute 1 year Winter I+20%	16.521	14.889	-0.150	0.000	0.66		0.329	1.1	77.8	OK
SW-9.000	SW-22	15 minute 1 year Winter I+20%	16.137	14.872	-0.226	0.000	0.12		0.078	0.5	6.7	OK
SW-9.001	SW-23	15 minute 1 year Winter I+20%	16.190	14.845	-0.208	0.000	0.20		0.206	0.7	13.1	OK
SW-6.007	SW-24	15 minute 1 year Winter I+20%	16.419	14.696	-0.165	0.000	0.68		1.170	0.8	88.1	OK
SW-10.000	SW-25	15 minute 1 year Summer I+20%	18.324	16.980	-0.144	0.000	0.28		0.086	0.6	7.9	OK
SW-6.008	SW-26	15 minute 1 year Winter I+20%	18.621	14.638	-0.174	0.000	0.67		1.914	0.9	88.5	OK
SW-11.000	SW-27	180 minute 1 year Winter I+20%	15.900	14.560	-0.140	0.000	0.05		0.175	0.5	3.2	OK
SW-6.009	SW-28	180 minute 1 year Winter I+20%	15.770	14.559	0.016	0.000	0.23		87.725	0.8	14.8	SURCHARGED
SW-6.010	SW-29	180 minute 1 year Winter I+20%	16.055	14.234	-0.203	0.000	0.23		0.287	0.7	14.8	OK
SW-6.011	SW-30	180 minute 1 year Winter I+20%	15.117	14.105	-0.204	0.000	0.23		0.287	0.8	14.8	OK
SW-12.000	SW-31	360 minute 1 year Winter I+20%	15.000	14.085	-0.300	0.000	0.00		0.000	0.0	0.0	OK
SW-12.001	SW-32	360 minute 1 year Winter I+20%	15.000	14.035	-0.300	0.000	0.00		0.000	0.0	0.0	OK
SW-6.012	SW-33	180 minute 1 year Winter I+20%	15.100	13.951	-0.204	0.000	0.22		0.470	0.8	14.8	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Water

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 15.000 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.246 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
SW-1.000	SW-1	15 minute 30 year Winter I+20%	22.421	21.573	-0.098	0.000	0.61		0.138	1.0	22.6	OK
SW-2.000	SW-2	15 minute 30 year Winter I+20%	22.734	21.408	-0.126	0.000	0.40		0.106	1.4	23.7	OK
SW-1.001	SW-3	15 minute 30 year Winter I+20%	22.350	21.089	-0.060	0.000	0.88		0.332	2.2	68.8	OK
SW-1.002	SW-4	15 minute 30 year Summer I+20%	21.878	20.679	0.002	0.000	1.05		0.340	1.2	76.1	SURCHARGED
SW-1.003	SW-5	1440 minute 30 year Winter I+20%	22.223	19.518	0.922	0.000	0.13		1.377	0.3	5.7	SURCHARGED
SW-3.000	SW-6	1440 minute 30 year Winter I+20%	20.122	19.521	0.149	0.000	0.04		0.502	0.5	2.7	SURCHARGED
SW-3.001	SW-7	1440 minute 30 year Winter I+20%	20.799	19.520	0.314	0.000	0.06		3.491	0.5	3.7	SURCHARGED
SW-4.000	SW-8	15 minute 30 year Winter I+20%	20.370	19.525	-0.095	0.000	0.74		0.227	1.1	50.1	OK
SW-3.002	SW-9	1440 minute 30 year Winter I+20%	20.887	19.519	0.378	0.000	0.13		7.284	0.6	8.2	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Water

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
SW-5.000	SW-10	15 minute 30 year Winter I+20%	21.465	20.122	-0.143	0.000	0.29		0.087	1.6	20.6	OK
SW-3.003	SW-11	1440 minute 30 year Winter I+20%	20.998	19.517	0.454	0.000	0.12		2.438	0.5	9.4	SURCHARGED
SW-1.004	SW-12	1440 minute 30 year Winter I+20%	21.074	19.516	1.061	0.000	0.10		286.082	0.6	3.7	SURCHARGED
SW-6.000	SW-13	15 minute 30 year Winter I+20%	17.386	16.009	0.060	0.000	0.34		0.317	1.0	14.4	SURCHARGED
SW-6.001	SW-14	15 minute 30 year Winter I+20%	17.197	15.989	0.153	0.000	0.56		0.858	0.6	17.4	SURCHARGED
SW-7.000	SW-15	15 minute 30 year Winter I+20%	17.255	16.241	-0.141	0.000	0.30		0.089	1.9	25.6	OK
SW-6.002	SW-16	15 minute 30 year Winter I+20%	17.205	15.974	0.186	0.000	0.99		1.039	1.0	64.7	SURCHARGED
SW-6.003	SW-17	15 minute 30 year Winter I+20%	16.839	15.825	0.180	0.000	1.26		2.928	1.0	69.3	SURCHARGED
SW-8.000	SW-18	15 minute 30 year Winter I+20%	19.455	17.975	-0.080	0.000	0.74		0.158	2.9	77.9	OK
SW-6.004	SW-19	15 minute 30 year Winter I+20%	16.798	15.758	0.344	0.000	1.52		2.020	1.5	159.3	SURCHARGED
SW-6.005	SW-20	15 minute 30 year Winter I+20%	16.564	15.394	0.131	0.000	2.10		5.648	1.4	160.3	SURCHARGED
SW-6.006	SW-21	15 minute 30 year Winter I+20%	16.521	15.228	0.189	0.000	1.43		1.361	1.5	168.0	SURCHARGED
SW-9.000	SW-22	240 minute 30 year Winter I+20%	16.137	15.113	0.015	0.000	0.06		0.350	0.4	3.6	SURCHARGED
SW-9.001	SW-23	240 minute 30 year Winter I+20%	16.190	15.112	0.059	0.000	0.12		1.074	0.7	8.1	SURCHARGED
SW-6.007	SW-24	240 minute 30 year Winter I+20%	16.419	15.110	0.248	0.000	0.43		6.216	0.6	55.3	SURCHARGED
SW-10.000	SW-25	15 minute 30 year Summer I+20%	18.324	17.028	-0.096	0.000	0.62		0.140	0.7	17.5	OK
SW-6.008	SW-26	240 minute 30 year Winter I+20%	18.621	15.106	0.294	0.000	0.44		4.079	0.7	58.0	SURCHARGED
SW-11.000	SW-27	240 minute 30 year Winter I+20%	15.900	15.100	0.400	0.000	0.09		0.786	0.5	5.4	SURCHARGED
SW-6.009	SW-28	240 minute 30 year Winter I+20%	15.770	15.099	0.556	0.000	0.24		232.251	0.8	15.0	SURCHARGED
SW-6.010	SW-29	1440 minute 30 year Summer I+20%	16.055	14.235	-0.203	0.000	0.23		0.289	0.8	15.0	OK
SW-6.011	SW-30	1440 minute 30 year Summer I+20%	15.117	14.105	-0.203	0.000	0.23		0.289	0.8	15.0	OK
SW-12.000	SW-31	360 minute 30 year Winter I+20%	15.000	14.085	-0.300	0.000	0.00		0.000	0.0	0.0	OK
SW-12.001	SW-32	360 minute 30 year Winter I+20%	15.000	14.035	-0.300	0.000	0.00		0.000	0.0	0.0	OK
SW-6.012	SW-33	1440 minute 30 year Summer I+20%	15.100	13.952	-0.204	0.000	0.23		0.472	0.8	15.0	OK

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Water

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 15.000 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.246 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
SW-1.000	SW-1	15 minute 100 year Winter I+20%	22.421	21.596	-0.075	0.000	0.78		0.165	1.0	29.1	OK
SW-2.000	SW-2	15 minute 100 year Winter I+20%	22.734	21.424	-0.110	0.000	0.52		0.125	1.5	30.6	OK
SW-1.001	SW-3	15 minute 100 year Winter I+20%	22.350	21.221	0.072	0.000	1.11		0.787	2.2	86.3	SURCHARGED
SW-1.002	SW-4	15 minute 100 year Winter I+20%	21.878	20.747	0.070	0.000	1.35		0.448	1.4	97.3	SURCHARGED
SW-1.003	SW-5	1440 minute 100 year Winter I+20%	22.223	19.923	1.327	0.000	0.16		1.835	0.3	7.0	SURCHARGED
SW-3.000	SW-6	1440 minute 100 year Winter I+20%	20.122	19.926	0.554	0.000	0.05		0.960	0.5	3.3	FLOOD RISK
SW-3.001	SW-7	1440 minute 100 year Winter I+20%	20.799	19.925	0.720	0.000	0.07		3.949	0.5	4.1	SURCHARGED
SW-4.000	SW-8	1440 minute 100 year Winter I+20%	20.370	19.926	0.306	0.000	0.07		0.680	0.6	5.0	SURCHARGED
SW-3.002	SW-9	1440 minute 100 year Winter I+20%	20.887	19.924	0.783	0.000	0.15		8.050	0.6	9.3	SURCHARGED

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Water

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
SW-5.000	SW-10	15 minute 100 year Winter I+20%	21.465	20.134	-0.131	0.000	0.37		0.101	1.7	26.6	OK
SW-3.003	SW-11	1440 minute 100 year Winter I+20%	20.998	19.922	0.858	0.000	0.13		3.396	0.5	10.6	SURCHARGED
SW-1.004	SW-12	1440 minute 100 year Winter I+20%	21.074	19.921	1.466	0.000	0.11		375.289	0.7	4.2	SURCHARGED
SW-6.000	SW-13	15 minute 100 year Winter I+20%	17.386	16.474	0.525	0.000	0.36		0.843	0.9	15.5	SURCHARGED
SW-6.001	SW-14	15 minute 100 year Winter I+20%	17.197	16.453	0.617	0.000	0.71		1.385	0.6	22.0	SURCHARGED
SW-7.000	SW-15	15 minute 100 year Winter I+20%	17.255	16.480	0.098	0.000	0.37		0.360	2.0	31.9	SURCHARGED
SW-6.002	SW-16	15 minute 100 year Winter I+20%	17.205	16.441	0.654	0.000	1.12		1.885	1.0	72.9	SURCHARGED
SW-6.003	SW-17	15 minute 100 year Winter I+20%	16.839	16.287	0.642	0.000	1.42		3.456	1.1	77.8	SURCHARGED
SW-8.000	SW-18	15 minute 100 year Winter I+20%	19.455	18.117	0.062	0.000	0.90		0.319	2.9	94.5	SURCHARGED
SW-6.004	SW-19	15 minute 100 year Winter I+20%	16.798	16.215	0.801	0.000	1.80		3.083	1.8	189.0	SURCHARGED
SW-6.005	SW-20	15 minute 100 year Winter I+20%	16.564	15.733	0.470	0.000	2.45		6.144	1.7	187.6	SURCHARGED
SW-6.006	SW-21	15 minute 100 year Winter I+20%	16.521	15.510	0.471	0.000	1.70		1.841	1.8	200.9	SURCHARGED
SW-9.000	SW-22	360 minute 100 year Winter I+20%	16.137	15.450	0.352	0.000	0.06		0.732	0.4	3.3	SURCHARGED
SW-9.001	SW-23	360 minute 100 year Winter I+20%	16.190	15.450	0.396	0.000	0.11		1.474	0.6	7.3	SURCHARGED
SW-6.007	SW-24	360 minute 100 year Winter I+20%	16.419	15.447	0.585	0.000	0.41		6.701	0.6	53.7	SURCHARGED
SW-10.000	SW-25	15 minute 100 year Summer I+20%	18.324	17.052	-0.072	0.000	0.80		0.168	0.8	22.6	OK
SW-6.008	SW-26	360 minute 100 year Winter I+20%	18.621	15.442	0.631	0.000	0.43		4.561	0.6	57.4	SURCHARGED
SW-11.000	SW-27	360 minute 100 year Winter I+20%	15.900	15.436	0.736	0.000	0.09		1.166	0.4	5.2	SURCHARGED
SW-6.009	SW-28	360 minute 100 year Winter I+20%	15.770	15.435	0.891	0.000	0.24		319.247	0.8	15.0	SURCHARGED
SW-6.010	SW-29	2160 minute 100 year Winter I+20%	16.055	14.235	-0.203	0.000	0.23		0.289	0.8	15.0	OK
SW-6.011	SW-30	2160 minute 100 year Winter I+20%	15.117	14.105	-0.203	0.000	0.23		0.289	0.8	15.0	OK
SW-12.000	SW-31	360 minute 100 year Winter I+20%	15.000	14.085	-0.300	0.000	0.00		0.000	0.0	0.0	OK
SW-12.001	SW-32	360 minute 100 year Winter I+20%	15.000	14.035	-0.300	0.000	0.00		0.000	0.0	0.0	OK
SW-6.012	SW-33	2160 minute 100 year Winter I+20%	15.100	13.952	-0.204	0.000	0.23		0.472	0.8	15.0	OK

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APPENDIX C. WASTEWATER CALCULATIONS & DESIGN NETWORK TABLES

- As per Irish Water Code of Practice for Wastewater Infrastructure, IW-CDS-5030-03
- Network Design Tables

Appendix C

Wastewater Calculations & Design Network Tables

FOUL SEWERAGE DESIGN

Design Criteria for Wastewater

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Domestic (l/s/ha)	0.00	Maximum Backdrop Height (m)	20.000
Industrial Peak Flow Factor	0.00	Domestic Peak Flow Factor	6.00	Min Design Depth for Optimisation (m)	1.200
Flow Per Person (l/per/day)	150.00	Add Flow / Climate Change (%)	10	Min Vel for Auto Design only (m/s)	1.00
Persons per House	2.70	Minimum Backdrop Height (m)	0.000	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Wastewater

