Waterman Moylan
Engineering Consultants

Engineering Assessment Report

Proposed Strategic Housing Development at Belcamp, Dublin 17

April 2022

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This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015 and BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
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Comments

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Disclaimer

This report has been prepared by Waterman Moylan, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Terms and Condition of Business and taking account of the resources devoted to us by agreement with the Client.

We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report is confidential to the Client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at its own risk.

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1. Introduction

This Engineering Assessment Report has been prepared by Waterman Moylan as part of the documentation in support of proposed Strategic Housing Development (SHD) planning submission in Belcamp, Dublin 17.

This report assesses wastewater and surface water drainage, water supply infrastructure and the road and transportation network in the vicinity of the site, and details the criteria used to design the proposed wastewater and surface water drainage, water supply and transport networks.

1.1 Site Location and Description

The Belcamp lands are located centrally in the Dublin Fringe area, north of the Northern Cross Route, R139, to the east of the IDA lands, and to the west of the Malahide Road (R107). The IDA lands are zoned "High Technology" (HT), to provide for office, research and development and high technology/high technology manufacturing type employment in a high quality built and landscaped environment. The total site area of the subject lands is c.67.2 hectares.

The subject site is bounded to the north and west by agricultural lands, to the south by the R139 Regional Road and to the east by an existing mixed-use development, by Phase 1 of the Belcamp development, which is currently under construction by the Applicant, and by the Malahide Road (R107).

The Mayne River flows from west to east through the site. The northern portion of the subject site is within Fingal County Council's jurisdiction, while the southern portion of the site is within Dublin City Council's jurisdiction, with the Mayne River forming the border between the two Local Authorities.

The site location is shown in the Figure below:

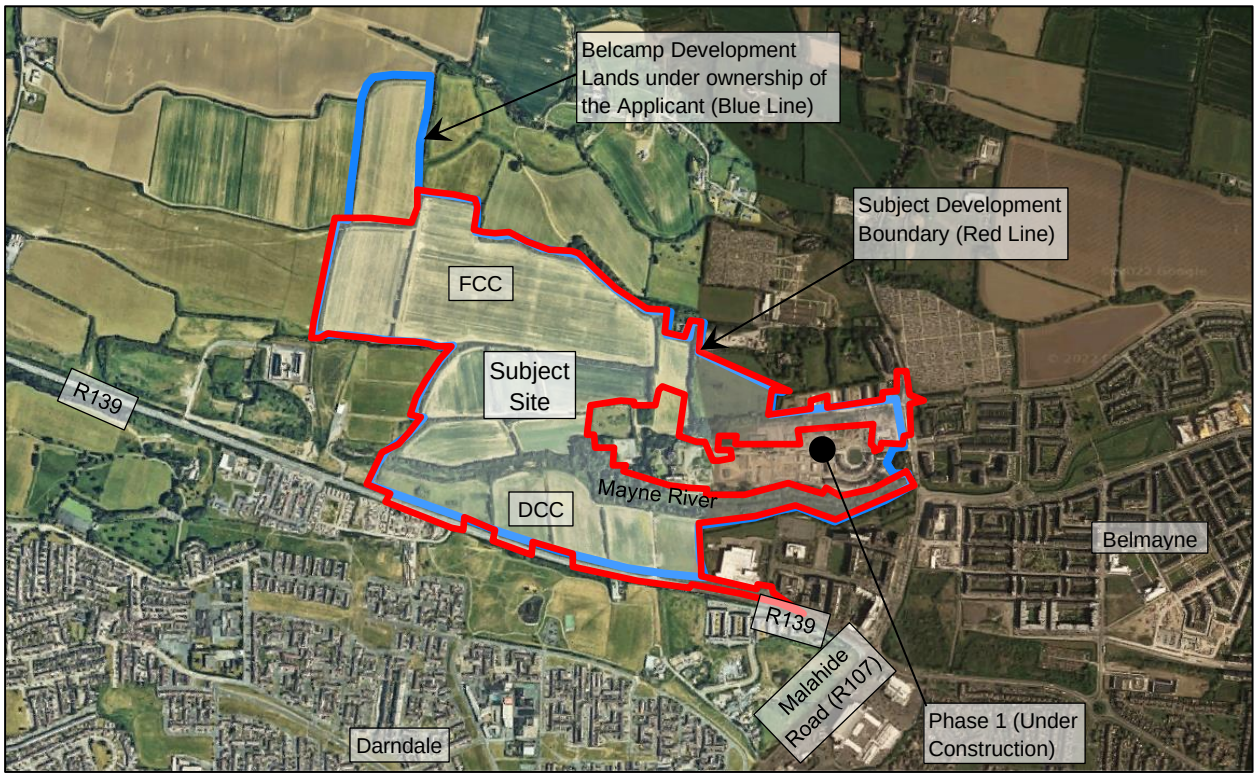


Figure 1 | *Site Location (Source: Google Maps)*

Topographic survey data shows that the southern portion of the site falls generally from south-west to north-east, towards the Mayne River, with a high point of c.35.5m OD Malin at the south-west of the site and a low point of c.26.5m OD Malin at the north-east of the main development area. The strip of land proposed as a greenway continues to fall to a low point of c.17m OD Malin close to the Malahide Road.

The northern portion of the site falls generally from north-west to south-east towards the Mayne River, though some of the lands at the north-east of the site fall to the north-east, away from the river and towards a ditch and culvert at the north-eastern boundary of the site.

1.2 Wider Development Area

The subject site is part of a larger proposed multi-phased development which includes lands to the east of the site, which are also under the ownership of the Applicant. Phase 1A of the Belcamp development was approved and is currently under construction under Planning Reference F15A/0609. Phase 1B of the development, immediately north of the Phase 1A lands and south of the Crosswaithe development (which is under construction by others under Planning Reference F18A/0092 and is to be named Belcamp Manor), has received a Decision to Grant permission under Planning Reference F21A/0401. Planning submissions have been made for Phase 1C under Reg. Ref. F22A/0136, located immediately north of the old Belcamp College building complex. Proposals to conserve the existing walled garden and provide for amenities within the enclosure are included as part of Phase 1C.

In addition to the development of the Applicant's Belcamp lands, there is development proposed and underway by others in the vicinity of the site, including development of the Belmayne – Belcamp Lane Masterplan area, located to the south and to the east of the subject lands.

1.3 Proposed Development

The proposed development comprises a total of 473 houses, 274 duplexes and 1,780 apartment units in 18 no. blocks, all on a c.67.2 Ha site. All of the proposed houses/duplexes are in the northern portion of the site, within Fingal County Council, and there are 550 apartment units proposed in this portion of the site, with 1,230 apartment units proposed in the southern portion of the site, within Dublin City Council. The schedule of accommodation is set out in the Table below:

Description		1-Bed	2-Bed	3-Bed	4-Bed	Total Residential	Commercial Space
Dublin City Council	Block 1	94	139	40	-	273	-
	Block 2	71	73	16	-	160	-
	Block 3	96	176	25	-	297	925.8m² Retail/Café and Childcare
	Block 4	70	178	37	-	285	-
	Block 5	37	51	8	-	96	-
	Block 6	19	80	20	-	119	-
	DCC Subtotal	***387***	***697***	***146***	***0***	***1,230***	***925.8m²***
Fingal County Council	Houses	-	16	385	72	473	-
	Duplexes	24	40	210	-	274	-
	Block A	8	15	-	-	23	-
	Block B	8	15	-	-	23	-
	Block C	7	20	-	-	27	-
	Block D	22	15	5	-	42	1,020.5m² Pub/Restaurant & Retail

Description		1-Bed	2-Bed	3-Bed	4-Bed	Total Residential	Commercial Space
	Block F	44	56	3	-	103	1,162.0m² Café/Bar/Restaurant & Retail
	Block G	29	36	-	-	65	140.0m² Retail
	Block H	20	26	-	-	46	-
	Block J	16	24	-	-	40	472.0m² Retail
	Block L	20	26	-	-	46	-
	Block M	24	32	-	-	56	-
	Block N	26	25	5	-	56	-
	Block P	5	18	-	-	23	-
	Crèche	-	-	-	-	-	606.7m² Childcare
	Clubhouse	-	-	-	-	-	97.0m² Changing Rooms
	FCC Subtotal	***253***	***364***	***608***	***72***	***1,297***	***3,498.2m²***
TOTAL		**640**	**1,061**	**754**	**72**	**2,527**	**4,424.0m²**

Table 1 | *Schedule of Accommodation*

The development includes significant commercial areas, much of it centred at a proposed Belcamp Town Square near the centre of the site, within the FCC portion of the lands. The schedule of commercial development areas is set out in the Table below:

Description			Commercial Area	
			Unit Area	*Total Per Block*
DCC	Block 3	Retail/Café 1	322.8m²	925.8m²
		Retail/Café 2	95.0m²	
		Childcare	508.0m²	
	DCC Subtotal			***925.8m²***
FCC	Block D	Pub/Restaurant	260.0m²	1,020.5m²
		Retail Unit 1	116.0m²	
		Retail Unit 2	141.0m²	
		Retail Unit 3	55.0m²	
		Retail Unit 4	96.0m²	
		Retail Unit 5	117.0m²	
		Retail Unit 6	103.0m²	
		Retail Unit 7	132.5m²	
	Block F	Café/Bar/Restaurant	219.0m²	1,162.0m²
		Retail Unit 8	152.0m²	
		Retail Unit 9	196.0m²	
		Retail Unit 10	194.0m²	
		Retail Unit 11	193.0m²	
		Retail Unit 12	208.0m²	

Description		Commercial Area	
		Unit Area	*Total Per Block*
Block G	Retail Unit 13	140.0m²	140.0m²
Block J	Retail Unit 14	144.7m²	472.0m²
	Retail Unit 15	91.3m²	
	Retail Unit 16	91.3m²	
	Retail Unit 17	144.7m²	
Crèche	Childcare	606.7m²	606.7m²
Clubhouse	Changing Rooms	97.0m²	97.0m²
FCC Subtotal			***3,498.2m²***
TOTAL			**4,424.0m²**

Table 2 | *Schedule of Commercial Areas*

The eastern portion of the site, between the Mayne River to the north and existing development to the south, is proposed to be used as a greenway. It will serve as a connection for pedestrians and cyclists between the subject site and the Malahide Road (R107).

There is a large open space proposed at the north-west of the site, in addition to several smaller open spaces throughout the development.

Figure 2 | *Proposed Site and Context*

2. Foul Water Network

2.1 Existing Foul Water Network

The existing North Fringe Interceptor Sewer (NFIS) traverses the southern portion of the subject site. The NFNIS is a 1,050mm diameter gravity sewer draining much of north-west Dublin and discharging eastwards to Sutton Pumping Station, which in turn pumps wastewater to the Ringsend Wastewater Treatment Works.

A 375mm diameter foul water sewer is under construction in College Avenue as part of the Phase 1 works (Planning Reference F15A/0609). This sewer is designed to accommodate the Belcamp Lands north of the Mayne River and drains to an existing 525mm diameter trunk sewer, recently extended by the Applicant across the Malahide Road from the Hermitage Apartments. The Malahide Road 525mm sewer outfalls to the 1,050mm diameter NFIS at Parkway Boulevard.

Refer to the accompanying Waterman Moylan drawing no.'s 19-114-P2100 to P2111, which show the existing and proposed foul water drainage layouts.

2.2 Proposed Foul Water Network

It is proposed to discharge wastewater from the southern portion of the site via a series of 150mm to 375mm sewers eastwards, outfalling to the existing NFIS via a new connection at the east of the site.

It is proposed to discharge wastewater from the northern portion of the site via a series of 150mm and 225mm sewers to the 525mm trunk sewer currently under construction as part of the Phase 1 works.

Irish Water have issued a Confirmation of Feasibility letter for the proposal, which is included in Appendix A (reference number CDS20001888).

A meeting was held with Irish Water Dublin City Council and Waterman Moylan on 22 April 2022, where the proposed water and foul networks were discussed.

Irish Water subsequently issued a Statement of Design Acceptance, which is included in Appendix B.

The final detail of the foul and water networks will be outlined in the connection agreements submission after a successful planning permission.

Refer to the accompanying Waterman Moylan drawing no.'s 19-114-P2100 to P2111, which show the existing and proposed foul water drainage layouts.

2.3 Foul Water Drainage – General

Foul water sewers will be constructed strictly in accordance with the Irish Water Code of Practice for Wastewater Infrastructure and Irish Water Standard Details. No private drainage will be located within public areas.

Drains will be laid to comply with the requirements of the latest Building Regulations, and in accordance with the recommendations contained in the Technical Guidance Document H.

2.4 Foul Water Drainage Calculations

The calculated foul water flows at the subject development are set out in the Table below. Domestic wastewater loads have been calculated based on 2.7 persons per unit with a per capita wastewater flow of 150 litres per head per day along with a 10% unit consumption allowance, in line with Section 3.6 of the Irish Water Code of Practice for Wastewater Infrastructure. Per capita wastewater flows for the commercial areas have been based on the flow rates set out in Appendix C of the Code of Practice, and a peak flow multiplier of 2.5 has been used, as per Section 2.2.5 of Appendix B of the Code of Practice.

Description		Total Population	Load per Capita	Daily Load	Total DWF	Peak Flow
		No. People	*l/day*	*l/day*	*l/s*	*l/s*
DCC Apartments (1,230 Units)		3,321.0	150	547,965.0	6.342	15.855
FCC Houses (473 Units)		1,277.1	150	210,721.5	2.439	6.097
FCC Duplexes (274 Units)		739.8	150	122,067.0	1.413	3.532
FCC Apartments (550 Units)		1,485.0	150	245,025.0	2.836	7.090
Pre-school/Crèche (1,115m²)	Staff	40	90	3,960.0	0.046	0.115
	Children	200	90	19,800.0	0.229	0.573
Restaurant/Pub/Café (479m²)	Staff	75	45	3,712.5	0.043	0.107
	Customers	500	30	16,500.0	0.191	0.477
Retail (2,733m²)	Staff	100	90	9,900.0	0.115	0.286
	Customers	1,200	12	15,840.0	0.183	0.458
Total		**-**	**-**	**1,195,491.0**	**13.837**	**34.592**

Table 3 | *Calculation of Total Foul Water Flow from the Development*

The total dry weather flow from the development is 13.837 l/s, with a peak flow of 34.592 l/s.

2.5 Foul Water Drainage – Diversions of Existing Sewers

As indicated on the drainage drawings, there is a necessary diversion of an existing 375mm sewer that flows into Belcamp from the Traveller site opposite Block 6 off the R139. This 375mm discharges to the 1050mm diameter North Fringe Interceptor Sewer. The diversion relocates the 375mm sewer out of the line of the proposed Block 5 and into the new R139 link road. This diversion was discussed with Irish Water at our meeting of 22 April 2022 and was the subject of a diversion submission to Irish Water. Correspondence from Irish Water dated 28 April 2022 confirmed our engagement with their diversions department and a pending reference number.

2.6 Foul Water Drainage – Wayleaves

As indicated below in light brown shading, a 23m wayleave (11.5m either side of the pipe centreline) is provided for the 1050mm diameter foul sewer (North Fringe Interceptor Sewer). No structures come within this reservation.