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WW-1.000	32.718	0.164	200.0	0.000	12	0.0	1.500	o	225	Pipe/Conduit	
WW-2.000	32.597	0.163	200.0	0.000	8	0.0	1.500	o	225	Pipe/Conduit	
WW-1.001	19.603	0.716	27.4	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
WW-1.002	17.526	0.466	37.6	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
WW-1.003	21.713	0.190	114.3	0.000	4	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WW-1.000	21.396	0.000	0.0	12	0.0	17	0.26	0.81	32.2	0.4
WW-2.000	21.007	0.000	0.0	8	0.0	14	0.23	0.81	32.2	0.2
WW-1.001	20.844	0.000	0.0	22	0.1	14	0.64	2.20	87.4	0.7
WW-1.002	20.128	0.000	0.0	25	0.1	16	0.59	1.88	74.6	0.8
WW-1.003	19.662	0.000	0.0	29	0.1	23	0.43	1.07	42.7	0.9

Network Design Table for Wastewater

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WW-3.000	41.291	0.206	200.0	0.000	11	0.0	1.500	o	225	Pipe/Conduit	
WW-3.001	18.248	0.091	200.0	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
WW-3.002	4.319	0.022	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.004	59.245	0.296	200.0	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
WW-4.000	19.680	0.131	150.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
WW-1.005	71.660	2.312	31.0	0.000	14	0.0	1.500	o	225	Pipe/Conduit	
WW-5.000	11.776	0.059	200.0	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
WW-5.001	8.188	0.041	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WW-3.000	18.673	0.000	0.0	11	0.0	17	0.26	0.81	32.2	0.3
WW-3.001	18.467	0.000	0.0	13	0.0	18	0.27	0.81	32.2	0.4
WW-3.002	18.375	0.000	0.0	13	0.0	18	0.27	0.81	32.2	0.4
WW-1.004	18.354	0.000	0.0	45	0.1	32	0.40	0.81	32.2	1.4
WW-4.000	19.120	0.000	0.0	6	0.0	12	0.23	0.94	37.2	0.2
WW-1.005	18.057	0.000	0.0	65	0.2	25	0.86	2.07	82.1	2.0
WW-5.000	16.282	0.000	0.0	2	0.0	8	0.15	0.81	32.2	0.1
WW-5.001	16.223	0.000	0.0	2	0.0	8	0.15	0.81	32.2	0.1

Network Design Table for Wastewater

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WW-6.000	14.115	0.101	140.0	0.000	4	0.0	1.500	o	225	Pipe/Conduit	
WW-5.002	35.101	0.351	100.0	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
WW-5.003	9.671	0.097	100.0	0.000	1	0.0	1.500	o	225	Pipe/Conduit	
WW-1.006	48.967	0.245	200.0	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
WW-1.007	8.766	0.044	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.008	67.903	0.340	200.0	0.000	1	0.0	1.500	o	225	Pipe/Conduit	
WW-1.009	11.992	0.060	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-7.000	54.996	1.399	39.3	0.000	14	0.0	1.500	o	225	Pipe/Conduit	
WW-7.001	27.907	0.997	28.0	0.000	19	0.0	1.500	o	225	Pipe/Conduit	
WW-1.010	5.031	0.025	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WW-6.000	16.286	0.000	0.0	4	0.0	10	0.21	0.97	38.5	0.1
WW-5.002	16.182	0.000	0.0	13	0.0	15	0.34	1.15	45.6	0.4
WW-5.003	15.831	0.000	0.0	14	0.0	16	0.35	1.15	45.6	0.4
WW-1.006	15.734	0.000	0.0	86	0.2	44	0.49	0.81	32.2	2.7
WW-1.007	15.490	0.000	0.0	86	0.2	44	0.49	0.81	32.2	2.7
WW-1.008	15.446	0.000	0.0	87	0.2	44	0.49	0.81	32.2	2.7
WW-1.009	15.106	0.000	0.0	87	0.2	44	0.49	0.81	32.2	2.7
WW-7.000	17.524	0.000	0.0	14	0.0	13	0.49	1.83	72.9	0.4
WW-7.001	16.125	0.000	0.0	33	0.1	17	0.72	2.17	86.4	1.0
WW-1.010	15.046	0.000	0.0	120	0.3	52	0.54	0.81	32.2	3.7

Network Design Table for Wastewater

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WW-1.011	8.478	0.042	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.012	23.235	0.116	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.013	27.232	0.136	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.014	10.758	0.054	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.015	19.526	0.112	175.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.016	3.025	0.015	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-8.000	46.091	0.230	200.0	0.000	1	0.0	1.500	o	225	Pipe/Conduit	
WW-9.000	15.317	0.077	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-8.001	4.976	0.025	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-8.002	32.056	0.160	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-8.003	25.747	0.129	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WW-1.011	15.021	0.000	0.0	120	0.3	52	0.54	0.81	32.2	3.7
WW-1.012	14.979	0.000	0.0	120	0.3	52	0.54	0.81	32.2	3.7
WW-1.013	14.863	0.000	0.0	120	0.3	52	0.54	0.81	32.2	3.7
WW-1.014	14.726	0.000	0.0	120	0.3	52	0.54	0.81	32.2	3.7
WW-1.015	14.673	0.000	0.0	120	0.3	50	0.56	0.87	34.5	3.7
WW-1.016	14.561	0.000	0.0	120	0.3	52	0.54	0.81	32.2	3.7
WW-8.000	13.915	0.000	0.0	1	0.0	6	0.12	0.81	32.2	0.0
WW-9.000	14.020	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
WW-8.001	13.685	0.000	0.0	1	0.0	6	0.12	0.81	32.2	0.0
WW-8.002	13.660	0.000	0.0	1	0.0	6	0.12	0.81	32.2	0.0
WW-8.003	13.499	0.000	0.0	1	0.0	6	0.12	0.81	32.2	0.0

Network Design Table for Wastewater

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WW-8.004	5.813	0.029	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-8.005	22.098	0.110	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-8.006	25.778	0.129	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.017	28.668	0.143	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.018	31.150	0.156	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.019	37.306	0.187	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.020	58.496	0.528	110.8	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.021	85.000	2.240	37.9	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.022	85.000	1.107	76.8	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.023	85.000	0.425	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW-1.024	26.471	0.132	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WW-8.004	13.371	0.000	0.0	1	0.0	6	0.12	0.81	32.2	0.0
WW-8.005	13.342	0.000	0.0	1	0.0	6	0.12	0.81	32.2	0.0
WW-8.006	13.231	0.000	0.0	1	0.0	6	0.12	0.81	32.2	0.0
WW-1.017	13.102	0.000	0.0	121	0.3	52	0.54	0.81	32.2	3.7
WW-1.018	12.959	0.000	0.0	121	0.3	52	0.54	0.81	32.2	3.7
WW-1.019	12.803	0.000	0.0	121	0.3	52	0.54	0.81	32.2	3.7
WW-1.020	12.617	0.000	0.0	121	0.3	45	0.67	1.09	43.4	3.7
WW-1.021	12.089	0.000	0.0	121	0.3	34	0.97	1.87	74.2	3.7
WW-1.022	9.849	0.000	0.0	121	0.3	41	0.76	1.31	52.1	3.7
WW-1.023	8.742	0.000	0.0	121	0.3	52	0.54	0.81	32.2	3.7
WW-1.024	8.317	0.000	0.0	121	0.3	52	0.54	0.81	32.2	3.7

Area Summary for Wastewater

Pipe Number	Gross Area (ha)	Pipe Total (ha)
1.000	0.000	0.000
2.000	0.000	0.000
1.001	0.000	0.000
1.002	0.000	0.000
1.003	0.000	0.000
3.000	0.000	0.000
3.001	0.000	0.000
3.002	0.000	0.000
1.004	0.000	0.000
4.000	0.000	0.000
1.005	0.000	0.000
5.000	0.000	0.000
5.001	0.000	0.000
6.000	0.000	0.000
5.002	0.000	0.000
5.003	0.000	0.000
1.006	0.000	0.000
1.007	0.000	0.000
1.008	0.000	0.000
1.009	0.000	0.000
7.000	0.000	0.000
7.001	0.000	0.000
1.010	0.000	0.000
1.011	0.000	0.000
1.012	0.000	0.000
1.013	0.000	0.000
1.014	0.000	0.000
1.015	0.000	0.000
1.016	0.000	0.000
8.000	0.000	0.000
9.000	0.000	0.000
8.001	0.000	0.000
8.002	0.000	0.000
8.003	0.000	0.000
8.004	0.000	0.000

Area Summary for Wastewater

Pipe Number	Gross Area (ha)	Pipe Total (ha)
8.005	0.000	0.000
8.006	0.000	0.000
1.017	0.000	0.000
1.018	0.000	0.000
1.019	0.000	0.000
1.020	0.000	0.000
1.021	0.000	0.000
1.022	0.000	0.000
1.023	0.000	0.000
1.024	0.000	0.000
	Total	Total
	0.000	0.000

Free Flowing Outfall Details for Wastewater

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
WW-1.024	WW-Outfall	10.260	8.184	0.000	0	0

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary
Consulting Engineers

APPENDIX D. IRISH WATER CORRESPONDENCE

- Confirmation of Feasibility Letter
- Statement of Design Acceptance

Appendix D

Irish Water Correspondence

Fred Fullard
Burkeway Homes
c/o David Goaley
O Connor Sutton Cronin

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

21 November 2019

Dear Fred Fullard,

Re: Connection Reference No CDS19008110 pre-connection enquiry -
Subject to contract | Contract denied

Connection of a proposed development comprising of 120 No. Housing Units and an existing development of 21 housing units at Truskey East, Barna

Irish Water has reviewed your pre-connection enquiry in relation to water and wastewater connections for a proposed development of 120 No. Housing Units and a wastewater connection for an existing 21 No. housing unit development at Truskey East, Barna, Co. Galway.

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.

A wastewater connection can be facilitated for the total 141 No. housing units (proposed and existing) to the existing 300mm Irish Water Foul Sewer at a point approximately 340m to the south of the entrance to the existing housing estate.

Please be aware that Irish Water is now responsible for the delivery of the connection related works in the public and third party domains including wastewater and watermain network extensions and connections. The costs and conditions associated with the connection would be detailed in a connection offer at connection application stage. The customer would be responsible for the costs associated with the provision of a network extension and connection to their development site. Further information on connection charges is available at https://www.water.ie/connections/information/connection-charges/.

A watermain connection to the existing Irish Water watermain network (which exists along the road fronting the existing housing estate) can be facilitated. The feasibility analysis undertaken by Irish Water as part of the pre-connection enquiry process relates only to the capacity of the Irish Water owned infrastructure to cater for the demand of the proposed development. The confirmation of feasibility does not extend to your fire flow requirements. To guarantee a flow to meet the Fire Authority requirements you should provide adequate fire storage capacity within your development. The watermain network serving the existing Cnoc Fraoigh Housing estate is privately owned, it ultimately connects to the Irish Water watermain network which runs along the public road. Should you intend to connect via this private network you will require permission from the third party owners and it will be your responsibility to confirm that the private watermain infrastructure has capacity, is structurally adequate and provides an adequate service for your demands and that of the existing housing estate development.

Strategic Housing Development

Irish Water notes that the scale of this development may dictate that it is subject to the Strategic Housing Development planning process. Therefore in advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services. A design proposal for the water and/or wastewater infrastructure can be submitted to cdsdesignqa@water.ie for assessment. All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details.

The development will be subject to Irish Water's Quality Assurance Requirements for Design and Field Inspections. The overall Quality Assurance requirements will be incorporated into a Connection Agreement at connection application stage as part of a Connection Offer from Irish Water. Please note there is a requirement for wayleaves to be provided along the routes of watermain and wastewater pipes in favour of Irish Water as part of the Connection Agreement. This is to facilitate the vesting of the watermain and wastewater infrastructure. This wayleave requirement extends to the arterial route of connection to the Irish Water network should a connection be proposed via third party/private infrastructure. Further guidance in relation to IW design requirements is available at https://www.water.ie/connections/developer-services/QA-Design-Req-Manual.pdf.

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 James O Malley from the design team at jomalley@water.ie . For further information, visit **www.water.ie/connections.**

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

Fred Fullard

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

10 July 2020

Re: Design Submission for Truskey East, Barna, Co. Galway (the "Development") (the "Design Submission") / Connection Reference No: CDS19008110

Dear Fred Fullard,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form 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 (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative:
Name: James O'Malley
Phone: 094 90 43310
Email: jomalley@water.ie

Yours sincerely,

Maria O'Dwyer
Connections and Developer Services

Appendix A

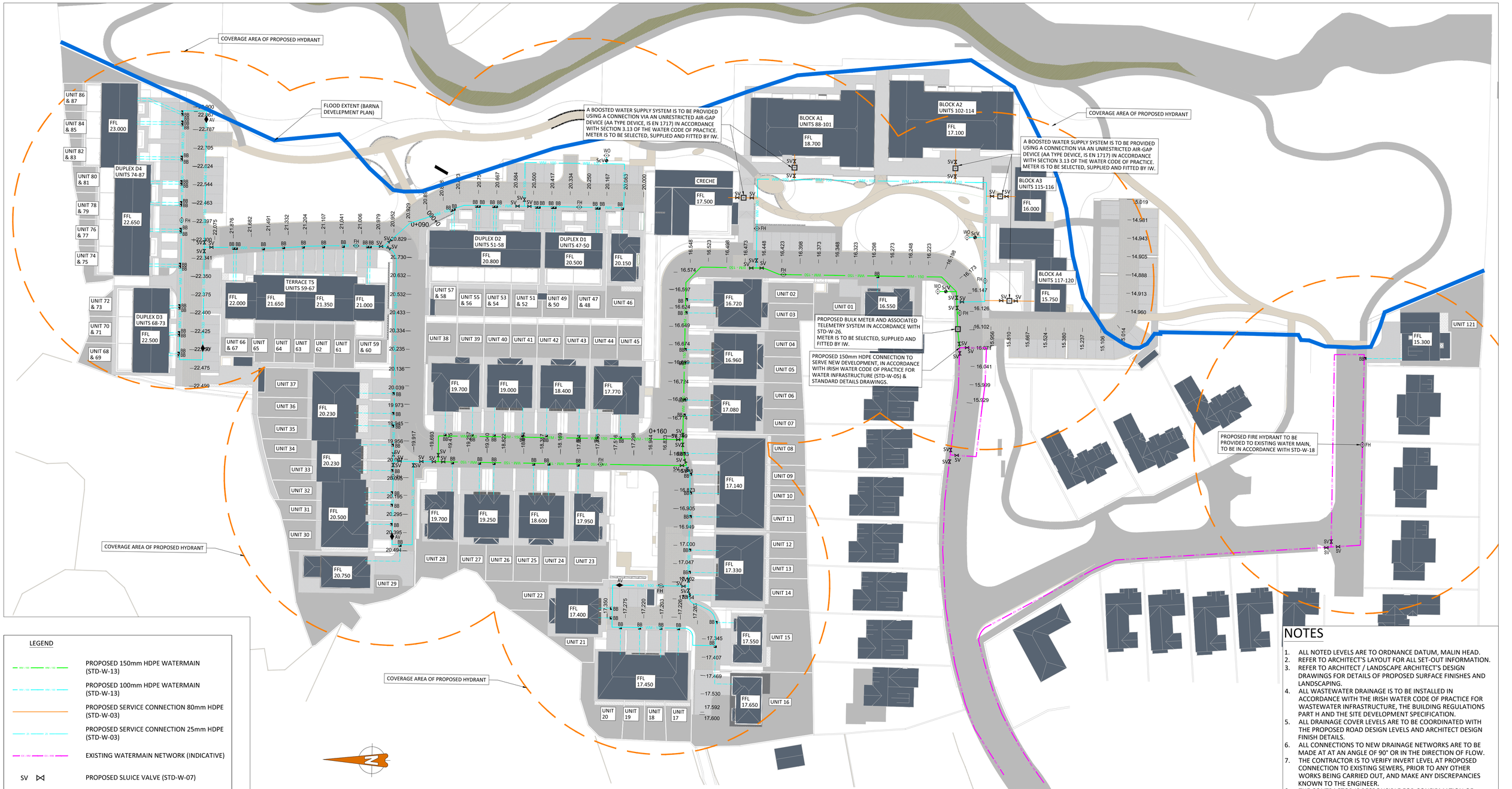
Document Title & Revision

- B861-OCSC-XX-XX-C-DR-0550-A1- Rev. C01 WATERMAIN LAYOUT
- B861-OCSC-XX-XX-C-DR-0502 A1 Rev.C03 WASTEWATER NETWORK LAYOUT
- B861-OCSC-XX-XX-C-DR-0540 A1 Rev.C03 PUBLIC ROAD DRAINAGE LAYOUT
- B861-OCSC-XX-XX-C-DR-0511 A1 Rev.C02 WASTEWATER LONG SECTIONS SHEET 02 OF 04
- B861-OCSC-XX-XX-C-DR-0512 A1 Rev.C03 WASTEWATER LONG SECTIONS SHEET 03 OF 04

Standard Details/Code of Practice Exemption: N/A

For further information, visit ***www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.



LEGEND

- PROPOSED 150mm HDPE WATERMAIN (STD-W-13)
- PROPOSED 100mm HDPE WATERMAIN (STD-W-13)
- PROPOSED SERVICE CONNECTION 80mm HDPE (STD-W-03)
- PROPOSED SERVICE CONNECTION 25mm HDPE (STD-W-03)
- EXISTING WATERMAIN NETWORK (INDICATIVE)
- SV — PROPOSED SLUICE VALVE (STD-W-07)
- FH — PROPOSED ON-LINE HYDRANT (STD-W-18)
- WO — PROPOSED WASHOUT HYDRANT (STD-W-30A)
- AV — PROPOSED ON-LINE AIR VALVE (STD-W-22)
- ScV — PROPOSED SCOUR VALVE (STD-W-30)
- M — PROPOSED BULK METER AND ASSOCIATED TELEMETRY SYSTEM (STD-W-26)
- BB — PROPOSED BOUNDARY BOX (STD-W-03)

PLANNING DRAWING.
NOT FOR CONSTRUCTION.
ALL LEVELS GIVEN ARE RELATIVE TO ORDNANCE DATUM.
THIS DRAWING HAS BEEN ISSUED FOR INFORMATION PURPOSES ONLY AND MUST NOT BE USED FOR CONSTRUCTION UNDER ANY CIRCUMSTANCES

NOTES

1. ALL NOTED LEVELS ARE TO ORDNANCE DATUM, MALIN HEAD.
2. REFER TO ARCHITECT'S LAYOUT FOR ALL SET-OUT INFORMATION.
3. REFER TO ARCHITECT / LANDSCAPE ARCHITECT'S DESIGN DRAWINGS FOR DETAILS OF PROPOSED SURFACE FINISHES AND LANDSCAPING.
4. ALL WASTEWATER DRAINAGE IS TO BE INSTALLED IN ACCORDANCE WITH THE IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE, THE BUILDING REGULATIONS PART H AND THE SITE DEVELOPMENT SPECIFICATION.
5. ALL DRAINAGE COVER LEVELS ARE TO BE COORDINATED WITH THE PROPOSED ROAD DESIGN LEVELS AND ARCHITECT DESIGN FINISH DETAILS.
6. ALL CONNECTIONS TO NEW DRAINAGE NETWORKS ARE TO BE MADE AT AT AN ANGLE OF 90° OR IN THE DIRECTION OF FLOW.
7. THE CONTRACTOR IS TO VERIFY INVERT LEVEL AT PROPOSED CONNECTION TO EXISTING SEWERS, PRIOR TO ANY OTHER WORKS BEING CARRIED OUT, AND MAKE ANY DISCREPANCIES KNOWN TO THE ENGINEER.
8. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMATION OF PRESENCE ALL EXISTING UTILITIES, IF ANY, ALONG ROUTE OF PROPOSED DRAINAGE NETWORKS - BY INTRUSIVE INVESTIGATION OR EQUAL.
9. EXISTING PUBLIC SEWER TO BE JET CLEANED AND CCTV SURVEYED PRIOR TO, AND AFTER PROPOSED CONNECTIONS FROM NEW NETWORK.
10. ALL NEW DRAINAGE INFRASTRUCTURE TO BE JET CLEANED AND CCTV SURVEYED, WITH ANY NOTED DEFECTS REMEDIATED, ON COMPLETION OF WORKS, TO THE SATISFACTION OF THE LOCAL AUTHORITY.
11. MINIMUM DISTANCES FROM THE KERB TO WASTEWATER MANHOLE AND WASTEWATER SEWER TO BE IN ACCORDANCE WITH IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE SECTION 3.5.15.
12. REFER TO ARCHITECTS DRAWINGS FOR DETAILS OF PRIVATE DRAINAGE.
13. ALL COVER LEVELS ARE TO BE COORDINATED WITH ROAD DESIGN LEVELS AND LANDSCAPE ARCHITECT'S PROPOSED FINISH LEVELS.

- FOR SETTING OUT REFER TO ARCHITECT'S DRAWINGS.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER ARCHITECTURAL AND ENGINEERING DRAWINGS AND ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
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Rev No.	Date	Revision Note	Drn by	Chkd by
P01	10.01.20	ISSUED FOR INFORMATION	SD	MK
P02	14.01.20	SUITABLE FOR PLANNING	SD	MK
P03	12.05.20	SUITABLE FOR PLANNING	AB	MK
P04	15.05.20	UPDATED SITE LAYOUT	RP	MK
P05	27.05.20	REVISED WATER MAIN NETWORK DESIGN	AB	MK
C01	09.06.20	ISSUED FOR PLANNING	AB	MK

Rev No.	Date	Revision Note	Drn by	Chkd by

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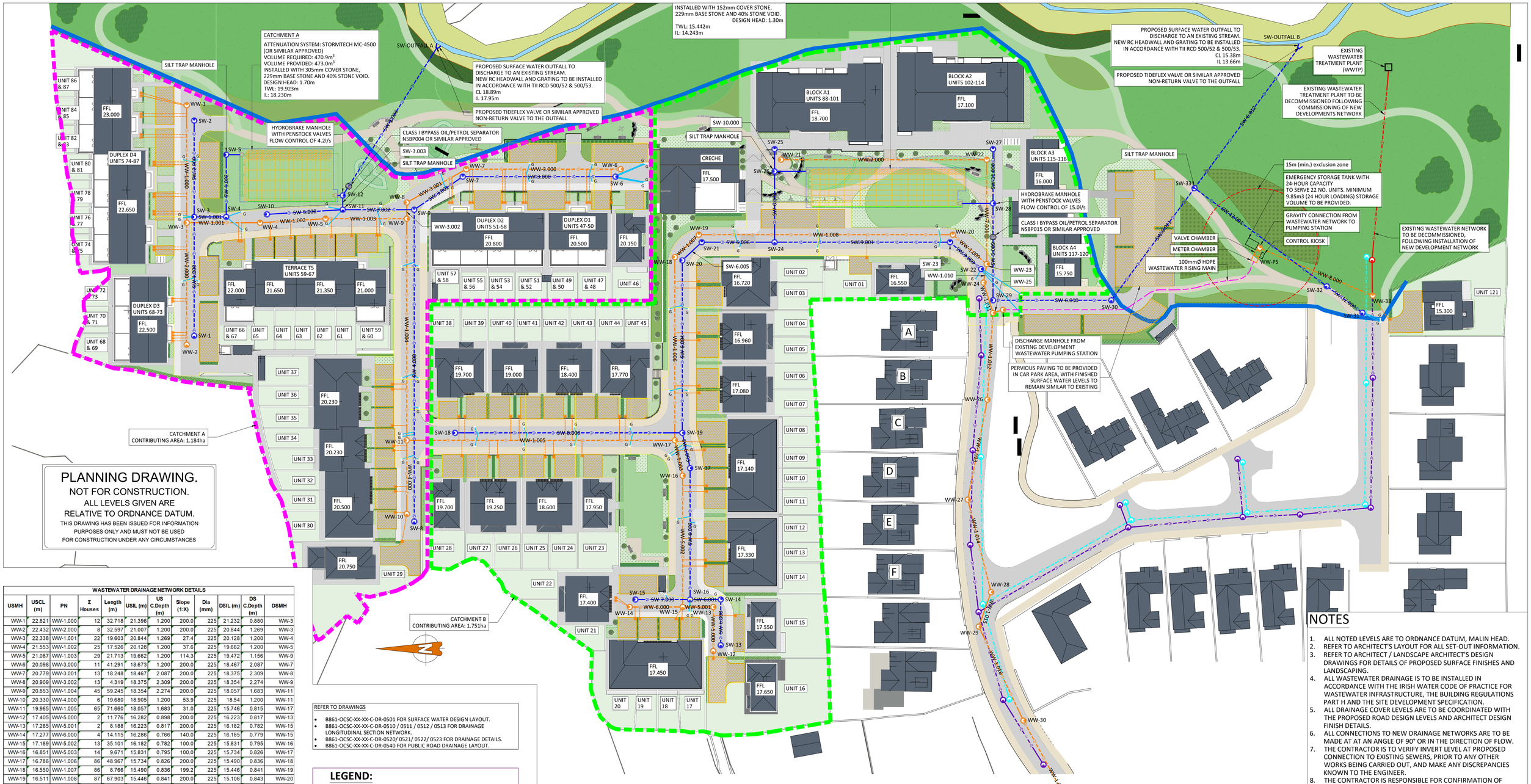
OCSC O'CONNOR | SUTTON | CRONIN Multidisciplinary Consulting Engineers

Dublin | London | Belfast | Galway | Cork

Client: BURKEWAY HOMES LTD
Project: RESIDENTIAL DEVELOPMENT AT BEARNA
Title: WATER MAIN NETWORK LAYOUT

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
B861	OCSC	XX	XX	C	DR	0550	A1	C01

Date: 10/01/20 Scale: 1:500 @ A1 Drn by:SD Chkd by:MK Aprvd by:AH



PLANNING DRAWING.

NOT FOR CONSTRUCTION.
ALL LEVELS GIVEN ARE RELATIVE TO ORDNANCE DATUM.