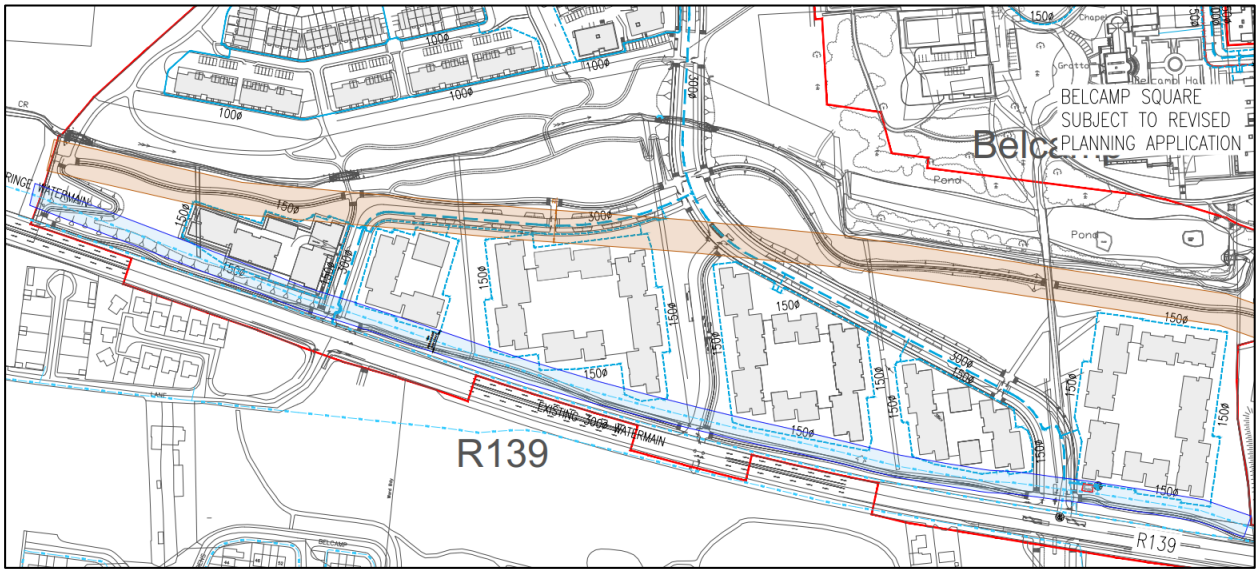


Figure 3 | *Wayleave to 1050m diameter North Fringe Interceptor Sewer*

3. Surface Water Network

3.1 Existing Surface Water Network

The proposed development site is a greenfield site. The Mayne River traverses the site, flowing from west to east. There are two existing off-line lakes at the northern edge of the Mayne River that part of the existing Belcamp Lands discharge to (refer to Section 3.1.2, below, for further information on the catchment areas).

There is an existing bridge separating the two lakes, and water discharges from the western lake to the eastern lake via a weir under the existing bridge. Water discharges from the eastern lake to the Mayne River via another weir structure. The lakes are substantially higher than the Mayne River at the discharge point from the eastern lake.

A survey was carried out at the site, and the survey drawing includes all existing watercourses and existing flood routing (note that the survey drawing is incorporated into the various accompanying layout drawings). Ditches convey surface water from the site as part of three separate catchments, one to the south and two to the north of the Mayne River, as described in the sections below. Refer also to the accompanying Waterman Moylan drawing no.'s 19-114-P2100 to P2111, which show the existing and proposed surface water drainage.

3.1.1 Existing Catchment South of Mayne River

The southern portion of the site falls generally from south-west to north-east towards the Mayne River, with a high point of c.35.5m at the south-west of the site and a low point of c.26.5m at the north-east of the main development area. The strip of land proposed as a greenway continues to fall to a low point of c.17m close to the Malahide Road.

There are several ditches on this southern portion of the site which fall from south to north, draining surface water to the Mayne River. A walk-through of the site revealed that the four north-south ditches traversing the site do not receive any inflow of surface water from upstream of the ditches. The ditch at the western boundary of the site does receive surface water draining from upstream catchment areas before discharging to the river. The ditch at the eastern boundary of the site, adjacent to the existing neighbouring mixed-use development, may receive some minor inflows from lands outside the site boundary.

The adjacent R139, at the southern boundary of the site, is independently drained to a separate storm water network in the road.

3.1.2 Existing Catchments North of Mayne River

Ditches convey surface water from the northern portion of the site as part of two separate catchments. The majority of the northern portion of the site drains in a southerly direction towards the lakes adjacent to the Mayne River via a series of ditches, ultimately discharging to the river via the existing weir.

A layout of the water courses on site and their flow characteristics has been prepared on drawing 19-114-P1002. An extract without existing utilities/services in indicated in the figure below.

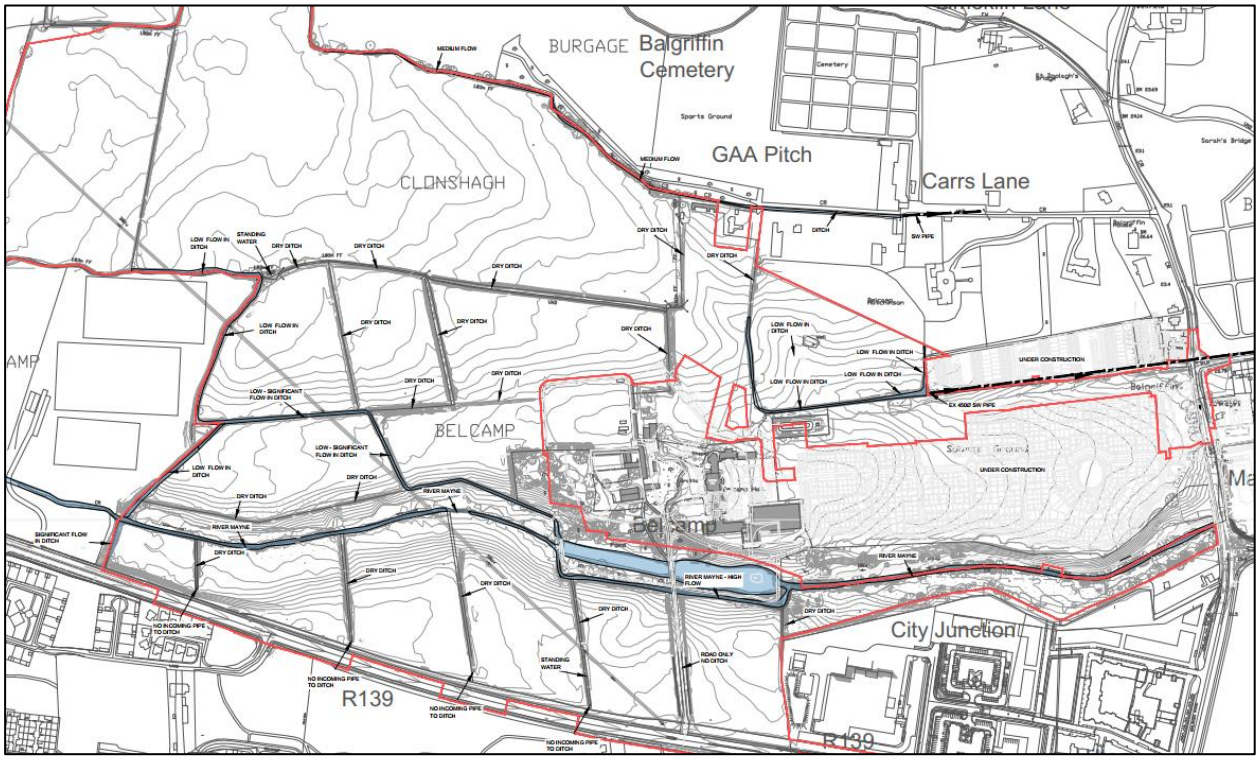


Figure 4 | *Water Courses on site, from drawing P1002*

A portion of the lands to the north-east drain in a north-easterly direction towards a ditch at the northern boundary of the Belcamp Lands, which discharges through the car park entrance of the Balgriffin Inn (previously Campions Pub) via a culvert, outfalling east via an existing headwall of the graveyard to the ditch that drains north to the Cuckoo Stream,

3.2 Proposed Surface Water Network

It is proposed to drain the site as three separate catchments: one to the south of the Mayne River (Catchment D1) and two to the north (Catchment A1 & A2), as indicated on the Figure below. There are a number of other catchments within the overall Belcamp Lands which overlap with the red line for the SHD. Catchment B1 and B2 are serving Phase 1, for which permission is already granted and which is substantially built under Planning Reference F15A/0609. Catchment C1 serves, for the most part, the proposed Phase 1B site, submitted for planning in late July 2021 under Planning Reference F21A/0401. There is a portion of the SHD lands that are within the C1 catchment and attenuation has been sized accordingly.

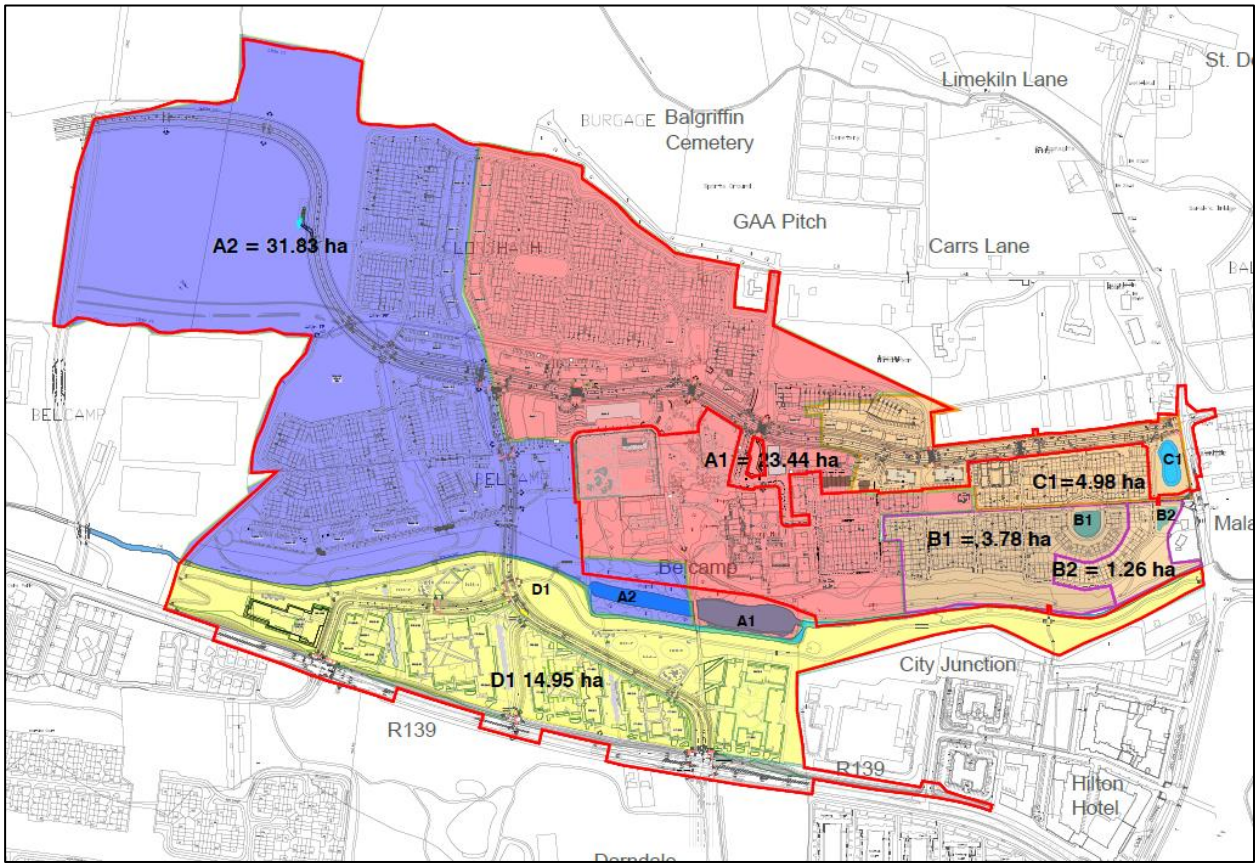


Figure 5 | *Proposed Surface Water Catchments*

3.2.1 Proposed Catchment South of Mayne River

South of the Mayne River, it is proposed to utilise the existing ditches that run south to north along the existing hedge-lines as open surface water features, but these are not needed or desirable for attenuation as there are trees lining both sides of the ditch. Each proposed block will drain to a ditch via underground surface water drains. The ditches will, in turn, each flow into a headwall before culverting under the road and ultimately discharging to the Mayne River. Steps will be provided into/out of each of the ditches as a health and safety feature. The main regional attenuation will be provided in the open space adjacent to the Mayne River, east of the main road in a dry detention format. A Downstream Defender unit is proposed upstream of the basin to remove pollutants and debris and protect the hydrobrake outfall chamber from siltation.

In developing the drainage proposals for the portion of the site within DCC's jurisdiction, Waterman Moylan have liaised with Maria Treacy of the DCC Drainage Division, who provided feedback and commentary on the emerging strategy.

3.2.2 Proposed Catchments North of Mayne River

Fingal County Council identified capacity constraints in the culvert at the north-east of the site that discharges under the existing access of the Balgriffin Inn (formerly Campions Pub). It is proposed to redirect a significant portion of the catchment from this culvert to maintain its capacity for the C1 catchment (Belcamp Phase 1B and the eastern extents of the EWLR). This diverted catchment will flow to the lower lake south of Belcamp Hall adjacent to the Mayne River. The C1 catchment is to be attenuated in the Phase 1B lands (currently a decision to grant for F21A/0401 is pending an ABP decision). Attenuation within the

Phase 1B site includes a small area of the SHD lands as indicated in Figure 2. All flows that originate from outside the Belcamp lands will be factored into the attenuation of the lake so that only the catchment that is on the Gannon Lands will be attenuated. FCC will need to ensure that any future development upstream of the Belcamp site, to the north west, that wishes to discharge to the Belcamp network is attenuated upstream to greenfield rates, unless an alternative outfall is found, which is preferable.

All of the lands east of the proposed Belcamp Parkway (main road that runs north/south through the DCC and FCC sites) will drain to the lower eastern lake (Catchment A1), while all lands to the west of the proposed Belcamp Parkway will drain to the upper western lake (Catchment A2). Drainage for the eastern sub-catchment, to the lower lake, will discharge through a new surface water sewer under construction as part of the Phase 1 works. This sewer has been designed to cater for flows from the subject development.

Utilising the natural treatment and storage potential of the existing lakes is an environmentally and ecologically sound solution that will benefit the receiving waters of the Mayne River.

Please refer to the drainage drawing that refer to the lakes as part of this decision in the 19-114-P2000 drawing series.

3.2.3 Proposed Riparian Corridor of Mayne River

The riparian corridor proposals were discussed with Maria Treacy of DCC Water Services in correspondence dating from 30 June 2021 and earlier. Detail on the corridor and path finishes were requested.

The main cyclist / pedestrian path is to the south of the paths for cyclists and pedestrians are provided with 80mm of asphalt and concrete pencil kerb edgings, as per DCC's cycleway specification. A minimum width of 3m is proposed, with the main pedestrian and cycle route south of the Mayne as a 5m reservation, with tar finish as per DCC's cycleway specification noted above.

Existing crossing points over the river Mayne to the west of the lakes will be reused and upgraded to accommodate 3m cyclist / pedestrian paths over the river. One new pedestrian / cyclist crossing point is proposed to the western boundary of the site. The new Belcamp Parkway distributor road will form a new vehicular crossing over the river just west of the lakes. One new crossing point east of the lakes is proposed as a box culvert, similar to the existing culverts that are to the west of the lakes. All of these crossing points are detailed on the Engineering Drawings.

A structure free riparian corridor of 25m has been provided each side of the Mayne River, with only paths and culverts proposed within this envelope. In most places a more generous corridor is provided, exceeding 25m either side of the bank edge, and a minimum of 25m either side of the river centreline is provided throughout.

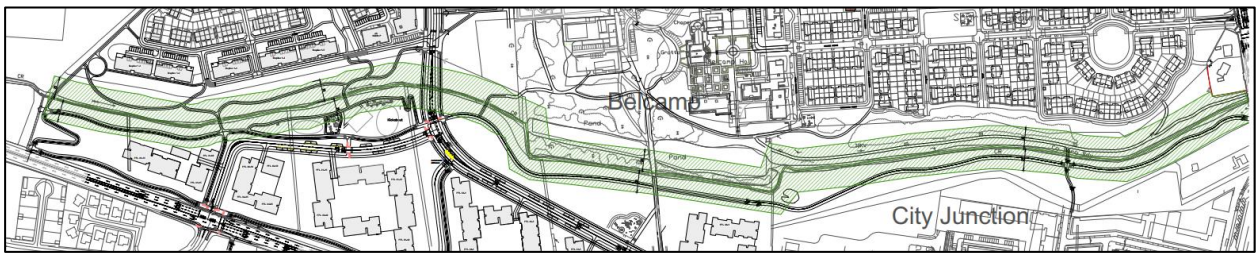


***Figure 6** | Riparian Corridor of 50m overall provided along the River Mayne*

3.3 Proposed SuDS Strategy

The proposed development has been designed to incorporate best drainage practice. Section 3.4, below, sets out the methodology used in determining the existing greenfield runoff rates and calculating attenuation storage requirements for each catchment. The relevant calculations are included in full in Appendix C.