THIS DRAWING HAS BEEN ISSUED FOR INFORMATION PURPOSES ONLY AND MUST NOT BE USED FOR CONSTRUCTION UNDER ANY CIRCUMSTANCES

WASTEWATER DRAINAGE NETWORK DETAILS

USMH	USCL (m)	PN	Σ Houses	Length (m)	USIL (m)	US C.Depth (m)	Slope (1:X)	Dia (mm)	DSIL (m)	DS C.Depth (m)	DSMH
WW-1	22.821	WW-1.000	12	32.718	21.396	1.200	200.0	225	21.232	0.880	WW-3
WW-2	22.432	WW-2.000	8	32.597	21.007	1.200	200.0	225	20.844	1.269	WW-3
WW-3	22.338	WW-1.001	22	19.603	20.844	1.269	27.4	225	20.128	1.200	WW-4
WW-4	21.553	WW-1.002	25	17.526	20.128	1.200	37.6	225	19.662	1.200	WW-5
WW-5	21.087	WW-1.003	29	21.713	19.662	1.200	114.3	225	19.472	1.156	WW-9
WW-6	20.098	WW-3.000	11	41.291	18.673	1.200	200.0	225	18.467	2.087	WW-7
WW-7	20.779	WW-3.001	13	18.248	18.467	2.087	200.0	225	18.375	2.309	WW-8
WW-8	20.909	WW-3.002	13	4.319	18.375	2.309	200.0	225	18.354	2.274	WW-9
WW-9	20.853	WW-1.004	45	59.245	18.354	2.274	200.0	225	18.057	1.683	WW-11
WW-10	20.330	WW-4.000	6	19.680	18.905	1.200	53.9	225	18.54	1.200	WW-11
WW-11	19.965	WW-1.005	65	71.660	18.057	1.683	31.0	225	15.746	0.815	WW-17
WW-12	17.405	WW-5.000	2	11.776	16.282	0.898	200.0	225	16.223	0.817	WW-13
WW-13	17.265	WW-5.001	2	8.188	16.223	0.817	200.0	225	16.182	0.782	WW-15
WW-14	17.277	WW-6.000	4	14.115	16.286	0.766	140.0	225	16.185	0.779	WW-15
WW-15	17.189	WW-5.002	13	35.101	16.182	0.782	100.0	225	15.831	0.795	WW-16
WW-16	16.851	WW-5.003	14	9.671	15.831	0.795	100.0	225	15.734	0.826	WW-17
WW-17	16.786	WW-1.006	86	48.967	15.734	0.826	200.0	225	15.490	0.836	WW-18
WW-18	16.550	WW-1.007	86	8.766	15.490	0.836	199.2	225	15.446	0.841	WW-19
WW-19	16.511	WW-1.008	87	67.903	15.446	0.841	200.0	225	15.106	0.843	WW-20
WW-20	16.174	WW-1.009	87	11.992	14.749	1.200	199.9	225	14.689	1.201	WW-23
WW-21	18.499	WW-7.000	14	54.996	17.524	0.750	39.3	225	16.125	0.750	WW-22
WW-22	17.100	WW-7.001	33	27.907	16.125	0.750	28.0	225	15.128	0.762	WW-23
WW-23	16.115	WW-1.010	120	5.031	14.689	1.201	86.7	225	14.631	1.200	WW-24
WW-24	16.056	WW-1.011	120	8.478	14.631	1.200	200.0	225	14.589	1.206	WW-25
WW-25	16.020	WW-1.012	142	23.235	14.589	1.206	200.0	225	14.472	1.316	WW-26
WW-26	16.013	WW-1.013	142	27.232	14.472	1.316	200.0	225	14.336	1.539	WW-27
WW-27	16.100	WW-1.014	142	25.511	14.336	1.539	200.0	225	14.209	1.436	WW-28
WW-28	15.870	WW-1.015	142	9.764	14.209	1.436	200.0	225	14.160	1.433	WW-29
WW-29	15.818	WW-1.016	142	27.802	14.160	1.433	200.0	225	14.021	1.457	WW-30
WW-30	15.703	WW-1.017	142	31.150	14.021	1.457	200.0	225	13.865	1.460	WW-31
WW-31	15.550	WW-1.018	142	37.306	13.865	1.460	84.0	225	13.421	1.200	WW-32
WW-32	14.846	WW-1.019	142	58.496	13.421	1.200	43.9	225	12.089	1.200	WW-33
WW-33	13.514	WW-1.020	142	85.000	12.089	1.200	37.9	225	9.849	1.200	WW-34
WW-34	11.274	WW-1.021	142	85.000	9.849	1.200	129.4	225	9.192	0.750	WW-35
WW-35	10.167	WW-1.022	142	85.000	9.192	0.750	200.0	225	8.767	1.205	WW-36
WW-36	10.197	WW-1.023	142	26.471	8.767	1.205	200.0	225	8.635	1.400	WW-Outfall
WW-37	14.775	WW-8.000	22	32.781	13.857	0.693	72.0	225	13.402	1.395	WW-PS

REFER TO DRAWINGS

- B861-OCSC-XX-XX-C-DR-0501 FOR SURFACE WATER DESIGN LAYOUT.
- B861-OCSC-XX-XX-C-DR-0510 / 0511 / 0512 / 0513 FOR DRAINAGE LONGITUDINAL SECTION NETWORK.
- B861-OCSC-XX-XX-C-DR-0520/ 0521/ 0522/ 0523 FOR DRAINAGE DETAILS.
- B861-OCSC-XX-XX-C-DR-0540 FOR PUBLIC ROAD DRAINAGE LAYOUT.

LEGEND:

- PROPOSED uPVC (SN8) WASTEWATER NETWORK
- 100mmØ HDPE RISING MAIN
- EXISTING WASTEWATER NETWORK TO BE MAINTAINED (FROM TOPO SURVEY RECORDS)
- EXISTING WASTEWATER NETWORK TO BE DECOMMISSIONED (FROM TOPO SURVEY RECORDS)
- PRIVATE SURFACE WATER NETWORK TO BE MAINTAINED (FROM TOPO SURVEY RECORDS)
- PRIVATE WASTEWATER OUTFALL CHAMBER WITH 100mm uPVC PIPE
- INDICATIVE FLOOD EXTENT FROM BARNA DEVELOPMENT PLAN

NOTES

1. ALL NOTED LEVELS ARE TO ORDNANCE DATUM, MALIN HEAD.
2. REFER TO ARCHITECT'S LAYOUT FOR ALL SET-OUT INFORMATION.
3. REFER TO ARCHITECT / LANDSCAPE ARCHITECT'S DESIGN DRAWINGS FOR DETAILS OF PROPOSED SURFACE FINISHES AND LANDSCAPING.
4. ALL WASTEWATER DRAINAGE IS TO BE INSTALLED IN ACCORDANCE WITH THE IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE, THE BUILDING REGULATIONS PART H AND THE SITE DEVELOPMENT SPECIFICATION.
5. ALL DRAINAGE COVER LEVELS ARE TO BE COORDINATED WITH THE PROPOSED ROAD DESIGN LEVELS AND ARCHITECT DESIGN FINISH DETAILS.
6. ALL CONNECTIONS TO NEW DRAINAGE NETWORKS ARE TO BE MADE AT AT AN ANGLE OF 90° OR IN THE DIRECTION OF FLOW.
7. THE CONTRACTOR IS TO VERIFY INVERT LEVEL AT PROPOSED CONNECTION TO EXISTING SEWERS, PRIOR TO ANY OTHER WORKS BEING CARRIED OUT, AND MAKE ANY DISCREPANCIES KNOWN TO THE ENGINEER.
8. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMATION OF PRESENCE ALL EXISTING UTILITIES, IF ANY, ALONG ROUTE OF PROPOSED DRAINAGE NETWORKS - BY INTRUSIVE INVESTIGATION OR EQUAL.
9. EXISTING PUBLIC SEWER TO BE JET CLEANED AND CCTV SURVEYED PRIOR TO, AND AFTER PROPOSED CONNECTIONS FROM NEW NETWORK.
10. ALL NEW DRAINAGE INFRASTRUCTURE TO BE JET CLEANED AND CCTV SURVEYED, WITH ANY NOTED DEFECTS REMEDIATED, ON COMPLETION OF WORKS, TO THE SATISFACTION OF THE LOCAL AUTHORITY.
11. MINIMUM DISTANCES FROM THE KERB TO WASTEWATER MANHOLE AND WASTEWATER SEWER TO BE IN ACCORDANCE WITH IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE SECTION 3.5.15.
12. REFER TO ARCHITECTS DRAWINGS FOR DETAILS OF PRIVATE DRAINAGE.
13. ALL COVER LEVELS ARE TO BE COORDINATED WITH ROAD DESIGN LEVELS AND LANDSCAPE ARCHITECT'S PROPOSED FINISH LEVELS.
14. CONCRETE SURROUND TO BE PROVIDED WHERE PIPE COVER IS LESS THAN 1.2m.

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Rev No.	Date	Revision Note	Drn by	Chkd by
P01	12.05.20	ISSUED FOR PLANNING	AB	MK
P02	15.05.20	REVISED WASTEWATER NETWORK	RP	MK
P03	27.05.20	REVISED WASTEWATER NETWORK	AB	MK
C01	09.06.20	ISSUED FOR PLANNING	AB	MK
C02	08.07.20	SUITABLE FOR PLANNING	AB	MK
C03	10.07.20	REVISED PUMPING STATION	AB	MK

Rev No.	Date	Revision Note	Drn by	Chkd by

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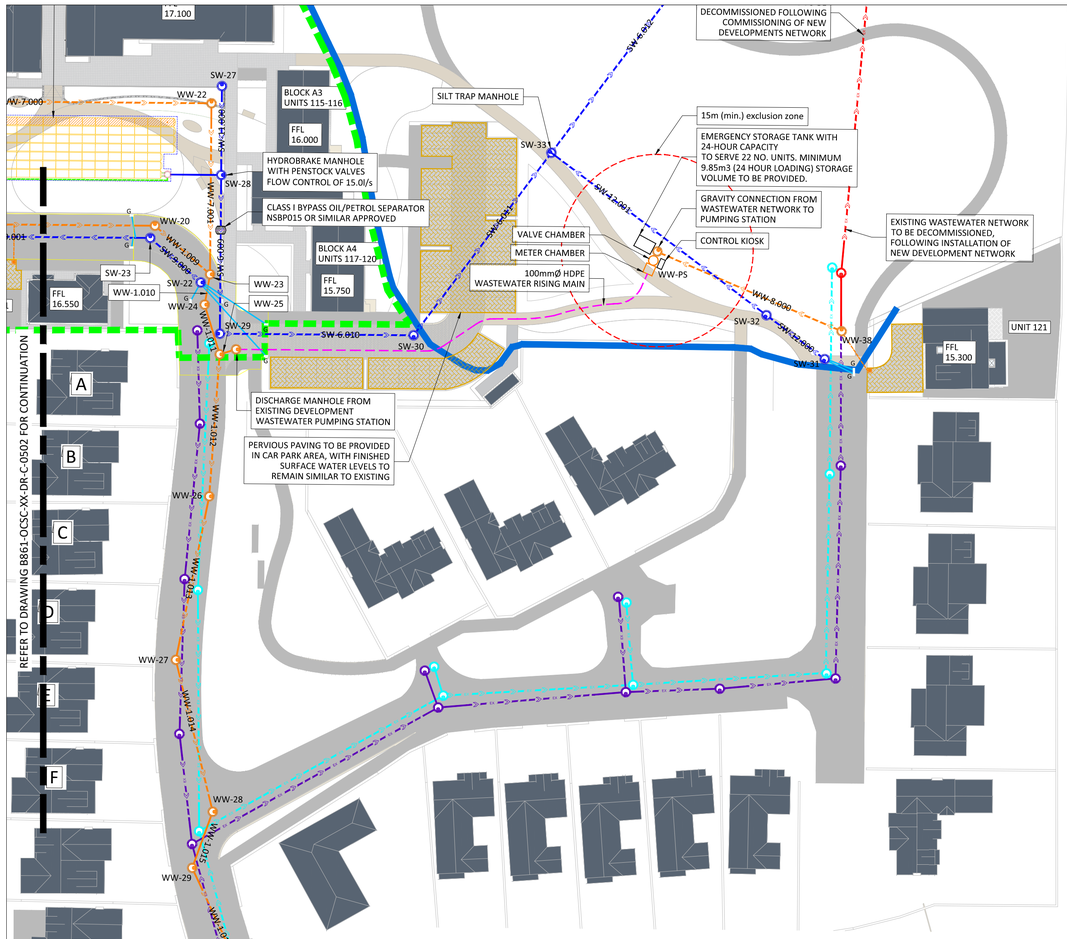
Client: BURKEWAY HOMES LTD
Project: RESIDENTIAL DEVELOPMENT AT BEARNA
Title: WASTEWATER NETWORK LAYOUT

Code	Originator	Zone	Level	Role	Type	Number	Status	Revision
B861	OCSC	XX	XX	C	DR	0502	A1	C03