A Storm Waste Management Plan has been prepared with various SuDS techniques to treat and minimise surface water runoff from the site. The methodology involved in developing the Storm Water Management Plan for the subject site is based on recommendations set out in the Greater Dublin Strategic Drainage Study (GDSDS) and in the SuDS Manual (Ciria C753). The SuDS Management Train describes the use of a sequence of components that collectively provide the necessary processes to control the frequency of runoff, the flow rate and the volume of runoff, and to reduce concentrations of contaminants to acceptable levels. Based on four key elements – Water Quantity, Water Quality, Amenity and Biodiversity – the targets of the SuDS train concept have been implemented in the design, providing SuDS devices for each of the following:

- Source Control
- Site Control
- Regional Control

3.3.1 Source Control

Permeable Paving:

It is proposed to introduce permeable paving in private courtyard areas throughout the development. Downpipes from the roofs of the blocks will drain to filter drains beneath the permeable paving to facilitate maximum infiltration of surface water from paved and roof areas. The goal of permeable paving is to control stormwater at the source to reduce runoff. In addition to reducing surface runoff, permeable paving has the dual benefit of improving water quality by trapping suspended solids and filtering pollutants in the substrata layers.

Green Roof:

It is proposed to introduce green roofing as a source control device. Each block will have green roofing introduced on at least 70% of the roof area.

The substrate and the plant layers in a green roof absorb large amounts of rainwater and release it back into the atmosphere by transpiration and evaporation. They also filter water as it passes through the layers, so the run-off, when it is produced, has fewer pollutants. Rainfall not retained by green roofs is detained, effectively increasing the time to peak and slowing peak flows.

A green roof can reduce annual percentage runoff by between 40% and 80% through this retention and evapotranspiration, with the impact dependent on a range of factors including the depth of substrate, the saturation of substrate at the onset of a rain event, the angle of the roof, the range of vegetation growing, intensity of rainfall and the time of year.

Planted Areas:

It is proposed to provide open grassed areas with low level planting at the ground floor around each apartment block. This will act as soft scape and will significantly slow down and reduce the amount of surface water runoff from the open spaces. Planter boxes and planted areas will also take surface water runoff from the downpipes from buildings before draining to filter drains beneath the permeable paving.

Swales & Filter drains:

Swales are proposed to take road runoff providing treatment and some ground recharge. Locations of swales are identified on the SuDS layout plan.

Filter drains to back gardens of houses and other designated areas permit treatment and ground recharge of runoff from mostly private areas.

3.3.2 Site Control

Roadside Bioretention Tree Pits:

It is proposed to provide roadside trees along the main access road. Trees can help control and treat storm water runoff from the surrounding road / footpath because their leaves, stems, and roots slow rain from reaching the ground and capture and store rainfall to be released later. Tree pits help to attenuate flows, trap silts and pollutants, promote infiltration and prevent erosion. Incorporating tree planting offers multiple benefits, including attractive planting features, improved air quality and increased biodiversity whilst helping to ensure adaptation to climate change.

Downstream Defender:

A downstream defender (trade name for a large chamber that retains solids and hydrocarbons) is intended for the DCC lands that will treat the flows that are to be stored in the basin.

3.3.3 Regional Control

Attenuation Lakes:

The two existing lakes, parallel to the Mayne River, will be used to attenuate the development north of the Mayne. These lakes have natural reeds and lake vegetation assisting with pollution and hydrocarbon removal. Excess surface water runoff, over and above the greenfield runoff, will be attenuated within the lakes above the permanent water level.

There is an inlet area to the upper lake that lends itself to pre-treatment which will be rehabilitated and re-used as pre-treatment facility for catchment A2 runoff to the upper lake.

This pre-treatment area is existing and joins the flows from the ditch system north of the river with those from the Mayne River inlet before they enter the upper lake. It is intended to provide a permanent body of water, approx. 300mm deep, plant with bull reeds and treat the entire A2 catchment before entry to the upper lake.

The dimensions of this pre-treatment area are approximately 35m long by 5.5m wide. With a depth of water of 300mm, this will provide 58m3 of treatment volume in addition to other treatment volumes associated with other SuDS items throughout the site.

Some rehabilitation of the existing walls, increase of the inlet pipework to 800mm, clearing out of the upper lake inlet culvert and removal of accumulated silt build up in the pre-treatment area will be required.

Please refer to the image below for a layout of this area.

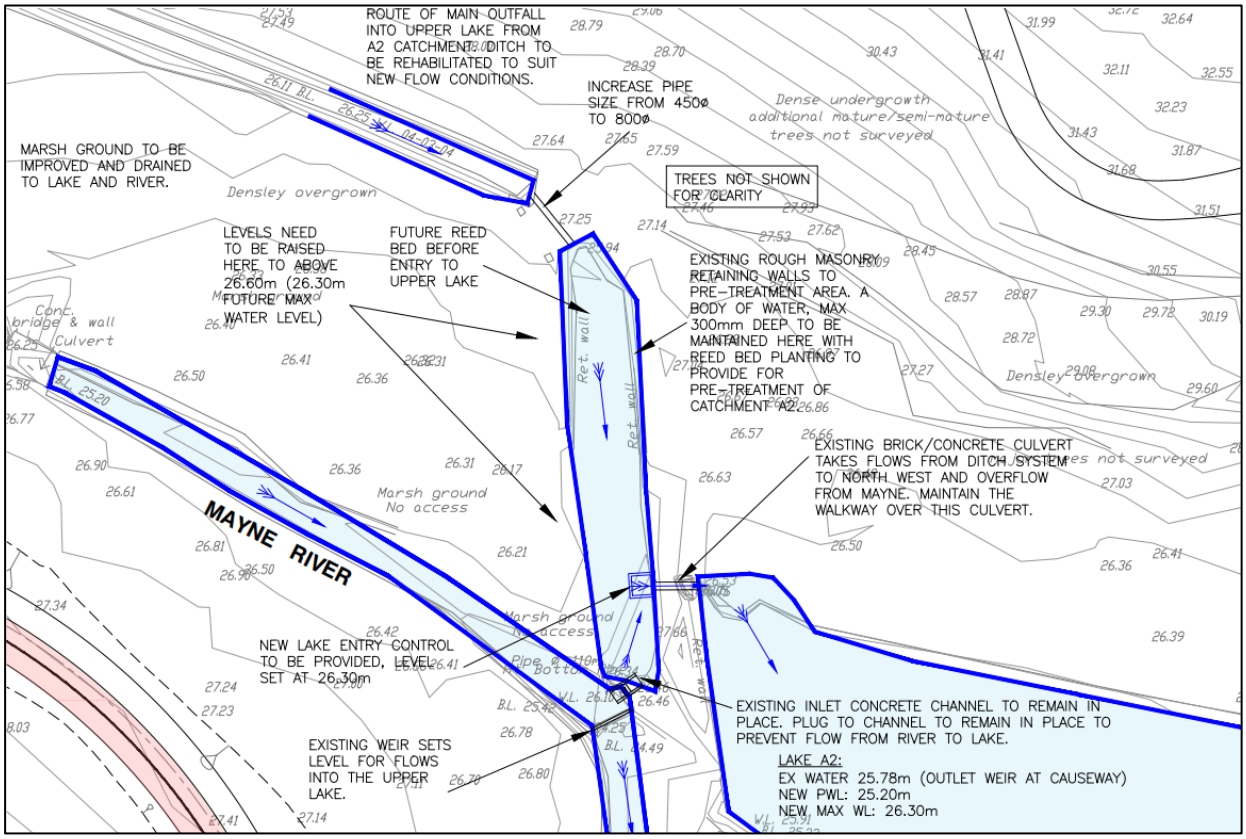


Figure 7 | *Pre-Treatment Area to Upper Lake*

Regional Flow Control:

For Catchment A1, a hydrobrake is provided on the lower lake weir to the river to regulate the discharge rate, limiting flows to the agreed runoff rate. This flow control has been designed and provided for under phase 1. Please refer to drawing P2405 for details of this hydrobrake manhole which serves as a walkway around the existing weir, which maintains as much as possible the function and visibility of the weir.

Flows to the upper lake, from Catchment A2, will be through the existing ditch immediately east of the distributor road over the Mayne. This ditch flows into the upper lake which in turn flows into the lower lake and over the weir into the Mayne as described above. It may be necessary to discharge the upper lake directly into the Mayne River to avoid hydraulic inefficiencies as the two lakes increase in depth, inhibiting fee flow of water into the lower lake. This is also an opportunity to combine the overflow from the upper lake with the outfall manhole. Please refer to drawing P2401 for details. The flows in the upper lake will be attenuated by means of a hydrobrake and isolating penstock. It is not feasible to utilise the existing culvert and its levels between the two lakes without compromising the hydraulic performance of the outfall from the upper lake. However, it is intended to keep this in place for historical and conservation reasons. It is in a poor state of repair and its rehabilitation is covered under the proposals supplied by Cora, Conservation Engineers, as part of this application. Final detail of the lakes and their flow controls are subject to agreement with Fingal County Council.

The DCC catchment is split by the main distributor road, but it is intended to amalgamate the attenuation into one offline dry detention basin east of the distributor road where levels are most suitable. A hydrobrake at the outfall will limit flows to the greenfield equivalent rate, with excess surface water attenuated at the dry detention basin.

3.4 Interception or Treatment Storage and Attenuation Storage

As noted above, the methodology involved in developing the Storm Water Management Plan for the subject site is based on recommendations set out in the Greater Dublin Strategic Drainage Study (GDSDS) and in the SuDS Manual. Appendix E of the Greater Dublin Strategic Drainage Study (GDSDS) sets out criteria for determining the provision of interception or treatment storage, attenuation storage and long term storage at a development site. These calculations are included in full in Appendix C and are summarised below:

3.4.1 Criterion 1: River Water Quality Protection

The GDSDS states that approximately 30% to 40% of rainfall events are sufficiently small that there is no measurable runoff from greenfield areas into the receiving waters. These events are generally considered as the first 5mm of rainfall. However, GDSDS further notes that in contract to greenfield area, runoff from developments takes place for virtually every rainfall event.

For events larger than 5mm, and in situations where interception storage cannot be provided, surface water runoff treatment is provided in accordance with the CIRIA design manual C573.

The required interception volume and treatment storage for each of the three catchments are set out in the table below (the full calculations can be found in Appendix C). The calculated volumes assume 100% runoff from paved surfaces and 0% from pervious surfaces for the first 15mm of rainfall, in accordance with the GDSDS.

Catchment	Interception Storage	Treatment Volume
A1 Catchment	254.34m³	763.02m³
A2 Catchment	282.15m³	846.45m³
D1 Catchment	244.50m³	733.50m³

Table 4 | *Interception Storage and Treatment Volume Requirements*

The interception and treatment storage volume requirements will be met through the introduction of various SuDS features (which have been described in Section 3.3, above). The SuDS features have been assessed and sized to meet these requirements.

3.4.2 Criterion 2: River Regime Protection

Attenuation storage is provided to limit the discharge rate from the site into receiving waters. As per the GDSDS, the required attenuation volume is calculated assuming 100% runoff from paved areas, and has been calculated for the 1-year, 30-year and 100-year return periods, identifying the critical storm for each – refer to the calculations included in Appendix C.

The required attenuation volume for each catchment is tabulated below, alongside the calculated greenfield runoff rate for each catchment and the actual attenuation volume to be provided:

Catchment	Area	Hard Standing %	Attenuation Location
North-Eastern Catchment A1 (*)	31.83 ha	49 %	Attenuation Lakes (Discharging to Lower Lake)
North-Western Catchment A2 (*)	23.44 ha	30 %	Attenuation Lakes (Discharging to Upper Lake)

Southern Catchment D1	14.95 ha	32 %	Dry Detention Basin

Table 5 | *Attenuation Volume Requirements*

Catchment	Allowable outflow (**)	Attenuation Volume Required	Attenuation Location
North-Eastern Catchment A1 (*)	161 l/s (+219 l/s)	4898 m^3	Attenuation Lakes (Discharging to Lower Lake)
North-Western Catchment A2 (*)	219 l/s	3347 m^3	Attenuation Lakes (Discharging to Upper Lake)
Southern Catchment D1	103l/s	1701 m^3	Dry Detention Basin

(*) Denotes figures subject to refined calculation of hard and soft areas.

(**) This figure depends on the discharge option agreed with FCC either from (a) the upper lake to the Mayne or (b) the upper lake to the lower lake

Table 6 | *Attenuation Volume Requirements*

The North-Western and North-Eastern Catchments will be attenuated in the lakes, discharging to the Upper Lake and Lower Lake respectively. The Upper Lake has a surface area of c.2,822m^2, while the Lower Lake has a surface area of c.4,244m^2.

Each of the two lakes will provide 1.6m of additional storage depth over and above the revised permanent water level. The volumes of storage will be further refined to ensure that the appropriate amounts of storage are applied to each lake's carrying capacity.

The southern catchment will be attenuated in the D1 dry detention basin along the southern bank of the Mayne River with a max flooded depth of 1.2m.

3.4.3 Criterion 3: Levels of Service

As per the GDSDS, there are four criteria for levels of service. These are:

Criterion 3.1: No external flooding except where specifically planned (30-year high intensity rainfall event).

Criterion 3.2: No internal flooding (100-year high intensity rainfall event).

Criterion 3.3: No internal flooding (100-year river event and critical duration for site storage).

Criterion 3.4: No flood routing off site except where specifically planned (100-year high intensity rainfall event).

Both internal and external flooding have been assessed in the Flood Risk Assessment report which accompanies this Engineering Assessment report. The Flood Risk Assessment has been carried out in accordance with the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009.

The assessment identifies the risk of both internal and external flooding at the site from various sources and sets out mitigation measures against the potential risks of flooding. The sources of possible flooding

assessed in the report include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical errors.

As a result of the flood risk management and mitigation measures proposed, the residual risk of internal or external flooding for the 30-year and 100-year flood events is low, and accordingly all four of the above criteria have been met. Please refer to the accompanying Flood Risk Assessment report for the full analysis of the flood risk at the subject site.

3.4.4 Criterion 4: River Flood Protection

The long-term storage volume is a comparison of pre- and post-development runoff volumes. The objective is to limit the runoff discharged after development to the same as that which occurred prior to development.

Of the three methods described in the GDSDS for establishing River Flood Protection by comparison of the pre- and post-development runoff volumes, (Criteria 4.1, 4.2 and 4.3 respectively), Criteria 4.3 is selected for use as the most practical criteria at this stage in the design.

The Criteria 4.3 approach is for all runoff to be limited to either Q_{BAR} or to 2 l/s/Ha, whichever is the greater. The proposed drainage system includes flow control devices at each outfall to ensure that the discharge rate is limited to the greenfield equivalent and ample attenuation is provided for the 1-in-100 year storm, accounting for a 20% increase due to climate change.

3.4.5 Existing Water Quality: River Mayne and Lakes

Sampling and testing of water from the Mayne River, Lakes and the culvert that is adjacent to the Kavanagh development site that is currently building 79 houses behind Campions Pub / Balgriffin Inn (draining water from Belcamp lands to the north west) was undertaken by IE Consulting on 1 February 2022.

Sampling points are shown below:

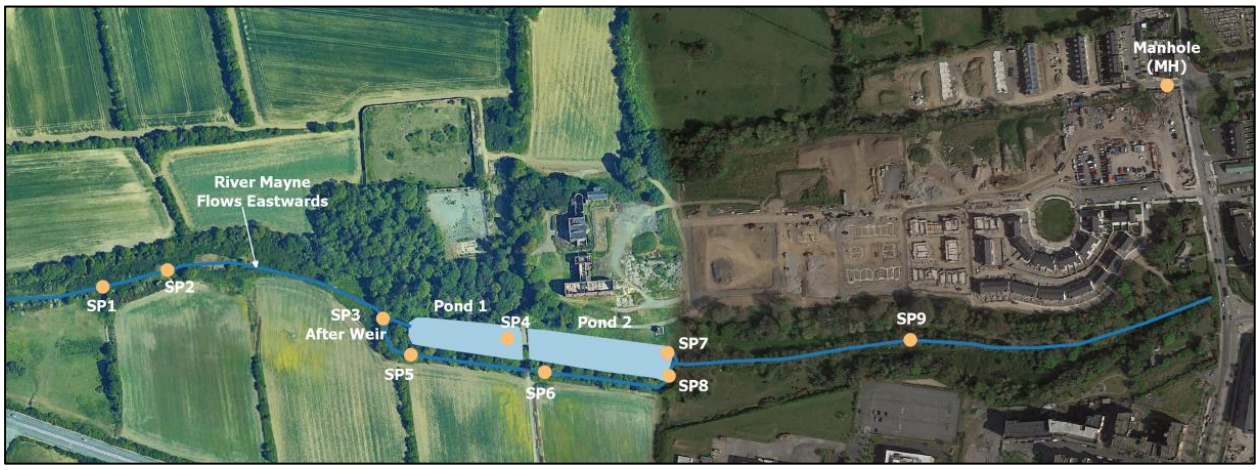


Figure 8 | *Water testing Sampling Points*

A copy of the water quality and testing report by IE Consulting dated April 2022 is included in Appendix E. The conclusions of the report are in section 5 noting poor quality of the existing Mayne River in general.

3.4.6 Proposed Water Quality: River Mayne and Lakes

It is contended that the water quality of the site will be significantly improved by the change of use of Belcamp from its current tillage state to residential development. This is typical with development sites and more so with the introduction of SUDS measures and the rehabilitation of the lakes.

3.4.7 Lake Management Proposals & Improving Water Quality

The existing lakes when the site was purchased were in a poor state of maintenance. There were algal blooms, no aquatic life, in addition to foul odours coming from the water. The lakes acted as a source of water for amenity and possibly for the local irrigation when originally constructed and had very little attenuation capacity due to the operation/makeup of the weir.

As part of the SHD submission, it is intended to introducing systems that promote improvements to water quality, considering the high amenity value of this area. These measures were proposed in Phase 1, however there are some further enhancements that are achievable, and so the red line for the SHD includes again the Lakes to include for these. They are as follows:

1. Maximise the depth of the water available by removing accumulated silt build-up. A method statement for the rehabilitation of the lakes in this regard has been prepared by IE Consulting and is included in Appendix D. Silt depths were established by probing to the clay liner that underlie the ponds. Sampling of the silt material was undertaken for both lakes and tested, yielding that the silt is non-hazardous waste.
2. Providing for greater amounts of flow through the two lakes. Pre-development, there was only one location for water to ingress into the lakes at its western end. There will now be two inlets, one at the upper lake and one at the lower lake. This provides for greater and more regular agitation of water in the lake.
3. Provide for an aeration diffuser system within both lakes for use in times of low flow or excessive heat. Waterman Moylan have liaised with Heathland Group UK who provided an outline proposal for an aeration diffuser system. This includes a land-based compressor with heavy cables that are laid on the bed to both lakes and air pumped into the lakes at various locations. This entrains air into the water and mixes the thermally stratified layers.

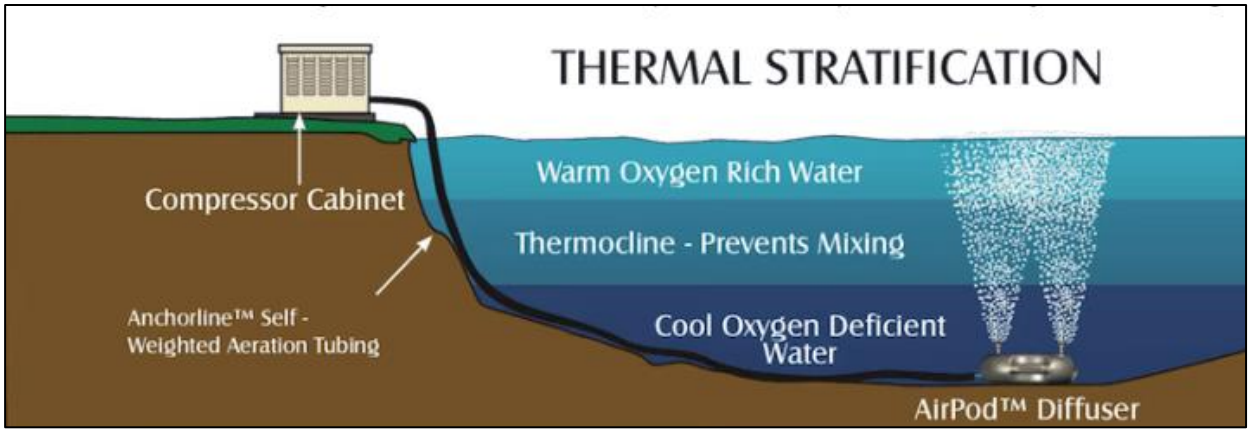


Figure 9 | *Thermal Stratification & Diffuser Schematic*

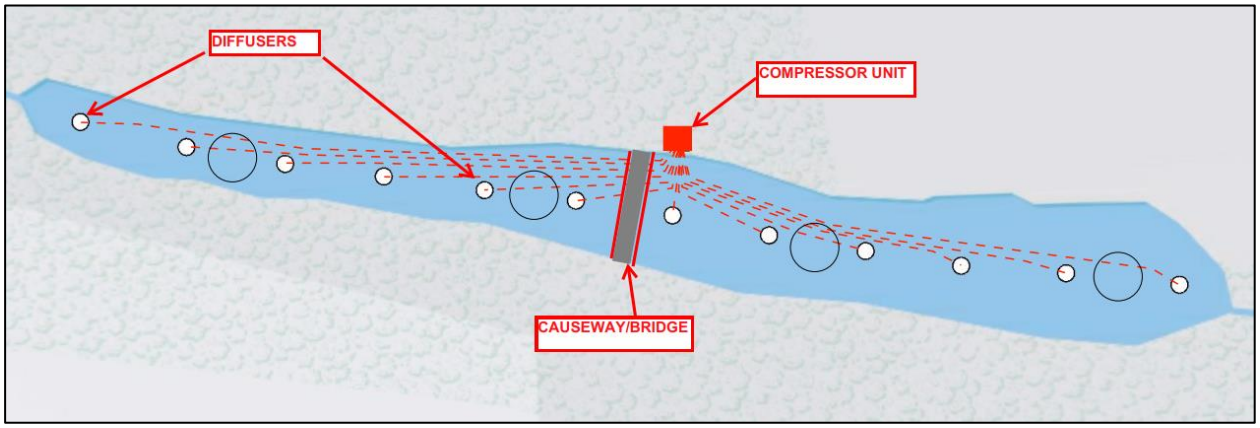


Figure 10 | *Heathland Group Proposal for Diffuser Locations in lakes*

The text below was provided by Heathland Group to explain the operation of the diffusers and some background on thermal stratification and improvements by aeration and improving water oxygenation.

OxiAir HD / Diffused Aeration Systems:

- *The OxiAir HD efficiently feeds each of the diffusers from a single supply, it comes with built-in controller / safety devices etc.*
- *This unit has a single-phase supply requirement and a consumption of just 1.1Kw, this means you reduce your loading by 13.45Kw compared to the fountain option.*
- *The OxiAir HD is a diffused aeration system, in terms of surface display you will only see bubbling from each of the strategically placed diffusers you won't get a visual fountain display. This is because the diffusers are placed on the bed of the lakes, and they diffuse air up through the water column. This results in greatly reduced risks from Stratification as it allows the water layers to mix. Based on the current information we have we would expect each diffuser to circulate around 11,000 litres of water per minute or 132,000 in total.*
- *In terms of oxygen transfer this would translate slightly different to a surface aerator, the diffusers push the cold, deoxygenated water to the surface where natural aeration occurs. They also add an amount themselves during the process.*
- *Diffused aeration supports aquatic life to the very best levels by promoting the natural organisms within a water body and helping the important things such as bacteria to thrive at the lower levels. Without these they would die, and the natural balance of the lake would be broken. It's the natural bacteria and life within the lower layers that help to reduce sediment levels, smells and maintain general health.*
- *We have supplied a number of these units to wildlife trusts, fisheries and all sorts of other applications, they are ideal as they don't require any power to be located in the lake or pond, they also don't disturb wildlife.*
- *These units would be my preferred choice if wildlife and safety is priority.*

Thermal Stratification Explained:

Ever discovered ice-cold water below a layer of warm water while swimming? That's the most obvious effect of thermal stratification. So, how does a water body end up having different layers of water with different temperatures?

First, we need to understand that liquids of different densities do not easily mix. In lakes and ponds, warmth generated by the sun heats the top layer of water, this in turn becomes less dense followed by the colder regions beneath which receive little to no heat. This forms three distinct layers these are:

- *Epilimmion- the upper warm layer*
- *Metalimmion- the middle layer that is a zone of gradual temperature decrease also known as a thermocline. This layer prevents the Epilimmion and hypolimmion from mixing.*

- *And hypolimmion- the cold bottom layer.*

Once firmly established, thermal stratification will persist unless strong winds can mix the water or until changes in seasonal climate such as during the autumn months when the warm surface water gradually cools and the densities are matched allowing for unrestricted mixing once again.

Thermal Stratification therefore plays a key role in the health of lakes and ponds and indeed the aquatic life they sustain. During the summer months it can be a regular occurrence hearing of a large volume of dead fish found in lakes and ponds especially after storms. Why is this?

Fish tend to move to the surface layers of a lake in the warmer months, there are several reasons for this, but the main reason is Thermal Stratification. The surface layers hold the warmer and higher levels of oxygen, the lower layers maybe very cold and contain very little or no dissolved oxygen. Picture your lake or pond split into two sections for ease let's use 50/50, the upper layers have a dissolved oxygen level of 6 parts per million (ppm) the lower layers have only 0ppm. If you get a rapid cooling in the surface layer (caused by heavy rain and storms) the density will change allowing, it to mix with the lower layer, the result is the dissolved oxygen in the surface layers is absorbed by the lower layer as they become one mass. This results in rapid oxygen reduction, and you are left with a waterbody that only contains 3ppm dissolved oxygen and resulting fish death.

Waterman Moylan liaised with the project Ecologist on the above systems to review the impact on aquatic life. While there are no proposals to introduce fish into the lakes, the improvements to water quality would not inhibit their introduction at a later date.

3.5 Surface Water – General

Surface water sewers will generally consist of PVC (to IS 123) or concrete socket and spigot pipes (to IS 6) and laid strictly in accordance with Fingal County Council requirements for taking in charge (northern portion of the site) or Dublin City Council requirements for taking in charge (southern portion of the site). It is intended that all sewers within the public domain will be handed over to the relevant Local Authority for taking in charge.

All private outfall manholes will be built in accordance with the Greater Dublin Regional Code of Practice for Drainage Works. No private drainage will be located within public areas.

Drains will be laid in accordance with the requirements of the Building Regulations, Technical Guidance Document H.

3.6 Flood Risk Assessment

A site-specific Flood Risk Assessment has been carried out for the proposed development and accompanies this submission under separate cover. The Flood Risk Assessment analyses the subject lands for risks from tidal flooding, fluvial flooding, pluvial flooding, ground water and failures of mechanical systems. Where risks were identified, mitigation measures have been proposed. As a result of the proposed mitigation measures, the residual risk of flooding from any source is low.

3.7 Proposed and Existing Culverts

As discussed in the Flood Risk Assessment, included with this application under separate cover, the River Mayne, both internal to and downstream of the subject site, will experience fluvial flooding for the 0.1%, 1%, and 10% AEP fluvial event scenarios. These flood areas internal to the site are caused by the restricted flow rate on the River Mayne during these weather events due to the existing culverts. It is not proposed to alter the existing culverts, as requested by FCC & DCC. It is proposed to retain the existing culverts and associated flood plains, which have been incorporated to the design of the project via the riparian corridor and green route associated with the River Mayne.

It is proposed to introduce new box culverts onto the River Mayne which will form bridges for pedestrian/cyclist and vehicular access routes. The design of these additional box culverts have incorporated adequate sizing so as to ensure that they can maintain a higher flow rate than those of the existing culverts which will not impact or alter the existing flood areas. The design of these culverts has also incorporated the recommendations of the project ecologist and IFI (Inland Fisheries Ireland), to include an otter ledge in proposed culverts, and that the proposed boxed culverts be of spilt level design to allow for fish to migrate to spawning areas. IFI have further advised that while the River Mayne is currently non-salmonoid, it is hoped that when the water quality is improved in the future that there will be the potential for the reintroduction of fish species to the river.

The location and cross-sections of the existing and proposed culverts are shown on drawings19-114-P1160 & P1161.

A Section 50 application is required to be submitted to the OPW (Office of Public Works) where there are any proposed changes to existing culverts or new culverts to be constructed. A formal Section 50 application cannot be submitted until planning permission has been granted, however, Waterman Moylan have submitted the design proposal to the OPW for comments and feedback. This has received a reference number of 174-2022.

4. Water Supply Network

4.1 Existing Water Supply Network

Irish Water records for the surrounding area have been reviewed as part of this assessment. The 600mm diameter trunk North Fringe Watermain traverses through the subject site, within the Dublin City Council lands. There is also an existing 300mm ductile iron watermain in the R139, constructed in 1994 and travelling parallel to the North Fringe Watermain. A 100mm watermain, constructed in 1997, runs for approximately 400m on the southern side of the R139.

The existing 300mm watermain includes a spur at the agricultural road through the southern portion of the site.

A new 300mm diameter trunk watermain is under construction in College Avenue, east of the subject site, as part of the Phase 1 works (Planning Reference F15A/0609). This watermain feeds the Phase 1 site and has been designed to also accommodate the subject development. It is connected to the existing Irish Water network at the Malahide Road.

The site is exceptionally well served by water supply mains, with the main North Dublin watermain within the lands along the southern boundary and the trunk Malahide water main along the eastern boundary.

Refer to the accompanying Waterman Moylan drawing no.'s 19-114-P3100 to P3110, which show the existing and proposed water supply layouts.

4.2 Proposed Water Supply Network

A meeting between Irish Water's (IW) Fionan Ginty and James O'Sullivan, Dublin City Councils (DCC) Stephen Burke and Mark Johnson, and Waterman Moylan's Mark Duignan and Darragh Aiken was held remotely on Friday 22 April. An overview of the entire Belcamp site was reviewed for external connectivity and management of the site generally. Some noteworthy points from the meeting are below:

- The permitted Phase 1 (register reference F15A/0609) design incorporated a link to the existing 450mm watermain at Parkside Boulevard (Belmayne) Junction on the R107 Malahide Road. This link will be going ahead in advance of the SHD under connection application in the coming months to provide pressures to the existing build phases and those other phases for which planning is pending that form part of the Belcamp lands.
- A pressure reducing valve (PRV) will be included in the connection to the 450mm main noted above.
- A secondary connection is required at the R139 existing entrance to Belcamp. DCC noted there is a spur left for this purpose and a PRV is also required here. DCC/IW will advise how this secondary connection will be managed.
- A third connection was advised to the existing 300mm main on the R139, which will remain closed during normal operation and serve as a backup.
- Internal to the site, there may be a need for PRV's, and IW will advise in due course.