Date: 12.05.20 Scale: 1:500 @ A1 Drn by:AB Chkd by:MK Aprvd by:AH



WASTEWATER DRAINAGE NETWORK DETAILS

USMH	USCL (m)	PN	Σ Houses	Length (m)	USIL (m)	US C.Depth (m)	Slope (1:X)	Dia (mm)	DSIL (m)	DS C.Depth (m)	DSMH
WW-1	22.821	WW-1.000	12	32.718	21.396	1.200	200.0	225	21.232	0.880	WW-3
WW-2	22.432	WW-2.000	8	32.597	21.007	1.200	200.0	225	20.844	1.269	WW-3
WW-3	22.338	WW-1.001	22	19.603	20.844	1.269	27.4	225	20.128	1.200	WW-4
WW-4	21.553	WW-1.002	25	17.526	20.128	1.200	37.6	225	19.662	1.200	WW-5
WW-5	21.087	WW-1.003	29	21.713	19.662	1.200	114.3	225	19.472	1.156	WW-9
WW-6	20.098	WW-3.000	11	41.291	18.673	1.200	200.0	225	18.467	2.087	WW-7
WW-7	20.779	WW-3.001	13	18.248	18.467	2.087	200.0	225	18.375	2.309	WW-8
WW-8	20.909	WW-3.002	13	4.319	18.375	2.309	200.0	225	18.354	2.274	WW-9
WW-9	20.853	WW-1.004	45	59.245	18.354	2.274	200.0	225	18.057	1.683	WW-11
WW-10	20.330	WW-4.000	6	19.680	18.905	1.200	53.9	225	18.54	1.200	WW-11
WW-11	19.965	WW-1.005	65	71.660	18.057	1.683	31.0	225	15.746	0.815	WW-17
WW-12	17.405	WW-5.000	2	11.776	16.282	0.898	200.0	225	16.223	0.817	WW-13
WW-13	17.265	WW-5.001	2	8.188	16.223	0.817	200.0	225	16.182	0.782	WW-15
WW-14	17.277	WW-6.000	4	14.115	16.286	0.766	140.0	225	16.185	0.779	WW-15
WW-15	17.189	WW-5.002	13	35.101	16.182	0.782	100.0	225	15.831	0.795	WW-16
WW-16	16.851	WW-5.003	14	9.671	15.831	0.795	100.0	225	15.734	0.826	WW-17
WW-17	16.786	WW-1.006	86	48.967	15.734	0.826	200.0	225	15.490	0.836	WW-18
WW-18	16.550	WW-1.007	86	8.766	15.490	0.836	199.2	225	15.446	0.841	WW-19
WW-19	16.511	WW-1.008	87	67.903	15.446	0.841	200.0	225	15.106	0.843	WW-20
WW-20	16.174	WW-1.009	87	11.992	14.749	1.200	199.9	225	14.689	1.201	WW-23
WW-21	18.499	WW-7.000	14	54.996	17.524	0.750	39.3	225	16.125	0.750	WW-22
WW-22	17.100	WW-7.001	33	27.907	16.125	0.750	28.0	225	15.128	0.762	WW-23
WW-23	16.115	WW-1.010	120	5.031	14.689	1.201	86.7	225	14.631	1.200	WW-24
WW-24	16.056	WW-1.011	120	8.478	14.631	1.200	200.0	225	14.589	1.206	WW-25
WW-25	16.020	WW-1.012	142	23.235	14.589	1.206	200.0	225	14.472	1.316	WW-26
WW-26	16.013	WW-1.013	142	27.232	14.472	1.316	200.0	225	14.336	1.539	WW-27
WW-27	16.100	WW-1.014	142	25.511	14.336	1.539	200.0	225	14.209	1.436	WW-28
WW-28	15.870	WW-1.015	142	9.764	14.209	1.436	200.0	225	14.160	1.433	WW-29
WW-29	15.818	WW-1.016	142	27.802	14.160	1.433	200.0	225	14.021	1.457	WW-30
WW-30	15.703	WW-1.017	142	31.150	14.021	1.457	200.0	225	13.865	1.460	WW-31
WW-31	15.550	WW-1.018	142	37.306	13.865	1.460	84.0	225	13.421	1.200	WW-32
WW-32	14.846	WW-1.019	142	58.496	13.421	1.200	43.9	225	12.089	1.200	WW-33
WW-33	13.514	WW-1.020	142	85.000	12.089	1.200	37.9	225	9.849	1.200	WW-34
WW-34	11.274	WW-1.021	142	85.000	9.849	1.200	129.4	225	9.192	0.750	WW-35
WW-35	10.167	WW-1.022	142	85.000	9.192	0.750	200.0	225	8.767	1.205	WW-36
WW-36	10.197	WW-1.023	142	26.471	8.767	1.205	200.0	225	8.635	1.400	WW-Outfall
WW-37	14.775	WW-8.000	22	32.781	13.857	0.693	72.0	225	13.402	1.395	WW-PS

REFER TO DRAWINGS

- B861-OCSC-XX-XX-C-DR-0501 FOR SURFACE WATER DESIGN LAYOUT
- B861-OCSC-XX-XX-C-DR-0502 FOR WASTEWATER DESIGN LAYOUT
- B861-OCSC-XX-XX-C-DR-0510/ 0511/ 0512 FOR DRAINAGE LONGITUDINAL SECTION NETWORK
- B861-OCSC-XX-XX-C-DR-0520/ 0521/ 0522/ 0523 FOR DRAINAGE DETAILS

NOTES

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3. REFER TO ARCHITECT / LANDSCAPE ARCHITECT'S DESIGN DRAWINGS FOR DETAILS OF PROPOSED SURFACE FINISHES AND LANDSCAPING.
4. ALL WASTEWATER DRAINAGE IS TO BE INSTALLED IN ACCORDANCE WITH THE IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE, THE BUILDING REGULATIONS PART H AND THE SITE DEVELOPMENT SPECIFICATION.
5. ALL DRAINAGE COVER LEVELS ARE TO BE COORDINATED WITH THE PROPOSED ROAD DESIGN LEVELS AND ARCHITECT DESIGN FINISH DETAILS.
6. ALL CONNECTIONS TO NEW DRAINAGE NETWORKS ARE TO BE MADE AT AT AN ANGLE OF 90° OR IN THE DIRECTION OF FLOW.
7. THE CONTRACTOR IS TO VERIFY INVERT LEVEL AT PROPOSED CONNECTION TO EXISTING SEWERS, PRIOR TO ANY OTHER WORKS BEING CARRIED OUT, AND MAKE ANY DISCREPANCIES KNOWN TO THE ENGINEER.
8. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMATION OF PRESENCE ALL EXISTING UTILITIES, IF ANY, ALONG ROUTE OF PROPOSED DRAINAGE NETWORKS - BY INTRUSIVE INVESTIGATION OR EQUAL.
9. EXISTING PUBLIC SEWER TO BE JET CLEANED AND CCTV SURVEYED PRIOR TO, AND AFTER PROPOSED CONNECTIONS FROM NEW NETWORK.
10. ALL NEW DRAINAGE INFRASTRUCTURE TO BE JET CLEANED AND CCTV SURVEYED, WITH ANY NOTED DEFECTS REMEDIATED, ON COMPLETION OF WORKS, TO THE SATISFACTION OF THE LOCAL AUTHORITY.
11. MINIMUM DISTANCES FROM THE KERB TO WASTEWATER MANHOLE AND WASTEWATER SEWER TO BE IN ACCORDANCE WITH IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE SECTION 3.5.15.
12. REFER TO ARCHITECTS DRAWINGS FOR DETAILS OF PRIVATE DRAINAGE.
13. ALL COVER LEVELS ARE TO BE COORDINATED WITH ROAD DESIGN LEVELS AND LANDSCAPE ARCHITECT'S PROPOSED FINISH LEVELS.
14. CONCRETE SURROUND TO BE PROVIDED WHERE PIPE COVER IS LESS THAN 1.2m.

LEGEND:

- WW??
- WW?.???
- PROPOSED uPVC (SN8) WASTEWATER NETWORK
- 100mmØ HDPE RISING MAIN
- EXISTING WASTEWATER NETWORK TO BE MAINTAINED (FROM TOPO SURVEY RECORDS)
- EXISTING WASTEWATER NETWORK TO BE DECOMMISSIONED (FROM TOPO SURVEY RECORDS)
- PRIVATE SURFACE WATER NETWORK TO BE MAINTAINED (FROM TOPO SURVEY RECORDS)
- PRIVATE WASTEWATER OUTFALL CHAMBER WITH 100mm uPVC PIPE
- INDICATIVE FLOOD EXTENT FROM BARNA DEVELOPMENT PLAN

PLANNING DRAWING.
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Rev No.	Date	Revision Note	Drn by	Chkd by
P01	06.03.19	SUITABLE FOR INFORMATION	MK	AH
P02	14.01.20	SUITABLE FOR PLANNING	SD	MK
P03	12.05.20	SUITABLE FOR PLANNING	AB	MK
P04	15.05.20	REVISED WASTEWATER DRAINAGE NETWORK	RP	MK
P05	27.05.20	REVISED WASTEWATER DRAINAGE NETWORK	AB	MK
C01	09.06.20	ISSUED FOR PLANNING	AB	MK
C02	08.07.20	SUITABLE FOR PLANNING	AB	MK
C03	10.07.20	REVISED PUMPING STATION	AB	MK

Rev No.	Date	Revision Note	Drn by	Chkd by

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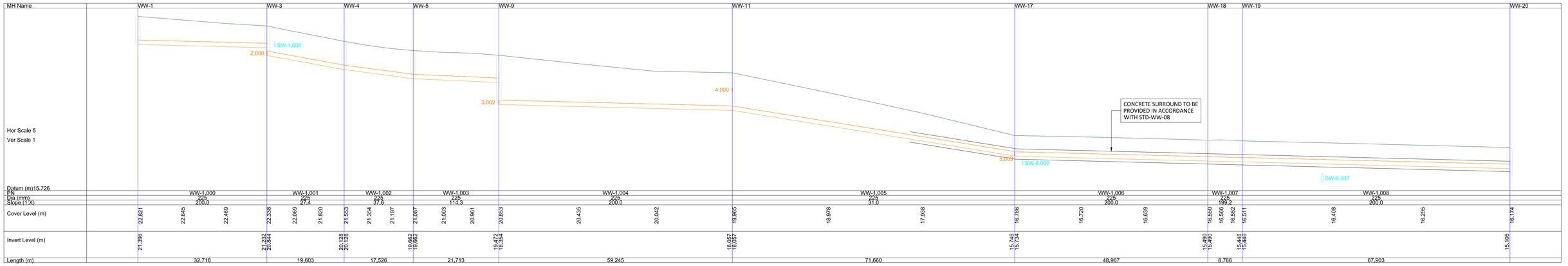
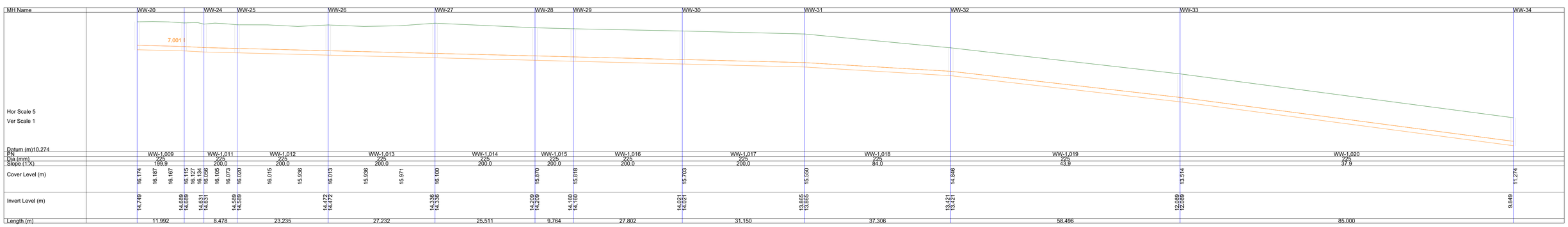
Client:	BURKEWAY HOMES LTD
Project:	RESIDENTIAL DEVELOPMENT AT BEARNA
Title:	PUBLIC ROAD DRAINAGE LAYOUT

Code	Originator	Zone	Level	Role	Type	Number	Status	Revision
B861	OCSC	XX	XX	C	DR	0540	A1	C03

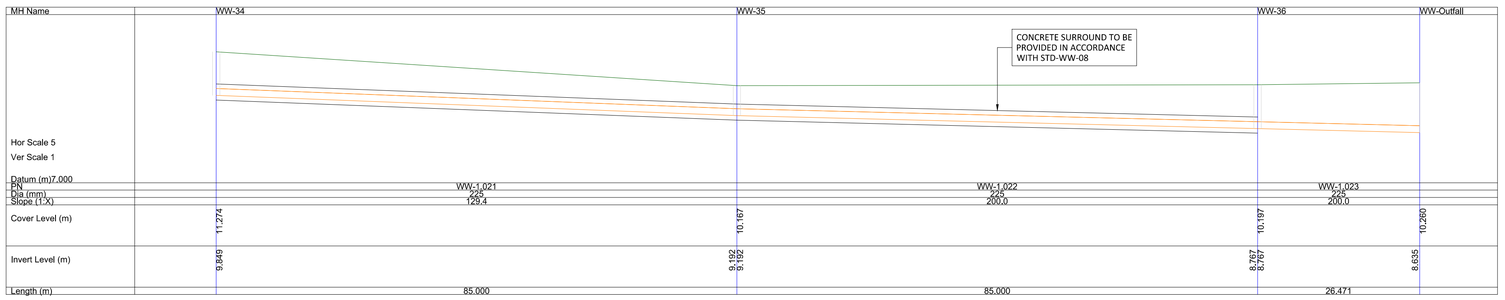
Date: 08.02.19 Scale: 1:500 @ A1 Drn by:AB Chkd by:MK Aprvd by:AH



MH Name	WW-1		WW-3	WW-4	WW-5	WW-9		WW-11			WW-17		WW-18	WW-19		WW-20
Hor Scale 5																
Ver Scale 1																
Datum (m)15.726																
PN	WW-1.000		WW-1.001	WW-1.002	WW-1.003	WW-1.004			WW-1.005			WW-1.006		WW-1.007	WW-1.008	
Dia (mm)	225		225	225	225	225			225			225		225	225	
Slope (1:X)	200.0		27.4	97.8	115.3	200.0			31.0			200.0		199.2	200.0	
Cover Level (m)	22.821	22.645	22.469	22.338	22.069	21.820	21.553	21.354	21.197	21.087	21.003	20.961	20.853	20.435	20.042	19.965	18.978	17.938	16.786	16.720	16.639	16.550	16.566	16.552	16.511	16.408	16.295	16.174
Invert Level (m)	21.396			21.232 20.844		20.128 20.128				19.662 19.662			19.472 18.354			18.057 18.057			15.746 15.734			15.490 15.490		15.446 15.446				15.106
Length (m)	32.718			19.603		17.526			21.713				59.245			71.660			48.967			8.766				67.903	



MH Name	WW-20			WW-24	WW-25		WW-26		WW-27			WW-28	WW-29	WW-30		WW-31		WW-32			WW-33			WW-34
Hor Scale 5																								
Ver Scale 1																								
Datum (m)10.274																								
PN	WW-1.009			WW-1.011	WW-1.012		WW-1.013		WW-1.014			WW-1.015	WW-1.016	WW-1.017		WW-1.018		WW-1.019			WW-1.020			
Dia (mm)	225			225	225		225		225			225	225	225		225		225			225			
Slope (1:X)	199.9			200.0	200.0		200.0		200.0			200.0	200.0	200.0		84.0		43.9			37.9			
Cover Level (m)	16.174	16.187	16.167	16.115 16.127	16.134 16.056	16.105	16.073	16.020	16.015	15.936		16.013	15.936	15.971		16.100		15.870	15.818		15.703		15.550		14.846			13.514			11.274
Invert Level (m)	14.749		14.689 14.689	14.631 14.631		14.589 14.589			14.472 14.472			14.336 14.336				14.209 14.209	14.160 14.160			14.021 14.021			13.865 13.865		13.421 13.421			12.089 12.089			9.849
Length (m)	11.992			8.478	23.235		27.232		25.511			9.764	27.802	31.150		37.306		58.496			85.000			



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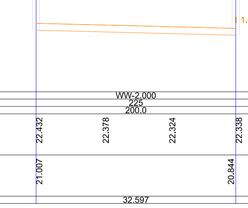
Hor Scale 5						
Ver Scale 1						
Datum (m)7.000						
PN	WW-1.021		WW-1.022		WW-1.023	
Dia (mm)	225		225		225	
Slope (1:X)	129.4		200.0		200.0	
Cover Level (m)	11.274	9.849	10.167	9.192 9.192	10.197	10.260 8.635
Invert Level (m)					8.767 8.767	
Length (m)	85.000		85.000		26.471	



MH Name	WW-2		WW-3
Hor Scale 5			
Ver Scale 1			
Datum (m)19.000			
PN	WW-2.000		
Dia (mm)	225		
Slope (1:X)	200.0		
Cover Level (m)	22.432	22.378 22.324	22.338
Invert Level (m)	21.007		20.844
Length (m)	32.597		

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P02	12.05.20	SUITABLE FOR PLANNING	AB	MK
P03	15.05.20	REVISED WASTEWATER LONGSECTIONS	RP	MK
P04	27.05.20	REVISED WASTEWATER LONGSECTIONS	AB	MK
C01	09.06.20	ISSUED FOR PLANNING	AB	MK
C02	08.07.20	SUITABLE FOR PLANNING	AB	MK

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Project: RESIDENTIAL DEVELOPMENT AT BEARNA
Title: WASTEWATER LONG SECTIONS SHEET 02 OF 04

Code	Originator	Zone	Level	Role	Type	Number	Status	Revision
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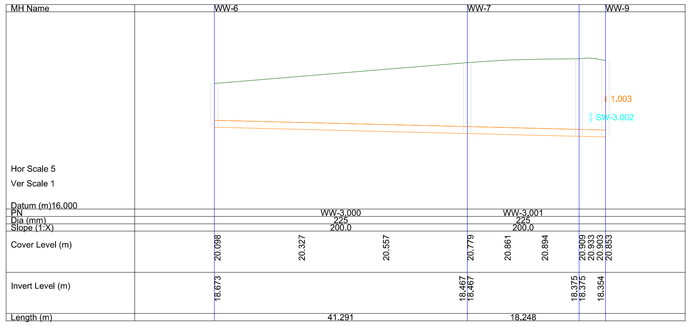
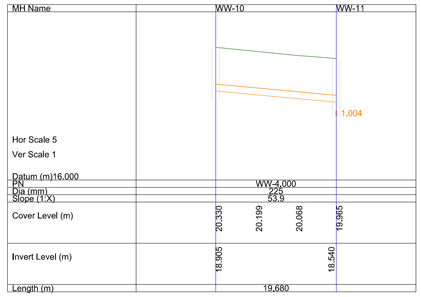
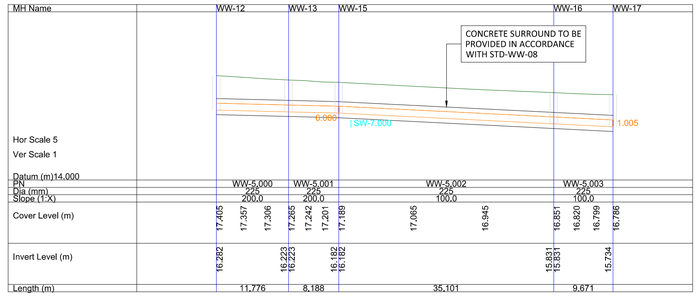
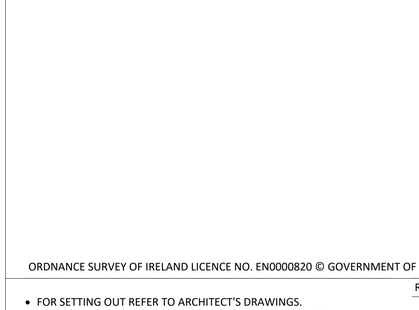
Date: 14.01.20 Scale: 1:500 @ A1 Drn by:SD Chkd by:MK Aprvd by:AH









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Client: BURKEWAY HOMES LTD
Project: RESIDENTIAL DEVELOPMENT AT BEARNA
Title: WASTEWATER LONG SECTIONS SHEET 03 OF 04

Code	Originator	Zone	Level	Role	Type	Number	Status	Revision
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Date: 12.05.20 Scale: 1:500 @ A1 Drn by:AB Chkd by:MK Aprvd by:AH

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APPENDIX E. TECHNICAL NOTE ON ROAD WIDTH

Appendix E

Technical Note on Road Width

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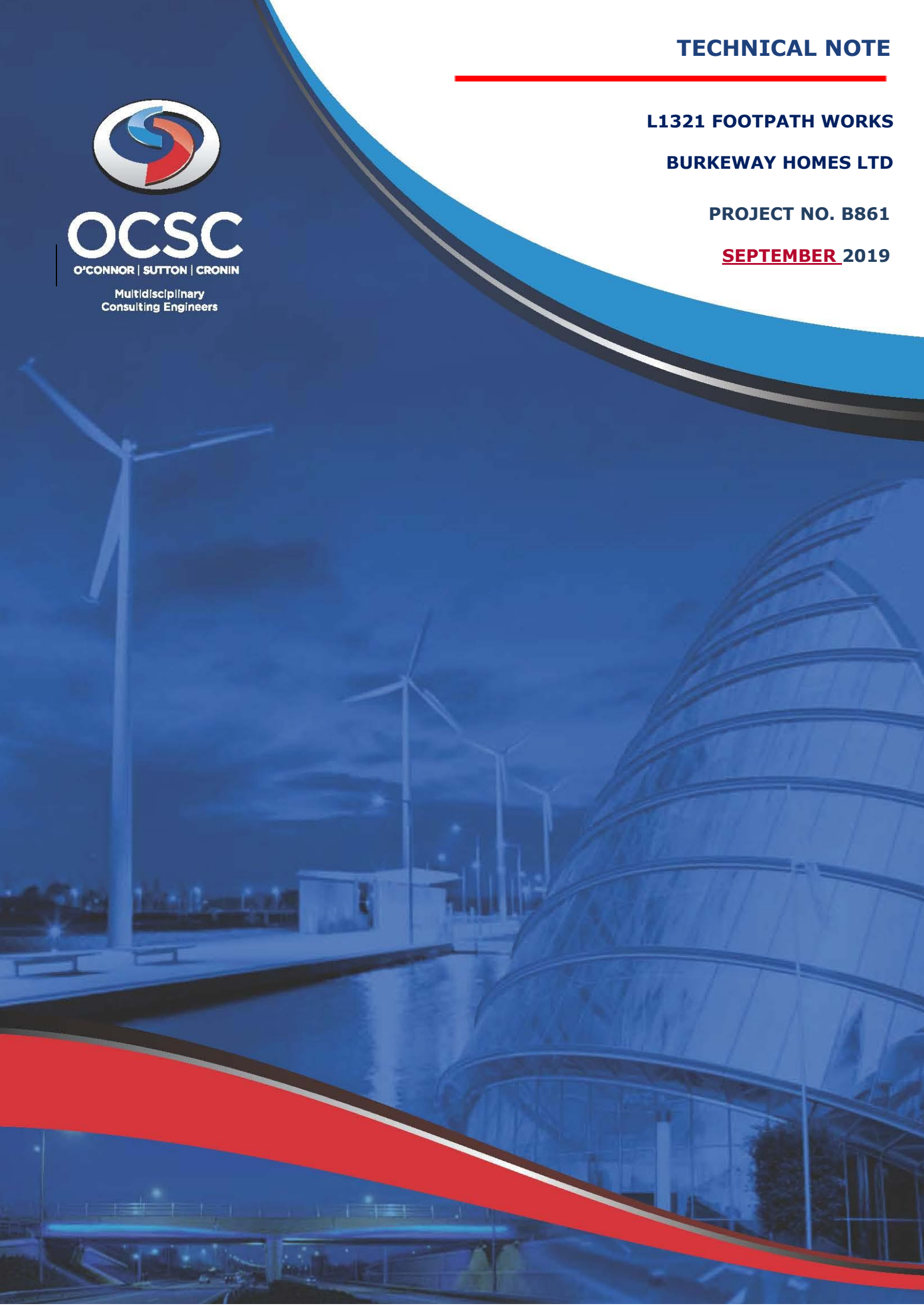
TECHNICAL NOTE

L1321 FOOTPATH WORKS

BURKEWAY HOMES LTD

PROJECT NO. B861

SEPTEMBER 2019



TECHNICAL NOTE

L1321 FOOTPATH WORKS

BURKEWAY HOMES LTD

PROJECT NO. B861

SEPTEMBER 2019

TECHNICAL NOTE

L1321 FOOTPATH WORKS

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	B861	OCSC	XX	XX	RP	C	0100	S0	P01

Rev.	Status	Authors	Checked	Authorised	Issue Date
C01	A1	KP	MK	AH	29.06.2020
P01	S3	OG	LG	AH	SEPT 2019

TECHNICAL NOTE

L1321 FOOTPATH WORKS

PROJECT NO. B861

TABLE OF CONTENTS PAGE

1 INTRODUCTION

O'Connor Sutton Cronin & Associates (OCSC) has been commissioned by Burkeway Homes Ltd to advance the Bearna Housing Development Strategic Housing Development Application. As part of that proposal a memorandum of understanding exists between Burkeway and Galway County Council that a footpath should be constructed along the L1321 between the proposed development and Bearna village, in order to improve pedestrian connectivity.

This technical note discusses the Local Road L1321 and the proposed footpath in the context of the *Design Manual for Urban Roads and Streets* (DMURS)

2 DMURS CLASSIFICATION

2.1 Road Classification

The movement function of a street is described in DMURS using a hierarchy system that classifies streets into the following categories, as shown in Figure 3.3:

- Arterial Streets
- Link Streets
- Local Streets

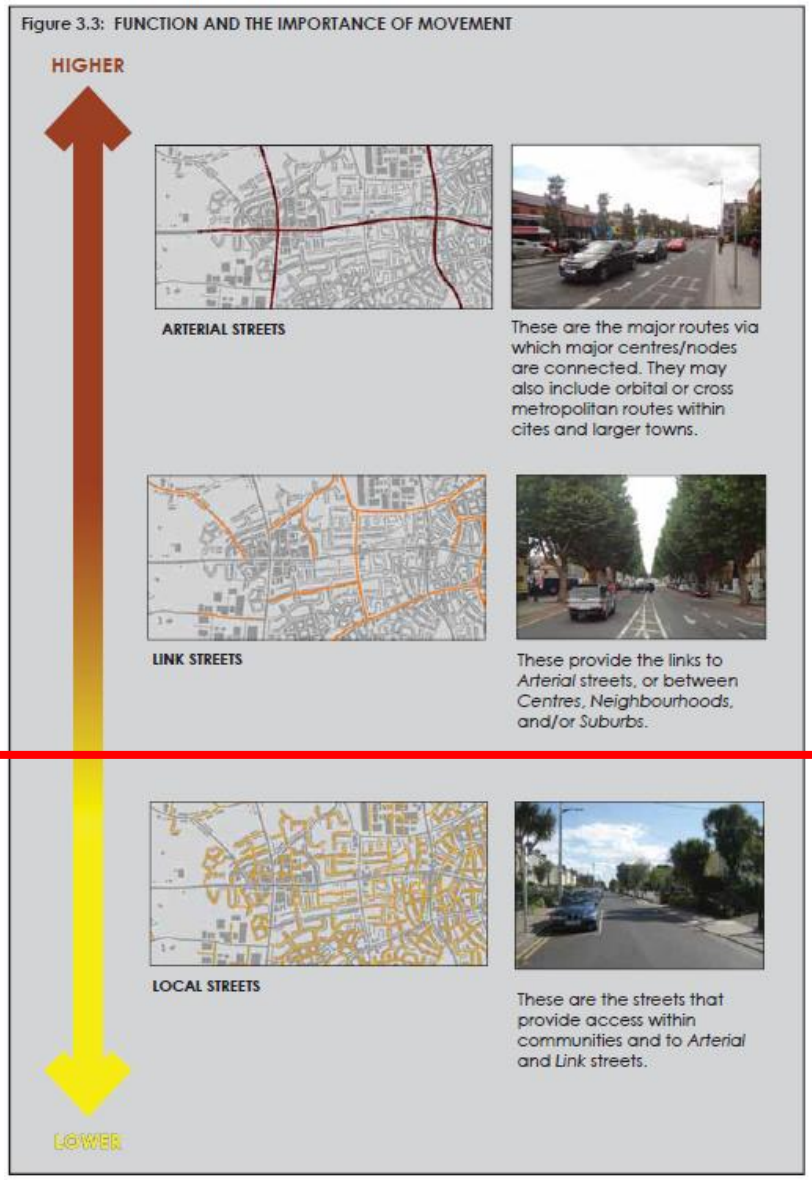

Figure 1 – DMURS Hierarchy of Streets

Under DMURS the L1321 Road is most appropriately classified as a **Local Road**. Table 3.1 of DMURS illustrates how this road hierarchy relates to other relevant documents.