Please refer to drawing 19-114-P3000 entitled "Watermain Layout District Metered Areas" for an overview of the Belcamp site and the proposed district metered areas layout. Amendments to this proposal will be advised by IW during the application for supply. An excerpt is below:

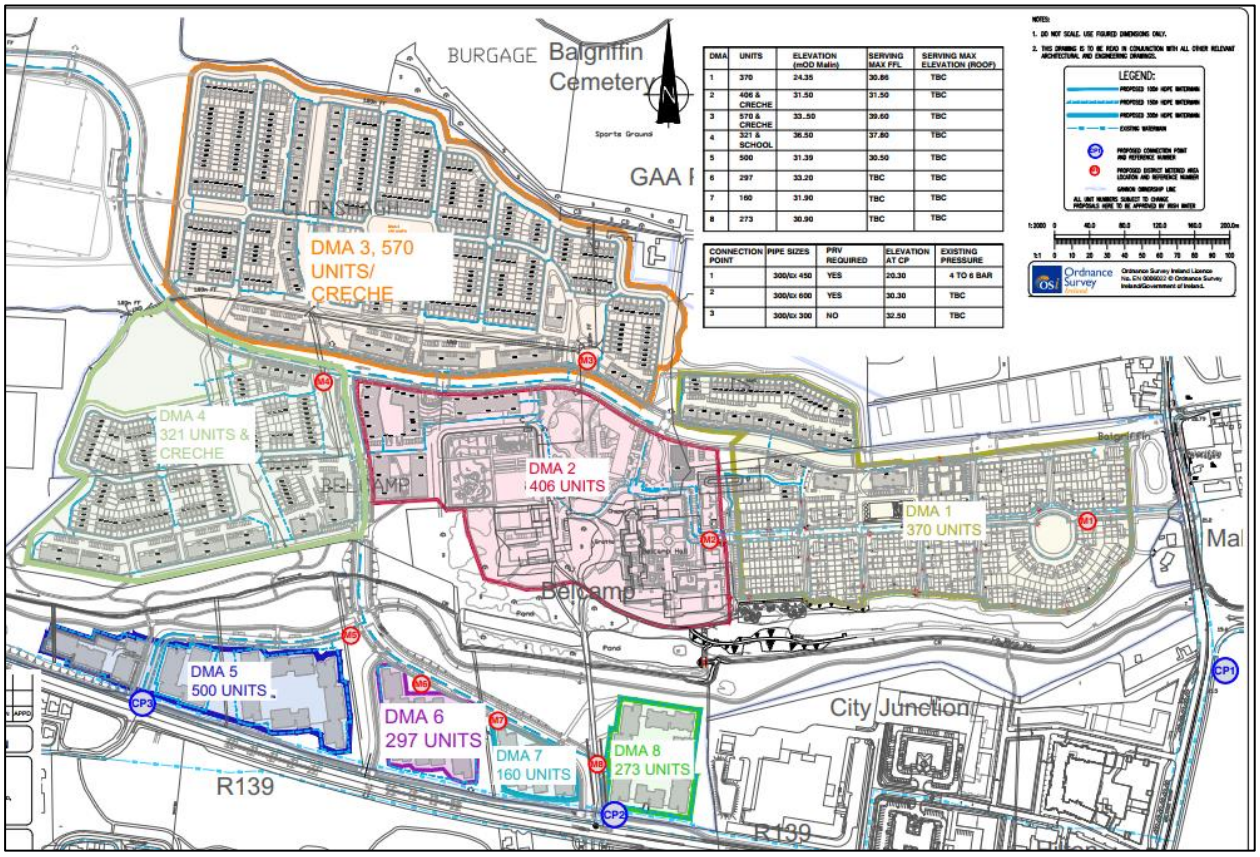


Figure 11 | *Extract of Watermain Layout District Metered Areas*

It is proposed to connect to the existing 300mm trunk main on College Avenue, currently under construction as part of the Phase 1 works. Two connections are also proposed at the R139; one connection to the 600mm main with a pressure reducing valve and metred connection, with a secondary connection to the 300mm main that runs parallel to the site boundary.

Water will be fed from these connections to the individual blocks and housing units via a series of 100mm, 150mm and 200mm watermains, with individual unit connections complete with meter boxes. Each apartment block will have bulk meters and each district metered area will have a bulk meter.

Irish Water have issued a Confirmation of Feasibility letter for the proposal, which is included in Appendix A (reference number CDS20001888). The proposed connections are in accordance with Irish Water's requirements, as set out in this letter. Irish Water have also issued a Statement of Design Acceptance, which is included in Appendix B.

4.3 Water Supply – General

All watermains will be laid strictly in accordance with the Irish Water Code of Practice for Water Supply Infrastructure and Irish Water Standard Details. Valves, hydrants, scour and sluice valves and bulk water meters will be provided in accordance with the requirements of Irish Water.

4.4 Water Supply Calculations

The calculated water demand at the subject development is set out in the below table. The average domestic demand has been established based on an average occupancy ratio of 2.7 persons per dwelling with a daily domestic per capita consumption of 150 litres per head per day and with a 10% allowance

factor. The average day/peak week demand has been taken as 1.25 times the average daily domestic demand, while the peak demand has been taken as 5 times the average day/peak week demand, as per Section 3.7.2 of the Irish Water Code of Practice for Water Infrastructure.

Description		Total Population	Water Demand	Average Demand	Average Peak Demand	Peak Demand
		No. People	*l/day*	*l/s*	*l/s*	*l/s*
DCC Apartments (1,230 Units)		3,321.0	547,965	6.342	7.928	39.639
FCC Houses (473 Units)		1,277.1	210,722	2.439	3.049	15.243
FCC Duplexes (274 Units)		739.8	122,067	1.413	1.766	8.830
FCC Apartments (550 Units)		1,485.0	245,025	2.836	3.545	17.725
Pre-school/Crèche (1,115m²)	Staff	40	3,960	0.046	0.057	0.286
	Children	200	19,800	0.229	0.286	1.432
Restaurant/Pub/Café (479m²)	Staff	75	3,713	0.043	0.054	0.269
	Customers	500	16,500	0.191	0.239	1.194
Retail (2,733m²)	Staff	100	9,900	0.115	0.143	0.716
	Customers	1,200	15,840	0.183	0.229	1.146
Total		**-**	**1,195,491**	**13.837**	**17.296**	**86.479**

Table 7 | *Calculation of Water Demand for the Development*

The average demand for the development is 13.837 l/s, with a peak demand of 86.479 l/s.

4.5 Water Supply – Wayleaves

A 16m wayleave (8m either side of the pipe centreline) is provided for the 600mm diameter North Fringe Watermain. This is indicated in the light blue hatching below along the R139. No structure is located within this reservation.

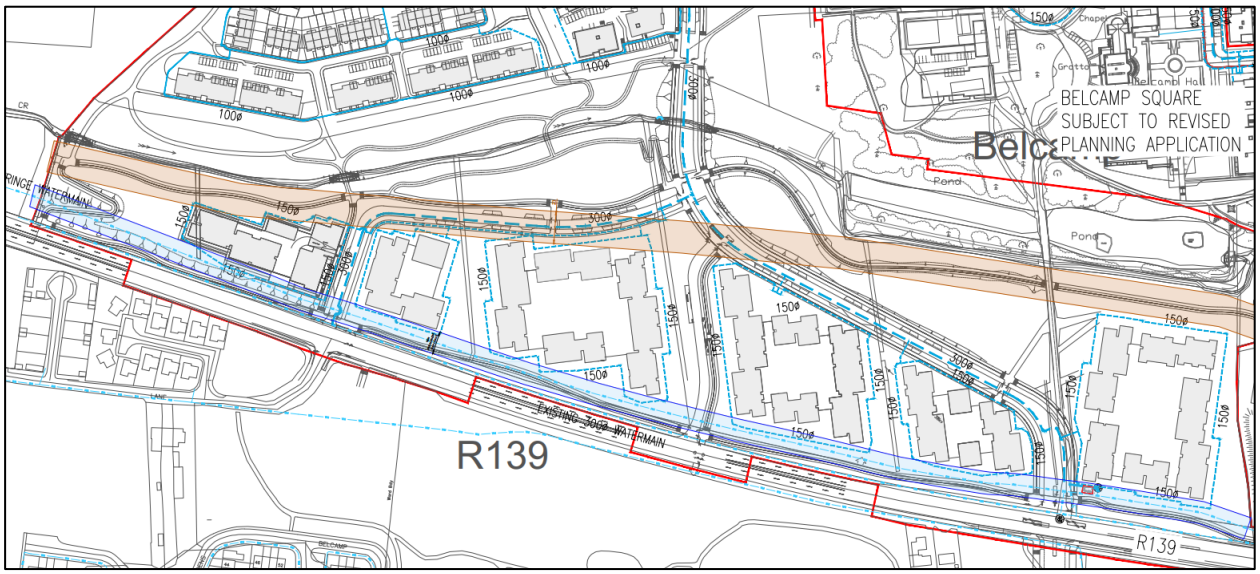


Figure 12 | *Watermain Wayleave (light blue shading)*

5. Roads and Transport Network

5.1 Existing Transport Network

5.1.1 Existing Road Infrastructure

The Belcamp development site is bounded by the R139 to the south and extends into Fingal to the north, with access onto the Malahide Road (R107).

The R139 is a regional road running east–west along the southern boundary of the subject site. Approximately 3.2km west of the junction with Malahide Road (R107), the R139 provides connection to M1 and M50 motorways (M1 Exit 1 and M50 Exit 3). Along the R139, between the M1/M50 junction and the Malahide Road junction, the carriageway comprises two lanes in each direction with dedicated right-turning pocket lanes, which currently facilitate access to some residential and commercial developments along the route. There is an existing right-turning lane into the Belcamp development site, and there is a signal-controlled pedestrian crossing adjacent to the site.

The Malahide Road (R107) is a regional road running south–north to the east of the site, at the boundary of the proposed greenway along the alignment of the Mayne River. This road extends from Fairview, approximately 6km south of the subject site, to Malahide, approximately 4.5km north of the subject site. The carriageway of the Malahide Road adjacent to the proposed development site (between Belmayne and R123 Balgriffin Road) is approximately 9.0m wide.

The Balgriffin Road (R123) forms a junction with the Malahide Road immediately east of the subject site and continues east towards Baldoyle Bay.

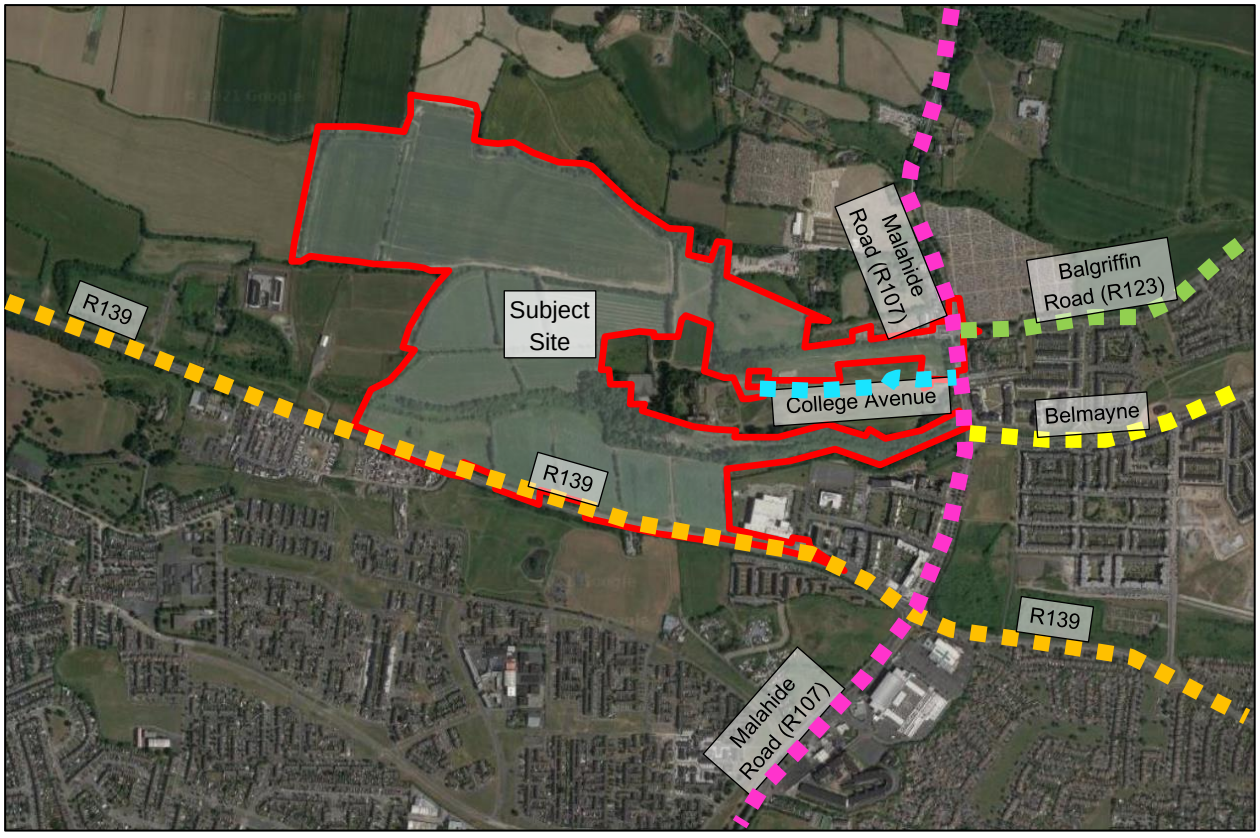


Figure 13 | *Existing Roads*

A portion of the Malahide Road is currently being upgraded as part of the Applicant's Phase 1 permitted development. The upgrades extend from the Belmayne Junction and continue north approximately 170m. The upgrades include a new entrance to serve the Applicant's Phase 1 permitted development, new footway construction, planing and relaying of a portion of the carriageway, wearing course and base course replacement and new landscaping.

Access to Phase 1, which is currently under construction, is provided via College Avenue, a new east–west road accessed via a new junction with the Malahide Road.

5.1.2 Existing Pedestrian Infrastructure

The existing pedestrian facilities in the surrounding area comprise an inter-connected network of footways linking the various neighbourhoods to each other, to the existing schools, to Belmayne, to Clarehall, to the Clongriffin train station, to public parks and to the surrounding public network – refer to the accompanying drawing no. 19-114-P1003.

5.1.3 Existing Cycle Infrastructure

Cyclists benefit from the provision of dedicated cycle lanes along both sides of the carriageway on Belmayne, Hole in the Wall Road and Main Street (Clongriffin). Belmayne includes cycle lanes along both sides of the road up until Marrsfield Avenue. These cycle lanes are separated from the carriageway by a grass verge.

Although there isn't a continuous cycle lane on the Malahide Road, there are stretches with cycle lanes. Cycle lanes (shared with the bus lane) are only provided on the R139 to the east of the Malahide Road (R107), continuing along Temple View Avenue, with no cycle lanes along the R139 south of the subject site.

These cycle lanes facilitate access to Clongriffin train station, Malahide Road Industrial Park and Dublin City Centre. The cycle journey from the site to Clongriffin train station takes approximately 15 minutes, and the cycle journey from the site to Malahide Road Industrial Park takes approximately 12 minutes. The cycle journey from the site to the GPO on O'Connell Street in Dublin City Centre takes approximately 33 minutes.

Covered public cycle parking with 112 stands is provided in Clongriffin at Station Square. This public cycle parking currently provides the opportunity for residents living in the surrounding area to commute to their final destination (place of work, school, college, etc.) by cycle-train combined travel.

Refer also to Section 6 of the Traffic and Transport Assessment, which accompanies this submission under separate cover, for an assessment of the Site Accessibility.

5.1.4 Existing Bus Network

The subject site is directly served by public bus services. The closest bus stops are located on Malahide Road (R107) immediately east of the proposed development site. These bus stops are served by Dublin Bus Routes 42 and Route 43. Route 42 operates between Talbot Street in Dublin City Centre and Sand's Hotel in Portmarnock. Route 43 operates between Talbot Street in Dublin City Centre and Swords Business Park.

Travel time from the bus stop on Malahide Road (R107) to Talbot Street in Dublin City Centre is approximately 16 minutes. In the opposite direction, the travel time from the subject bus stop on Malahide Road (R107) to Malahide is approximately 16 minutes, and to Swords Business Park is approx. 20 minutes.

In addition to the aforementioned Bus Routes 42 and 43, the surrounding area is also served by Dublin Bus Routes 15 and 27. The closest bus stops served by these routes are located on the R139, south-east of the proposed development site, east of the Malahide Road junction.

Access from the subject site to the bus stops on R139 is via Malahide Road (R107). The walking time varies from approximately 12 minutes from the portion of the site within DCC to 25 minutes from the units at the north-west of the development. A network of footpaths is provided on both sides of Malahide Road (R107) and the R139, with dedicated pedestrian crossings at each road crossing point along the route to the bus stops. These footpaths are separated from the carriageway by a grass verge for the majority of the route, with all pedestrian crossings including dropped kerbs and tactile pavement.