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 3.1: Terminology used within this Manual compared with other key publications.

Figure 2 -DMURS Road Terminology

This designation is suitable as the L1321 serves to provide access to many private residencies and to the nearby Arterial and Link roads. This classification is in-line with GCC's classification of the road as an L designation road. Eleven properties have direct access onto the road in the 480m stretch from the signalised junction between the L1321 and the R336 to the proposed site entrance at Cnoc Fraoigh. 7.5km to the north of the site entrance the L1321 also joins the N59 at a simple priority junction.

2.2 Context

The L1321 serves as a transition zone from the urban centre of Bearna to the more rural lands to the north. Transition Zones are distinct from rural roads and urban areas. They tend to have many indivudal access points to private dwellings, footpaths, and have more fronting boundary walls than rural roads.

Figure 3: As individual elements of the streetscape change, the context of the street alters from rural to town.

RURAL

Boundary: hedgerow and trees

Footpath: none

Kerb: none

Access: infrequent or limited to farmland

Road width: carriageway only

Street lighting: none

Built form: infrequent

Speed limit: should be greater than 60kph

TRANSITION ZONE*

Boundary: hedgerow and garden hedges with occasional boundary walls and gates

Footpath: commencing to one side

Kerb: occasional to one side

Access: increased individual access

Road width: carriageway, including setback/layby

Street lighting: occasional or none

Built form: occasional one off buildings offset from road

Speed limit: should be 50-60kph

Images: Google Street View

URBAN AREA (CITY, TOWN, VILLAGE)

Boundary: garden hedges, walls, railings, buildings

Footpath: both sides

Kerb: continuous dropped at crossings

Access: individual, school and housing access

Road width: carriageway only, no setback or parking

Street lighting: one or two sides

Built form: closer to road with established building lines

Speed limit: 50kph or less

* *The Transition Zone will include elements of development similar to the Rural Fridge (as defined within DMURS), or also commonly refered to as Peri-Urban areas.*

Figure 3 – Transition Zones DMURS Advice Note 1

Figure 4 -Bearna Context

The context of this transition zone is affirmed by the many individual accesses directly onto the road. the existing speed limit of 50kph and the many boundary walls and gates along the road. The proposed addition of the footpath for 330m on the eastern side of the L1321 will strengthen this context further. The proposed works to the L1321 are shown in the drawing overleaf and appended to this document.

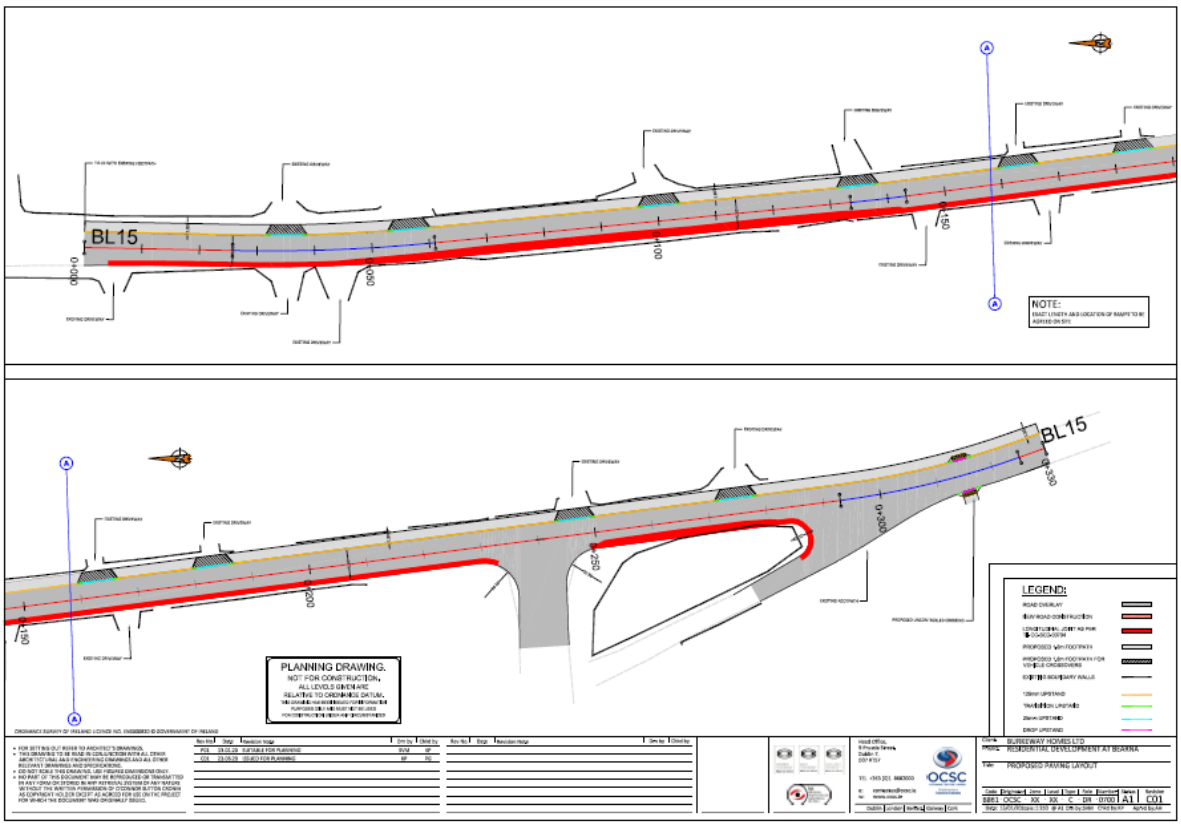

Figure 5 – Proposed Footpath Works

The works involve a slight realignment, new longitudinal construction to maintain the 5.5m carriageway width, a overlay of the existing road, the laying of a 125mm kerb, transitioning down to 25mm for vehicle access, and a 1.8m footpath on the eastern side of the road where none currently exists and provide for tying in with the 13 existing access points onto this stretch of the L1321. There will also be provided a new uncontrolled pedestrian crossing point, with associated tactile paving.

2.3 Carriageway Width

It is noted that in accordance with DMURS 5.5m is the max. appropriate width for this type of road. A narrower carriageway can be considered here (5.0m). In the opinion of OCSC 5.5m is appropriate as the route will be subject to occasional use by large road and agricultural vehicles.

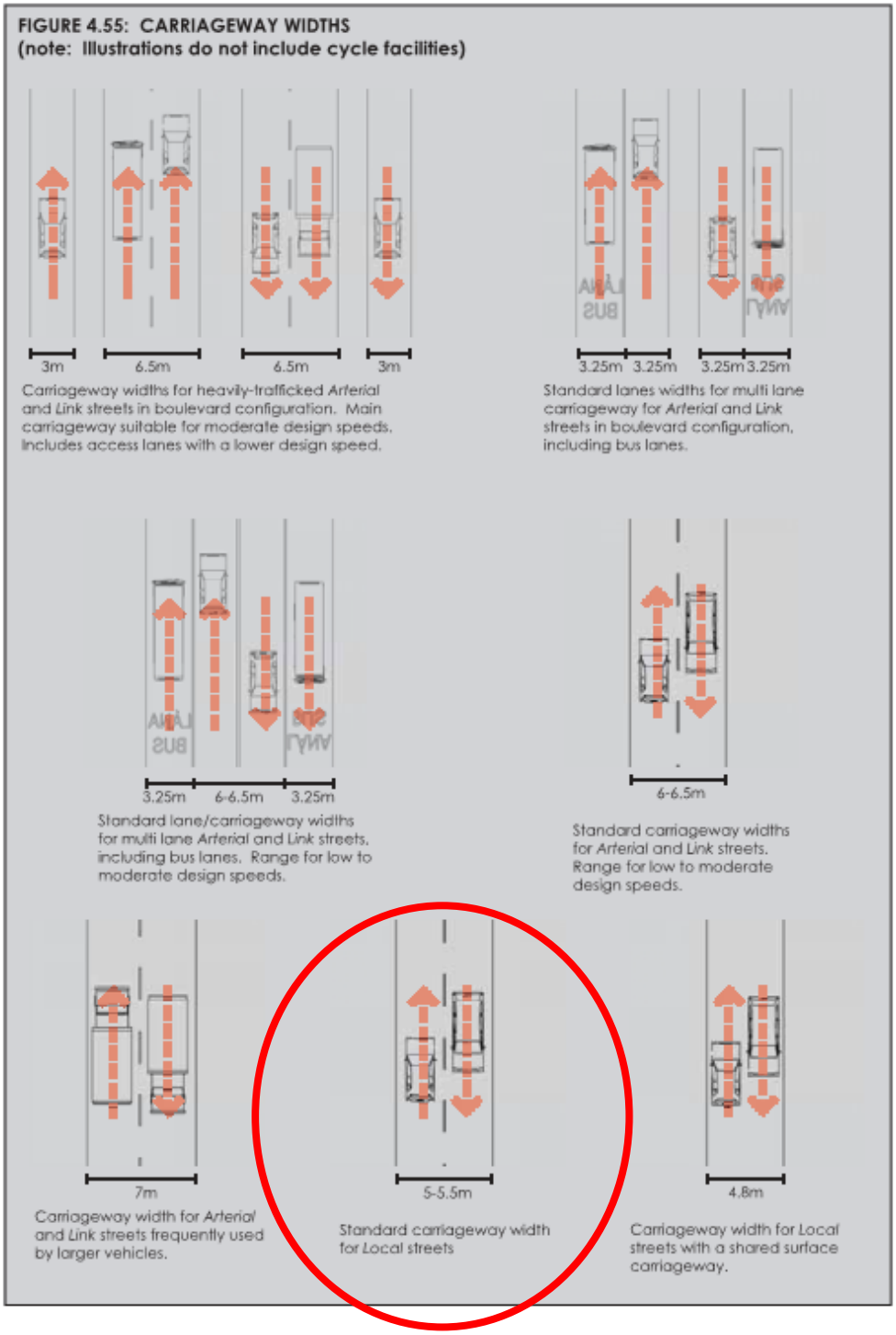

Figure 6 – DMURS Carriageway Widths

2.4 Proposed Footpath

The proposed footpath width of 1.8m is the minimum allowed under DMURS. It is considered appropriate based on the level of pedestrian activity.

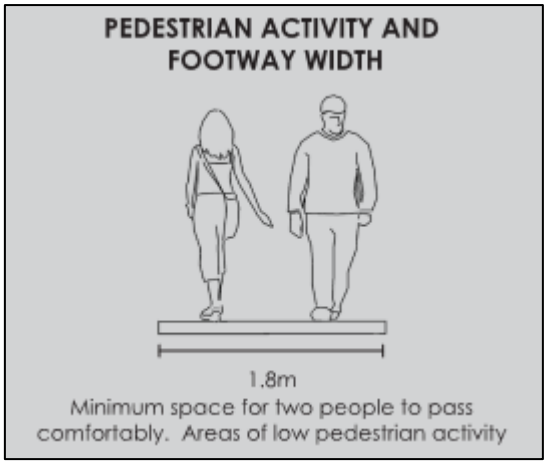

Figure 7 – DMURS Footway Width

2.5 Road Design Speeds

The design speed is the maximum speed at which it is envisaged/intended that the majority of vehicles will travel under normal conditions.