5.1.5 Existing Rail Network

The closest train station is Clongriffin Station, located approximately 2.5km (31-minute walk; 15-minute cycle) east of Belcamp Town Square, near the centre of the subject site. Walking and cycling access from the subject site to the Clongriffin Station is via Belmayne/Marrsfield Avenue. A good network of footpaths is provided on Belmayne and Marrsfield Avenue along the route to the station. Belmayne includes cycle lanes along both sides of the road up until Marrsfield Avenue. These cycle lanes are separated from the carriageway by a grass verge. No cycle lanes are provided along Marrsfield Avenue.

The Clongriffin Station is served by Commuter Rail and DART services. The Commuter Rail service through Clongriffin Station serves all stations from Dundalk through Dublin City Centre to Gorey. The service operates at 3–4 trains per hour in both direction on weekdays.

The DART service through Clongriffin Station serves all stations from Malahide through Dublin City Centre to Bray and Greystones. On weekdays, this service operates at a 20-minute frequency in both directions.

Refer also to Section 3.2 of the accompanying Traffic and Transport Assessment, which sets out the existing public transport provision in the area, and to the accompanying Public Transport Capacity Assessment prepared by traffic consultant Derry O'Leary.

5.2 South Fingal Transport Study

5.2.1 Background of the Study

The South Fingal Transport Study (SFTS) was prepared by SYSTRA Ireland on behalf of Fingal County Council, Dublin City Council and the NTA and was published in 2019.

The SFTS is a strategic transport and land use study of Fingal and Dublin North Fringe, including the portion of the subject site within Dublin City Council jurisdiction as well as the northern portion of the site within Fingal County. Its recommendations have been assessed with future population and employment growth and the expected future transport network, including road and public transport networks.

The SFTS provides recommendations for the East West Link Road (EWLR) and for Belcamp Parkway (referred to in the study as the Clarehall Junction Relief Road).

The main transport routes proposed through the subject site, as envisioned in the SFTS, are shown in the Figure below. This strategy is in accordance with the DCC and FCC Development Plans.

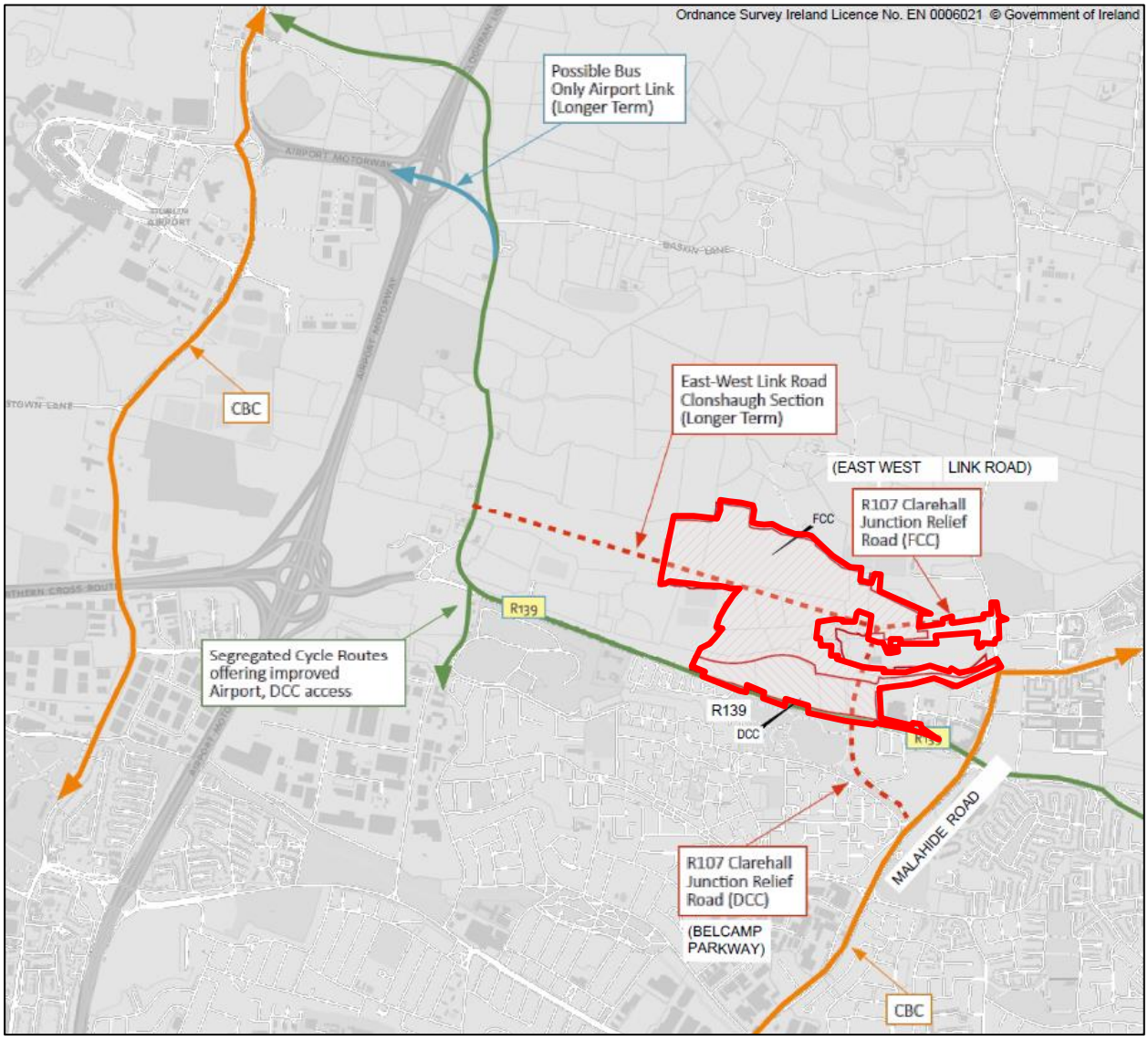


Figure 14 | *South Fingal Transport Strategy*

The South Fingal Transport Study report has informed the Belcamp Design and the development of the transport strategy and infrastructure.

5.2.2 SFTS Recommendation 21: Clare Hall Junction Relief Road (Belcamp Parkway)

The Clare Hall Junction Relief Road, referred to in this submission as Belcamp Parkway, is described by the SFTS as a proposed relief road connecting from the Malahide Road to the EWLR, and forming a new junction with the R139. This connection is in accordance with both the DCC and FCC development plans.

The Relief Road, as set out in the SFTS, crosses the Mayne River west of Belcamp Hall. It is proposed under the subject application for the Relief Road to connect with the EWLR in the vicinity of Belcamp Town Square.

The proposed EWLR/Belcamp Parkway (Relief Road) junction is located further west than it is shown in the Figure above, as extracted from the South Fingal Transport Strategy, in order to avoid the protected structure Belcamp House (also referred to as Belcamp Hall) and its associated lakes and walled garden.

5.2.3 SFTS Recommendation 22: Malahide Road/Balgriffin Road Junction Upgrade

The SFTS recommends that the Malahide Road/Balgriffin Road junction should be upgraded with signals and turning lanes, while also providing a safe and attractive environment for pedestrians and cyclists. This upgrade has been given a decision to grant permission by FCC under Phase 1B of the Belcamp development works (F21A/0401), along with approximately 350m of the EWLR. Nonetheless, this subject application also includes the proposed junction upgrade works, along with the approved ~350m of the EWLR, to ensure this application can provide the entirety of the link road from the Malahide Road to the site.

The junction is proposed to be upgraded to form a new 4-way signalised junction, with the EWLR forming the western arm of the new junction. The proposed junction includes new right-turning lanes and cycle facilities. The upgrade works will extend south on the Malahide Road to connect with the upgrades currently being carried out as part of the Phase 1 development.

5.2.4 SFTS Recommendation 23: East-West Link Road

The SFTS recommends that the EWLR be designed based on DMURS principles, placing an emphasis on public transport and active modes of transport. This would indicate that the road should be envisaged as part of the development rather than as a boundary at the edge of the development.

Accordingly, the road's proposed route is through the development, with connections/links to the north and to the south.

The SFTS envisages the EWLR as the main bus route providing east–west linkages to the fringe area and ultimately to the airport environs. Waterman Moylan met with representatives from the NTA, FCC and DCC in March 2022 to discuss the transport requirements of the proposed Belcamp SHD development. The current N8 BusConnects route departs from Clongriffin train station, continuing along Main Street before turning south onto the Hole in the Wall Road and then continuing west along the R139. At the meeting, the NTA advised that they require the N8 BusConnects Route to be altered to run through the subject development along the East–West Link Road (EWLR) into Belcamp Town Square and then, preferably, directly south onto the R139. The EWLR road is therefore designed to comply with the principles of a Core Bus Corridor and to accommodate optimum cyclist and pedestrian facilities.

The proposed development includes more than half of the orbital bus service route linking Malahide Road to Stockhole Lane, as described in the SFTS, to link the employment zoned lands north of the R139 with Dublin Airport and Swords. The remainder of route to Stockhole Lane is through lands zoned for High Technology (HT), "to provide for office, research and development and high technology/high technology manufacturing type employment in a high quality built and landscaped environment", and these lands are under the ownership of the IDA, who are actively considering development of these lands.

The Applicant has liaised with the IDA, who have requested connectivity via the Belcamp Lands in their submission to DCC on the draft Belcamp/Belmayne Masterplan in 2020. This subject application will not only be providing the EWLR into the heart of the employment zoned lands but will also be providing excellent pedestrian/cycle facilities along the R139 and River Mayne, which will link the IDA lands directly to Belcamp and Belmayne Town Square. During a meeting in March 2022, the IDA requested that the EWLR be moved northwards towards the northern boundary of the Belcamp Lands.

5.3 SYSTRA Public Transport Strategy

5.3.1 Background

The Applicant has engaged with SYSTRA, who prepared the South Fingal Transport Study, to provide a Sustainable/Public Transport Strategy report for Belcamp – this report accompanies this planning submission under separate cover. The report prepared by SYSTRA has assisted and informed the subject application design. The public transport strategy includes traffic modelling of the surrounding area and recommendations on how to mitigate the development's impact on the transport network.

The analysis includes 2028 modelling, analysis of trip patterns to and from the Belcamp development site, and identification of anticipated car trips with potential to switch to public transport or sustainable transport modes.

5.3.2 Modelling & Findings

SYSTRA's analysis found that the vast majority of trips are less than 15km in length, with 82% of journeys 10km or less during the morning peak and 78% 10km or less during the evening peak.

There is a significant morning peak concentration in the 2km to 5km radius. These morning peak destination "hotspots" for car trips are believed to be associated with primary school education escort trips, "park and ride" activity at Clongriffin Train Station, and a notable number of trips to the zone containing a major city hospital. Evening peak destination "hotspots" include Clongriffin Station and the Hospital zone, but with less concentration overall than the morning peak.

Westbound travel to/from the site results in significant movement to and from southern site access points, but the overall proportion of "longer" trips via Belcamp Parkway is low.

The data provides strong support for the concept of a shuttle link between the development and Clongriffin Station. Providing a similar shuttle service for those accessing primary and secondary education may also be beneficial but is likely to be more difficult to sustain in the long term; specifically proposing measures to increase accessibility to schools via walking and cycling may be more effective.

Within the models, use of public transport, including Bus Connects, drops off sharply as walking distance to stops increases.

5.3.3 Proposed Measures to be Implemented

In accordance with the recommendations of SYSTRA's report, several measures are proposed to minimise the impact that the development will have on the surrounding transport network.

The SFTS recommends that the main road infrastructure be included as part of the first phase of development, to ensure that there is adequate transportation provision in place before the development is occupied. This recommendation has been implemented in the proposal, with all of the main road infrastructure, including the East-West Link Road and Belcamp Parkway, included in the first phase of development – refer to Section 5.8, below, for further information on the proposed development phasing.

The development includes significant commercial and recreational elements, with retail and commercial units primarily centred around Belcamp Town Square. there is a reserved school site within the FCC portion of the lands, and the development benefits from recreational facilities, including playing fields with an associated clubhouse in the open space at the west of the site. These commercial and recreational facilities within the confines of the site will reduce the number of trips generated by the development to external destinations. Existing local amenities, including Clarehall Shopping Centre and Innisfails GAA club, are in close proximity to the site, which will encourage residents to use active modes of transport rather than

relying on private car for local journeys. Provision of high-quality pedestrian and cycle facilities, including frequent pedestrian crossing points along anticipated desire lines and dedicated cycle lanes, will further encourage active modes of transport, promoting a modal shift away from private car to sustainable transport options.

Primary school education escort trips have been determined to significantly impact morning traffic and providing internal infrastructure in the first phase allows for the reserved school site to be developed by the Department of Education (note that the site reserved for the school is within the Fingal County Council portion of the site). The school will help to keep new trip generation within the development, minimising the impact on surrounding areas. Introduction of a nearby school will also encourage the use of sustainable transport modes rather than private vehicles. The possible provision of a school bus will also be considered.

The East-West Link Road is designed as a bus route to Core Bus Corridor standards, with dedicated bus lanes on both sides of the carriageway. The road reservation for Belcamp Parkway has been designed to facilitate future 3.25m bus lanes if required in the future. The development has been designed based on extensive quality active transport links within the development and to adjoining facilities.

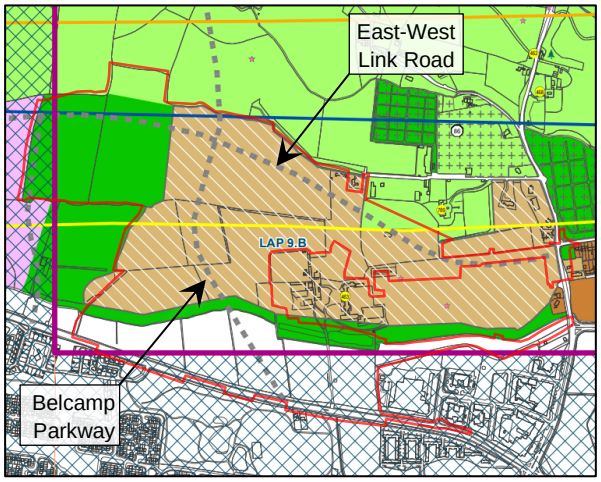
5.4 Proposed Road Network

5.4.1 Review of Development Plans

The proposed road network provides a legible road hierarchy and has been designed to closely align with the Fingal County Council and Dublin City Council Development Plans, the South Fingal Transport Study (SFTS) and DCC Draft Belmayne Belcamp Masterplan, the NTA's requirements for bus routes, and to meet the emerging transportation demand.

Both the Fingal County Development Plan 2017-2023 and the Dublin City Development Plan 2016-2022 include strategic road infrastructure through the subject Belcamp lands, as shown in the figure below:

Extract from Fingal County Development Plan 2017-2023 Sheet 9



Extract from Dublin City Development Plan 2017-2023 Map B

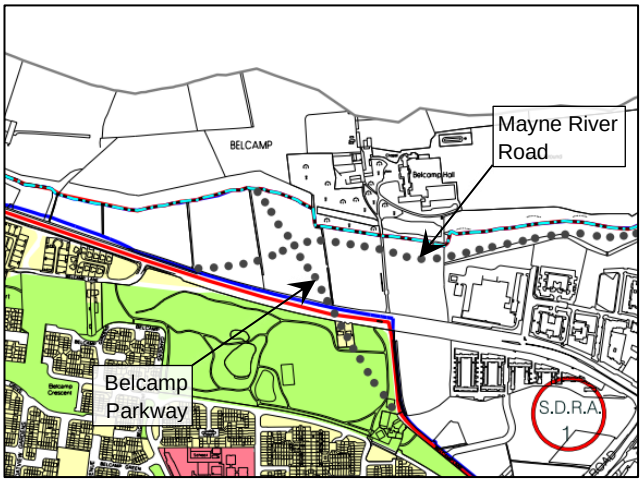


***Figure 15** | Extract of FCC and DCC Development Plan Maps*

5.4.2 Road Hierarchy

The proposed road layout includes the East-West Link Road (set out as an objective in the Fingal County Development Plan) and Belcamp Parkway (set out as an objective in both the Fingal County Development Plan and the Dublin City Development Plan).