The current speed limits in the Bearna area are shown overleaf, from the *Road Traffic (Special Speed Limits) County Galway Bye-Laws 2018-Location Map.*

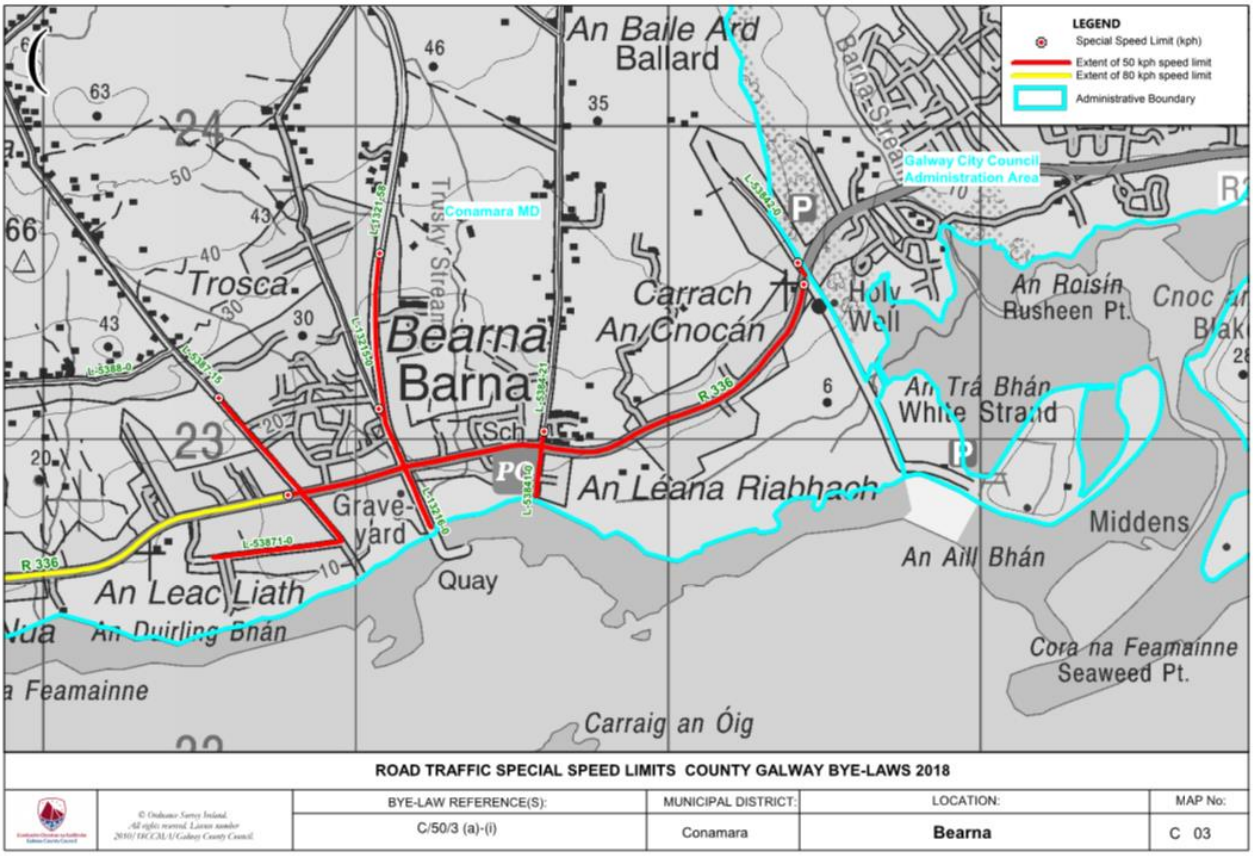

Figure 8 – Bearna Speed Limits

The L1321 has a speed limit of 50kph to a point north of the Cnoc Fraoigh junction. It is noted that the L1321 in the 50kph zone consists of a very long straight road and a high radius curve. The road width of 5.5m is considered appropriate as a wider road would serve to increase driver speed.

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APPENDIX F. ROAD SAFETY AUDIT

Appendix F

Road Safety Audit

ATKINS

Member of the SNC-Lavalin Group

Proposed Residential Development at Bearna

Stage 1 & 2 Road Safety Audit

Burkeway Homes Ltd.

July 2020

Notice

This document and its contents have been prepared and are intended solely for Burkeway Homes Ltd. information and use in relation to the Proposed Residential Development at Bearna.

Atkins assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

Document history

Revision	Purpose description	Origin-ated	Checked	Reviewed	Author-ised	Date
Rev 0	Draft Issue	JW	JW	MD	MD	04/06/2020
Rev 1	Final Issue	JW	JW	MD	MD	24/06/2020
Rev 2	Final Issue	JW	JW	MD	MD	17/07/2020

Client signoff

Client	Burkeway Homes Ltd.
Project	Proposed Residential Development at Bearna
Job number	5197317

Contents

Tables

Figures

No table of figures entries found.

1. Introduction

1.1. Background

This report describes the findings of a Stage 1 & 2 Road Safety Audit associated with the Proposed Residential Development at Bearna.

The Audit has been completed by Atkins on behalf of Burkeway Homes Ltd..

1.2. Site Inspection

The site inspection was carried out on Tuesday 3rd June 2020 by the Audit Team.

Weather conditions during the site inspection were sunny and dry; road surfaces were dry.

1.3. The Team

The Road Safety Audit Team members were as follows:

- Team Leader: Martin Deegan BEng (Hons) MSc CEng MICE
- Team Member: Jason Walsh BEng (Hons) PCert (RSA) CEng MIEI

1.4. The Design

The following drawing was examined as part of the Road Safety Audit (RSA) process:

Table 1-1 - Drawing List

Drawing No	Drawing Title	Revision Status
B861-OCSC-XX-XX-C-DR-0100	General Arrangement	P02
B861-OCSC-XX-XX-C-DR-0101	Proposed Plan & Profile	P02
B861-OCSC-XX-XX-C-DR-0102	Cross Section (1 of 3)	P01
B861-OCSC-XX-XX-C-DR-0103	Cross Section (2 of 3)	P01
B861-OCSC-XX-XX-C-DR-0104	Cross Section (3 of 3)	P01
B861-OCSC-XX-XX-C-DR-0106	Proposed Levels	P02
B861-OCSC-XX-XX-C-DR-0107	Proposed Longsection (1 of 2)	P02
B861-OCSC-XX-XX-C-DR-0108	Proposed Longsection (2 of 2)	P02

1.5. Road Safety Audit Compliance

Procedure and Scope

This Road Safety Audit has been carried out in accordance with the procedures and scope set out in TII publication number **GE-STY-01024 - Road Safety Audit**.

As part of the road safety audit process, the Audit Team have examined only those issues within the design which relate directly to road safety.

Compliance with Design Standards

The road safety audit process is not a design check, therefore verification or compliance with design standards has not formed part of the audit process.

Minimizing Risk of Collision Occurrence

All problems described in this report are considered by the Audit Team to require action in order to improve the safety of the scheme and minimise the risk of collision occurrence.

2. Road Safety Issues Identified

2.1. Problem: Gradients on Driveways and Footpaths

Location: **Along L1321 Road**

Drawings Ref: **B861-OCSC-XX-XX-C-DR-0101**

With the installation of the proposed footpath there will be level differences between some of the high-level gardens and the proposed footway. This could result in the following:

a) Steep gradients at tie-ins between existing driveways and the proposed footway

b) Inappropriate cross falls on the proposed footway

Recommendation
The Design Team should ensure that tie-in gradients between the proposed footway and the existing driveways are minimized and fall within industry standards.

2.2. Problem: Impact on 'Over the Edge' Drainage

Location: **Along L1321 Road**

Drawings Ref: **B861-OCSC-XX-XX-C-DR-0101**

The existing road uses an 'over the edge' drainage system which will be impacted upon by the provision of raised kerbs and a new footway. This could lead to surface water being retained within the carriageway leading to potential discomfort for pedestrians and aquaplaning for vehicles.

Recommendation
The Designer should ensure that adequate drainage interventions are provided to minimize the risk of surface water being retained within the carriageway.

2.3. Problem: Footpath Connectivity

Location: **Main Development Access Junction off L1321 Road**

Drawings Ref: **B861-OCSC-XX-XX-C-DR-0101**
It is unclear if the proposed footpath extends to the existing section of footpath provided at the main development junction. Lack of connection will result in difficulties for pedestrians and conflicts with vehicles.

Recommendation
The Designer should ensure that the connection with the existing section of footpath is provided.

2.4. Problem: Crossing Facilities

Location: **Main Development Access Junction off L1321 Road**

Drawings Ref: **B861-OCSC-XX-XX-C-DR-0101**
The existing crossing at the main development access junction does not appear to include the provision of tactile paving. This can result in difficulties for visually impaired pedestrians.

Recommendation
The Designer should ensure that the crossing is provided with appropriate tactile paving.

2.5. Problem: Provision of Pedestrian Linkage

Location: **Within Development Site**

Drawings Ref: **B861-OCSC-XX-XX-C-DR-0100**

The main pedestrian route serving the development has a break in footpath provision on the right-hand side adjacent the open space.

This could result in pedestrians walking in traffic lanes in conflicts with vehicles accessing and departing the development.

Recommendation

The Designer should provide a footpath connection at this location.

2.6. Problem: Pedestrian Crossing Facilities

Location: **Within Development Site**

Provisions for pedestrians to cross the road carriageway along key desire lines at internal road junctions do not appear to have been prescribed. This could lead to conflicts between pedestrians and vehicles.

Recommendation

The Design Team should provide pedestrian crossings at internal junctions to service key desire lines. Such measures might include dropped kerbs with appropriate level of tactile paving or raised crossings.

2.7. Problem: Speed Control Measures

Location: **Within Development Site**

Provisions for speed control measures have not been proposed, raised tables at key locations or raised crossings. Lack of speed control measures may result in inappropriate vehicle speeds.

Recommendation

The Designer should consider the use of speed control measures at key locations within the development.

2.8. Problem: Provision for Refuse Vehicle

Location: **Within Development Site**

Drawings Ref: **B861-OCSC-XX-XX-C-DR-0100**

Refuse Vehicles may be required to manoeuvre and reverse on many of the spur streets throughout the site. Some of these spur streets do not appear to include turning heads and which could result in lengthy reversing manoeuvres.

Recommendation

The Designer should ensure adequate turning facilities are provided for Refuse Vehicles where required.

2.9. Problem: Safety of Road Users During Construction

Location: **Existing Development Site**

Drawings Ref: **B861-OCSC-XX-XX-C-DR-0100**

The passage of construction vehicles through the existing development site could lead to increased risks for residents and road users.

Recommendation

The Designer should ensure that a Construction Traffic Management Plan is developed in advance of the works commencing on site.

3. Audit Team Statement

3.1. Certification

We certify that we have examined the drawings and documents listed in Chapter 1 of this Report.

3.2. Sole Purpose

The Road Safety Audit has been carried out with the sole purpose of identifying any features of the design which could be removed or modified in order to improve the road safety aspects of the scheme.

3.3. Implementation of RSA Recommendations

The problems identified herein have been noted in the Report together with their associated recommendations for road safety improvements. We (the Audit Team) propose that these recommendations should be studied with a view to implementation.

3.4. Audit Team's Independence to the Design Process

No member of the Audit Team has been otherwise involved with the design of the measures audited.

3.5. Road Safety Audit Team Sign-Off

Martin Deegan
Audit Team Leader
Road Safety Engineering Team
ATKINS

Signed: 
Date: 4th June 2020

Jason Walsh
Audit Team Member
Road Safety Engineering Team
ATKINS

Signed: 
Date: 4th June 2020

4. Designers Response

4.1. Preparing a Response to the Road Safety Audit

The Designer should prepare an Audit Response for each of the recommendations using the Road Safety Audit Feedback Form attached in Appendix A.

When completed, this form should be signed by the Designer and returned to the Audit Team.

4.2. Returning the Feedback Form

Please return the completed Road Safety Audit Feedback Form attached in Appendix A of this report to the following email or postal address:

Email address: martin.deegan@atkinsglobal.com

Postal address: Road Safety Engineering Team
Atkins
150 Airside Business Park
Swords
Co Dublin
K67 K5W4

Telephone: 00 353 (0)1 810 8000

The Audit Team will consider the Designers response and reply indicating acceptance or otherwise of the Designers response to each recommendation.

4.3. Triggering the Need for an Exception Report

Where the Designer and the Audit Team cannot agree on an appropriate means of addressing an underlying safety issue identified as part of the audit process, an Exception Report must be prepared by the Designer on each disputed item listed in the audit report.

Appendices

Appendix A. Road Safety Audit Feedback Form

Scheme: Proposed Residential Development at Bearna

Audit Stage: Stage 1 & 2 Road Safety Audit

Date Audit Completed: 4th June 2020

	To be completed by the Designer			To be completed by the Audit Team
Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures or comments	Alternative Measures accepted by Auditors (yes/no)
2.1	Yes	Yes	To be addressed in detail design	
2.2	Yes	Yes	To be addressed in detail design	
2.3	Yes	Yes	Connections will be provided.	
2.4	Yes	Yes	To be addressed in detail design	
2.5	No	No	It's an existing road and footpath and no proposed works intended to be done at that stretch.	Yes - monitor pedestrian movements along this link for conflicts upon opening of development
2.6	Yes	Yes	To be addressed in detail design	
2.7	No	No	Speed control measures are not required as there is no stretches of long straights.	Yes - consideration at detail design for provision of raised crossings for pedestrian priority at key locations
2.8	No	No	Autotrack has been done using the refuse truck and it works as required for waste collection.	Yes
2.9	No	No	Please note that the designer will make the client and the PSDP aware of this risk through design risk assessment and ask them to address the same through preliminary health and safety plan.	Yes

Signed by the Designer:
Punit Giria
Senior Engineer
O'Connor Sutton Cronin **Date: 19th June 2020**

Signed by the Audit Team Leader: **Date: 24th June 2020**

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