It was previously proposed to provide a new vehicular route south of the River Mayne, linking from the Malahide Road to the R139 in accordance with the DCC Development Plan. However, DCC Transportation Department have advised the design team that the Mayne River Road between Belcamp Parkway and the Malahide Road is no longer part of the strategic road network in the area. A new access link for pedestrians and cyclists is proposed along this route in accordance with the NTA 2021 Cycle Network Plan for the Greater Dublin Area. Refer to Section 5.4.8 below for further discussion of the Mayne River Road. The portion of this road connecting from Belcamp Parkway to the R139 is still included as part of the subject proposal, and is referred to as the R139 Link Road.

The proposed road hierarchy will comprise of three new arterial streets (the East-West Link Road, Belcamp Parkway and the R139 Link Road), a proposed bus gate to the R139, several new local link roads, and a series of new local access roads, including shared surface/homezones.

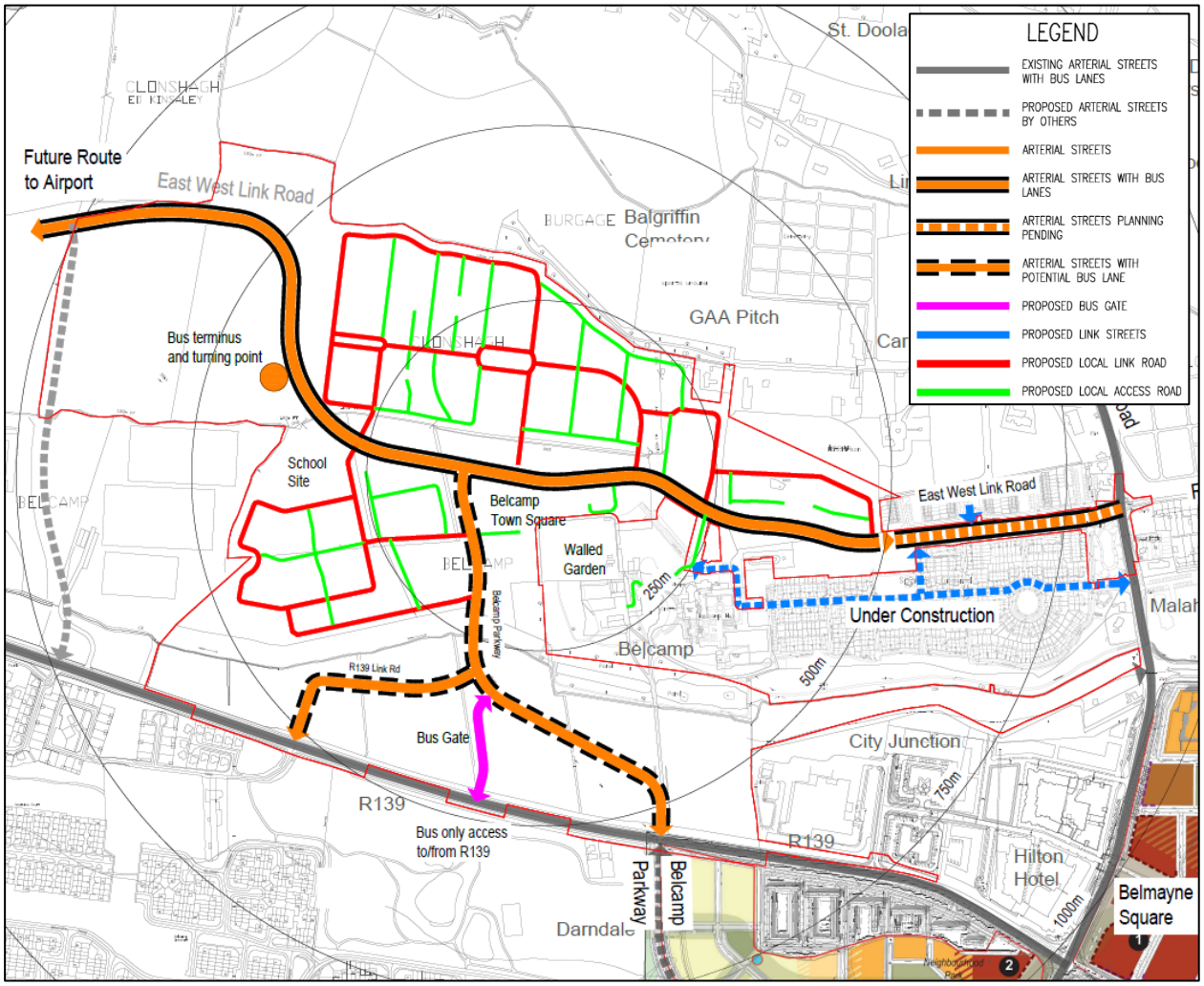


Figure 16 | *Proposed Transport Network General Arrangement*

A key component of the proposed development is the application of the design principles of DMURS to both roads and junctions, and to emphasise provision of high-quality cycle and pedestrian links throughout the site and to destinations in the area, including major shopping and business centre at Clarehall Junction, local GAA clubs and the strategic Mayne River green route. The Belcamp Lands will be developed specifically to avoid a car dominated environment and to optimise pedestrian and cyclist links. Refer to the

DMURS Report and Statement of Design Acceptance, which accompanies this submission under separate cover.

5.4.3 East–West Link Road

The East–West Link Road (EWLR) traverses the portion of the Belcamp lands within FCC's jurisdiction, extending from the Malahide Road (R107) at the east as far as the western boundary of the Applicant's lands.

The Phase 1B submission (F21A/0401), which has received a decision to grant planning permission, includes the first c.350m of the East–West Link Road and upgrade works at the Malahide Road/Balgriffin Cottages junction.

The junction is proposed to be upgraded to form a new 4-way signalised junction, with the EWLR forming the western arm of the new junction. The proposed junction includes new right-turning lanes and cycle facilities. The upgrade works will extend south on the Malahide Road to connect with the upgrades currently being carried out as part of the Phase 1 development. The Phase 1C application, which has been submitted to Fingal County Council for planning (Reg. Ref. F22A/0136), includes portions of the EWLR to provide access to the Phase 1C Blocks.

Although these portions of the EWLR have already been applied for, the subject application includes the entire length of the East–West Link Road from the Malahide Road junction at the east of the site as far as the IDA Lands to the west, and includes the proposed upgrade works at the junction with Malahide Road. The works proposed under this subject application are in accordance with those already applied for under Phases 1B and 1C, but are nonetheless included as part of this submission to ensure this application can provide the entirety of the link road from the Malahide Road to the site.

Figure 17 | *View of the Proposed East–West Link Road*

The EWLR is designed to facilitate continuation west beyond Belcamp, in accordance with the Fingal Development Plan and the South Fingal Transport Study. This street has been designed to incorporate high quality public transport facilities including a dedicated bus lane in both directions and high-quality bus stops strategically located to serve the proposed development. During a meeting held in March 2022 with the NTA, FCC and DCC, the NTA advised that they envision the BusConnects N8 route running along the EWLR from the Malahide Road (refer to Section 5.7.3 of this report).

The EWLR will be constructed to the western boundary of the site, adjacent to the lands owned by the IDA which are zoned for High Technology employment. Future planning by others will extend the road beyond the subject site in accordance with the FCC / DCC Development Plans, the Belcamp / Belmayne Masterplan and the South Fingal Transport Study.

The previously proposed road alignment, at consultation stage, provided a straighter alignment for the proposed East West Link Road (EWLR). However, alternative design options have since been explored by the design team in consultation with key stakeholders, including the IDA, who are landowners of the strategic employment lands adjoining the western boundary of the application lands. Following this consultation, it was considered that the previous alignment did not represent the optimal design solution for the Belcamp lands and the surrounding context, including the adjoining IDA High Technology employed zoned lands to the west of the site. At a strategic and spatial level, the discussions took place with representatives of the IDA and it is the position of the IDA that the IDA have taken the Development Plan alignment as the default position of the road for their future proposals for their landholding. In order to facilitate the potential of a large single user on the site and maintain their landbank as a strategic whole, the IDA is not in a position to agree on the east-west alignment that divides their lands and thus there is a requirement for the EWLR to align as per the now preferred road design, i.e. to the north west of the Belcamp lands. In light of this, the applicant has brought forward this preferred route, which is submitted as part of this planning application and is the preferred route for the application. This route also more closely aligns with the Development Plan alignment for the EWLR.

At a site level, the previous consultation stage road layout segregated the proposed school reserved site from the playing pitches and meant that students would have to cross this EWLR to access the playing pitches, which represented a safety risk. The 'S' bend now proposed in the road will act as a speed reducing measure for vehicles travelling from the west as it approaches the Belcamp school site and Town Square at the heart of the scheme. It is important to note that the realignment of the road means that the open space and playing fields are now connected to the future reserved school site and ensures that the school can use these facilities without the need to directly cross the EWLR.

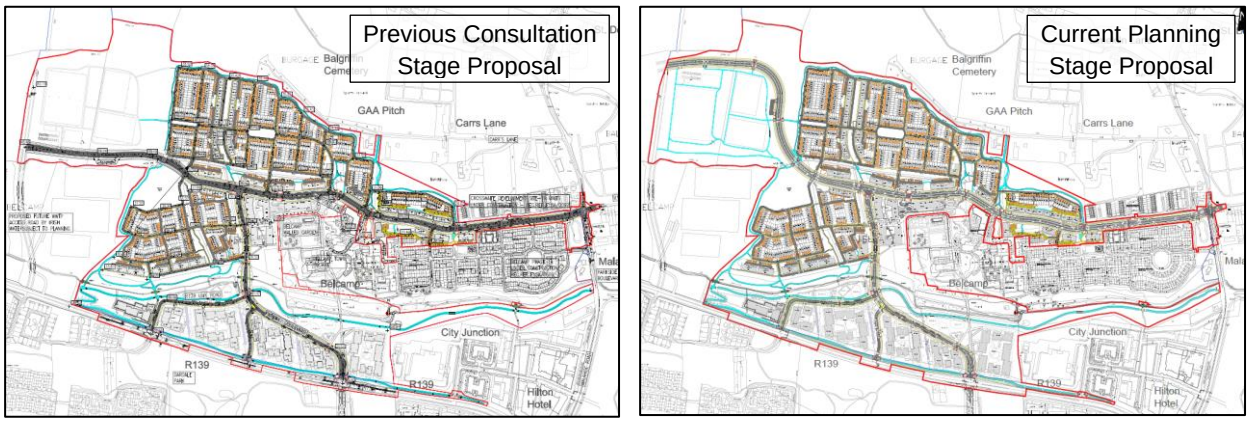


Figure 18 | *Previous and Current Proposed Alignment of East-West Link Road with Site Context*

Figure 19 | *Proposed Alignment of East-West Link Road through Open Space to Western Boundary*

The road also includes provision for active forms of transport, with separated cycle tracks on both sides of the carriageway and continuous footpaths with pedestrian crossings provided at anticipated desire lines.

It is proposed to provide a transport hub at Belcamp Town Square with bus stops, E-bike charging stations, bicycle racks, E-car charging points and multiple designated car-share fleet parking spaces. This transport hub will be accessible from the EWLR.

Figure 20 | *Typical Proposed Cycle Infrastructure: E-bike Charging Station and Bicycle Racks*

5.4.4 Belcamp Parkway

Belcamp Parkway is an extension of the DCC Belcamp/Belmayne Masterplan, which includes a link from the R107 Malahide Road to the R139 and forms a Boulevard style street through the DCC Masterplan area

linking to the Belcamp SHD development. It is a north-south arterial street and includes a new junction with the R139, where there is currently a signalised pedestrian crossing and access road to the Belcamp lands. From the R139 the Belcamp Parkway will cross the Mayne River and connect with the East West Link Road.

Figure 21 | *View of the Proposed Belcamp Parkway*

An emphasis has been placed on active modes of transport and links to the surrounding areas. There is a high standard of pedestrian, cyclist and public transport facilities provided. This will provide a clear, comprehensive, and high-quality transport network for residents and visitors. All of the proposed junctions have been designed in accordance with DMURS, incorporating high quality pedestrian and cyclist facilities.

Waterman Moylan met with representatives from the NTA, FCC and DCC in March 2022 to discuss the transport requirements of the proposed Belcamp SHD development. The NTA confirmed that the N8 BusConnects route is envisaged to run along the East–West Link Road, turning south onto Belcamp Parkway towards the R139. However, it is the NTA's preference for the bus to continue directly south rather than along the alignment of the Belcamp Parkway – as such a bus gate has been introduced, as described in Section 5.4.3 below. The NTA also advised that there are currently no proposals to bring one of the BusConnects D routes through the Belcamp development. However, BusConnects routes are subject to future change depending on demand and future development, and emphasis has been placed on providing a robust design that can facilitate various future bus routes through the site.

As such, Belcamp Parkway has been designed as a bus-capable road. The road has been designed with 3.25m wide lanes and a swept path analysis has been carried out using AutoTrack software using the NTA's bus type for the N8 and D route buses – refer also to Section 5.7.3, below.

5.4.5 Bus Gate

As noted above, Waterman Moylan met with representatives from the NTA, FCC and DCC in March 2022 to discuss the transport requirements of the proposed Belcamp SHD development. The current N8 BusConnects route departs from Clongriffin train station, continuing along Main Street before turning south onto the Hole in the Wall Road and then continuing west along the R139. At the meeting, the NTA advised

that they envisaged the N8 BusConnects Route being altered to run through the subject development along the East–West Link Road (EWLR) into Belcamp town square and then, preferably, directly south onto the R139.

Figure 22 | *Proposed Bus Gate*

The proposed road layout was amended following this meeting, to ensure that the requirements of the NTA are met. There is now a new Bus Gate proposed between Belcamp Parkway and the R139, with signal control on demand. The inclusion of a Bus Gate at the south of the site ensures that the proposed bus route can follow a direct path and will avoid a meandering route through the site. The Bus Gate also avoids any traffic, given that it provides bus-only access, and on-demand signal controls will ensure efficient wait times before turning onto the R139.

In addition to providing a new bus link between the East-West Link Road and the R139, the proposed bus gate route will also include additional pedestrian and cyclist links, and this link improves permeability through the site and to the surrounding road network.

5.4.6 R139 Link Road

A secondary Link Road is proposed from Belcamp Parkway onto the R139. The alignment of this proposed link road is shown in the Figure below:

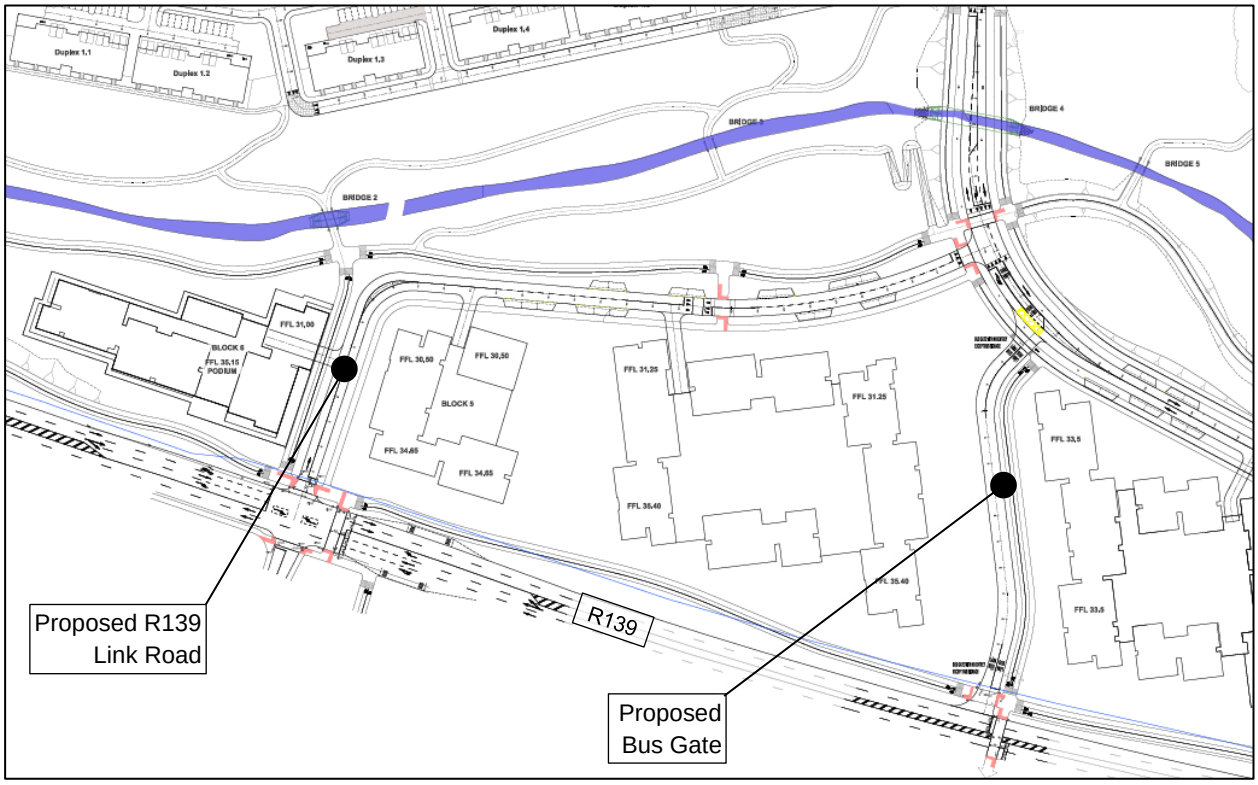


Figure 23 | *Proposed R139 Link Road and Bus Gate*

As noted above, the bus gate was introduced to give bus priority over cars and to provide a direct south link from the EWLR onto the R139, as discussed with the NTA in March 2022. However, Belcamp Parkway and the R139 Link Road have both also been designed to accommodate bus routes. This provides a robust, flexible design with options for future bus routes.

The removal of the bus gate and the use of the R139 link Road as a bus route can therefore be accommodated without compromise to the proposed submission, if that is ultimately the NTA's preference for the N8 BusConnects route.

Figure 24 | *Proposed R139 Link Road at the R139 Junction*

5.4.7 R139

Significant improvements will be provided for active travel options along the R139 along the full frontage of the Belcamp Lands, with the R139 in accordance with NTA and DCC objectives.

A new 5.0m wide footpath and two-way cycle track is to be introduced along the R139, for the full frontage of the site and approximately 250m beyond the eastern end of the site frontage with the R139, linking the development to Clarehall Junction.

Figure 25 | *View of Proposed Pedestrian/Cycle Path Along the R139*

The section of the R139 adjacent to the subject site is to be intentionally urbanised, with an active frontage and three signalised junctions – refer also to Section 5.5, below, which discusses the proposed junctions at the site. This is in accordance with requests by An Bord Pleanála to provide an active urban frontage. The proposed signals will be linked with traffic ducting and telemetry to the Clarehall junction and to the junction at Bewleys Head Office to the east, to ensure they work in sync with one another to avoid delays.

5.4.8 Mayne River Road to Malahide Road

It was previously proposed to provide a new vehicular route linking from the Malahide Road, south of the Mayne River and adjacent to Belmayne, as far as Belcamp Parkway. However, at the meeting held on 4 February 2022, DCC Transportation Department advised that this inner relief road is no longer part of the strategic road network in the area, and as it is not included in the South Fingal Transport Study recommendations, this link does not from part of the proposed development.

A new access link for pedestrians and cyclists is proposed along this route in accordance with the NTA 2021 Cycle Network Plan for the Greater Dublin Area.

5.5 Proposed Junctions

Several new junctions and junction upgrades are proposed as part of the subject development. Sightlines throughout the development are in accordance with the requirements set out in Section 4.4.4 of the Design Manual for Urban Roads and Streets – refer also to the accompanying DMURS Report and Statement of Design Consistency and to the drawing no.'s 19-114-P1135 and P1140.

Some of the main junctions are briefly described below.

5.5.1 R139 Link Road / R139

A new R139 Link Road is proposed to connect between the Belcamp Parkway and the R139, forming a new 4-way junction with the R139 adjacent to the existing Tara Lawns halting site access. A new dedicated cycle track is to be introduced along the R139. The new Link Road will feature dedicated cycle tracks on both sides of the carriageway. The new intersection will incorporate pedestrian crossing facilities, with a raised table at the Link Road to allow pedestrians to cross at grade.

The junction geometry, lanes and AutoTracking/swept path have all been designed to be bus capable, and the signals can provide bus priority.

5.5.2 R139 / Bus Gate

As noted above, a new Bus Gate will provide bus access to the R139 between the R139 Link Road and the Belcamp Parkway intersections. This junction will be signal controlled, with on-demand traffic lights ensuring priority for buses, without delaying traffic on the R139 when no bus is present.

It is also proposed to introduce a new toucan crossing at the bus gate junction. This crossing provides a direct link from the R139 at Darndal Park northwards towards the Belcamp Town Centre, and is in accordance with the DMURS emphasis on provision of high quality cycle and pedestrian links, allowing full permeability to active road users.

5.5.3 Belcamp Parkway / R139

The proposed Belcamp Parkway will cross the R139 at a signal-controlled junction, complete with pedestrian and toucan facilities. The new junction will include right-turning lanes. A new dedicated cycle track will be introduced along the R139, and Belcamp Parkway will include cycle lanes from this junction north to the junction with the East-West Link Road at Belcamp Town Square.

As with the R139 Link Road junction, the Belcamp Parkway/R139 junction's geometry, lanes and AutoTracking/swept path have all been designed to be bus capable, and the signals can provide bus priority.

5.5.4 R139 Link Road / Belcamp Parkway

The proposed new R139 Link Road and Belcamp Parkway will form a new intersection. Both roads are designed to include comprehensive cycle and pedestrian infrastructure.

Given that both the R139 Link Road and Belcamp Parkway have been designed as bus capable roads, the junction geometry, lanes and AutoTracking/swept path have all been designed to be bus capable.

5.5.5 East-West Link Road / Belcamp Parkway

The East-West Link Road and Belcamp Parkway will form a new junction at the centre of the subject development, at Belcamp Town Square. Both of these new roads will include cycle lanes. At the junction, there will be at-grade pedestrian crossing facilities.

The East-West Link Road is designed to include bus lanes on both sides of the carriageway. The west-bound bus lane will also serve as a left-turning lane for vehicles at this junction. The junction geometry, lanes and AutoTracking/swept path have all been designed to be bus capable, and the signals can provide bus priority.

Following a meeting in March 2022 between Waterman Moylan and the NTA, FCC and DCC, the geometry of this junction was revised to provide a more right-angled T-junction, to facilitate the N8 route in a more direct southerly direction.

5.5.6 Mayne River Road / Malahide Road

A new access link for pedestrians and cyclists will be provided from the Malahide Road, south of the Mayne River and adjacent to Belmayne.

5.5.7 East-West Link Road / Malahide Road

The existing Malahide Road/Balgriffin Cottages junction is proposed to be upgraded to form a new 4-way signalised junction, with the EWLR forming the western arm of the new junction. The proposed junction includes new right turning lanes and cycle facilities. The upgrade works will extend south on the Malahide Road to connect with the upgrades currently being carried out as part of the Phase 1 development.

This proposed upgrade is in accordance with the recommendations of the South Fingal Transport Study and provides a safe and attractive environment for pedestrians and cyclists.

This upgrade has been given a decision to grant permission by FCC under Phase 1B of the Belcamp development works (F21A/0401), along with approximately 350m of the EWLR. Nonetheless, this subject application also includes the proposed junction upgrade works, along with the approved ~350m of the EWLR, to ensure this application can provide the entirety of the link road from the Malahide Road to the site.

5.6 Quality Audit

A Quality Audit, including a Stage 1 Road Safety Audit, has been carried out by Bruton Consulting Engineers. For further information on the Quality Audit, refer to the DMURS Statement of Design Consistency which accompanies this submission under separate cover. The Quality Audit is included in full as an Appendix to that report.

5.7 Proposed Transport Network

The Belcamp Lands will be developed specifically to avoid a car dominated environment and to optimise pedestrian and cyclist links. In order to achieve this, the design team has placed significant emphasis on providing high-quality, extensive pedestrian and cyclist facilities.

This strategy is in accordance with the Design Manual for Urban Roads and Streets (DMURS), which prioritises, in order of importance, pedestrians, cyclists and public transport, with private cars the least important. Refer also to the DMURS Statement of Design Consistency, which accompanies this submission under separate cover, for further discussion of specific design features that have been incorporated within the proposed scheme with the objective of delivering a design that is in compliance with DMURS.

Waterman Moylan engaged with Breen Doris from the Active Travel section of FCC, who stated that FCC welcome the design team's approach to specifically avoid a car dominated environment, with the introduction of a Transport Hub at Belcamp Town Square that links buses (proposed N8 route to Clongriffin Dart Station) to bicycle links (with E-bike charging stations, bicycle stands and cycle routes converging).

5.7.1 Proposed Pedestrian Infrastructure

The proposed development will include a network of footpaths throughout the site and connecting with the surrounding infrastructure providing efficient, high-quality routes along desire lines to destinations within and surrounding the development area.

An active frontage along routes within the development is achieved with frequent entrances and openings that ensure the street is overlooked and that generate pedestrian activity as people come and go from buildings.

High quality pedestrian linkages will be provided to connect to Malahide Road (R107), the Mayne River, City Junction and to the R139, linking the development with the existing Clarehall Junction shopping and commercial area and to the future Belmayne Square.

Particular attention will be paid at detail design stage to the quality of the pedestrian routes and to the facilities at pedestrian destinations. These destinations include the Belcamp Town Square, the Walled Garden, Belcamp Square, local school and crèche facilities, connections to the public bus network, the green route along the Mayne River and the route along the R139 to Clarehall Junction.

Junctions will be designed with raised pedestrian tables/crossings at main pedestrian desire lines, allowing pedestrians to cross at grade. In addition to pedestrian and toucan facilities at signal-controlled junctions, on-call pedestrian signals will be provided at key desire lines. Refer to the accompanying Waterman Moylan drawing no. 19-114-P1005 which show proposed pedestrian routes through the site.

5.7.2 Proposed Cycle Infrastructure

The proposed development will include dedicated cycle facilities, including an off-road cycle track along the East-West Link Road and along the R139, separated from the vehicular carriageway by a verge. The proposed junction upgrade at the site entrance from Malahide Road includes new cycle stopping areas and new cycle lanes along the Malahide Road.

High quality cycle linkages will be provided to connect to Malahide Road (R107), the Mayne River, City Junction and to the R139 linking the development the existing Clarehall Junction shopping and commercial area and to the future Belmayne Square.

Particular attention will be paid at detail design stage to the quality of the cycle routes and to the facilities at cycle destinations. These destinations include the Belcamp Town Square, the Walled Garden, Belcamp Square, local school and crèche facilities, connections to the public bus network, the green route along the

Mayne River and the route along the R139 to Clarehall Junction. E-Bike charging stations and bicycle racks are to be provided at the transport hub, to encourage active travel to the town square.

The Department of Housing, Local Government and Heritage document "*Sustainable Urban Housing: Design Standards for New Apartments*" states that in order to apply and justify the use of a reduced car parking ratio, new developments must be comprehensively equipped with high quality cycle parking and storage facilities for residents and visitors. This document recommends a general minimum standard of 1 cycle storage space per bedroom with a visitor parking standard of 1 space per 2 residential units – refer also to the accompanying Car Parking Strategy report.

The required bicycle parking and the proposed bicycle parking are set out in the Table below:

Description			No. of Units	No. of Bedspaces	Total Requirement	No. of Bicycle Spaces Proposed		
						Residential	*Visitor*	*Total*
Dublin City Council	Apartments	Block 1	273	492	629	618	26	644
		Block 2	160	265	345	345	14	359
		Block 3	297	523	672	640	42	682
		Block 4	285	537	680	752	46	798
		Block 5	96	163	211	240	24	264
		Block 6	119	239	299	290	20	310
		Additional Visitor	-	-	-	-	5	5
		Crèche	6 Classrooms	-	-	-	3	3
		Block 3 Café/Retail	418m²	-	-	-	19	19
	DCC Subtotal		***1,230***	***2,219***	***2,834***	***2,885***	***199***	***3,084***
Fingal County Council	Duplexes	Block 1.1	18	38	47	38	9	47
		Block 1.2	18	38	47	38	9	47
		Block 1.3	18	38	47	38	9	47
		Block 1.4	18	38	47	38	9	47
		Block 1.5	18	38	47	38	9	47
		Block 2.1	8	24	28	24	8	32
		Block 2.2	16	48	56	48	16	64
		Block 2.3	16	48	56	48	16	64
		Block 2.4	8	24	28	24	8	32
		Block 2.5	12	36	42	36	12	48
		Block 2.6	16	48	56	48	16	64
		Block 3.1	12	36	42	36	12	48
		Block 3.2	12	36	42	36	12	48
		Block 3.3	12	32	38	40	12	52
		Block 3.4	12	32	38	32	12	44
		Block 3.5	12	36	42	36	12	48
		Block 3.6	16	48	56	48	16	64
		Block 3.7	16	48	56	48	16	64
		Block 3.8	8	24	28	24	8	32
		Block 3.9	8	24	28	24	8	32
	Apartments	Block A	23	38	50	38	12	50
		Block B	23	38	50	38	12	50
		Block C	27	47	61	47	14	61
		Block D	42	67	88	71	22	93
		Block F	103	165	217	165	52	217
		Block G	65	101	134	102	36	138
		Block H	46	72	95	88	24	112
		Block J	40	64	84	84	24	108
		Block L	46	72	95	88	24	112

	Block M	56	88	116	88	28	116
	Block N	56	91	119	96	34	130
	Block P	23	41	53	41	12	53
Town Square Environs		-	-	-	-	24	24
Public Racks at Block F/G		-	-	-	-	20	20
Clubhouse		-	-	-	-	50	50
FCC Subtotal		***824***	***1,618***	***2,030***	***1,688***	***617***	***2,305***
Total		**2,054**	**3,837**	**4,864**	**4,573**	**816**	**5,389**

Table 8 | *Cycle Parking Standards & Proposed Cycle Parking*

At Blocks 1 to 6, visitor parking is provided under podium/basement as well as on the street. At each block entrance, it is proposed to introduce 10 no. visitor cycle parking spaces in the form of Sheffield-style stands. These will provide convenient parking for short-stay visitors. In addition to the ample provision of residential and visitor cycle parking, additional public bicycle parking is provided at key locations including 50 spaces at the clubhouse serving the open space at the west of the site, 24 spaces in the Town Square environs and 20 spaces between Blocks F and G.

Refer also to the accompanying Waterman Moylan drawing no. 19-114-P1006 which show proposed cycle routes through the site.

5.7.3 Future Bus Network

The EWLR is envisaged as a core bus route, providing east–west linkages to the fringe area and ultimately to the airport environs. Accordingly, this road is designed to comply with the principles of a Core Bus Corridor, including dedicated bus lanes and new bus stops, and to accommodate optimum cyclist and pedestrian facilities.

Waterman Moylan met with representatives from the NTA, FCC and DCC in March 2022 to discuss the transport requirements of the proposed Belcamp SHD development. The current N8 BusConnects route departs from Clongriffin train station, continuing along Main Street before turning south onto the Hole in the Wall Road and then continuing west along the R139. At the meeting, the NTA advised that they envisaged the N8 BusConnects Route being altered to run through the subject development along the East–West Link Road (EWLR) into Belcamp town square and then, preferably, directly south onto the R139.

The proposed road layout was amended following this meeting, to ensure that the requirements of the NTA are met. The amended proposal provides a bus gate linking directly southwards from the EWLR onto the R139. As noted above, the bus gate was introduced to give bus priority over cars and to provide a direct south link from the EWLR onto the R139, as discussed with the NTA in March 2022.

The revised N8 route will benefit from a newly proposed bus gate, indicated in the Figure below, providing a bus-only route onto the R139, with signal control on demand. During the meeting with the NTA, FCC and DCC, the NTA noted that they would welcome the use of bus gates to prioritise public transport ahead of cars and to ensure that buses do not get stuck in traffic.

Belcamp Parkway and the R139 Link Road have both also been designed to be bus capable and can accommodate bus routes with 3.25m wide lanes, locations for bus stops and signalised junctions that can provide bus priority. This provides a robust, flexible design with options for future bus routes. The removal of the bus gate and the use of the R139 link Road as N8 bus route can be accommodated without compromise to the proposed submission, if that is the NTA's preference for the N8 BusConnects route.

The current N8 BusConnects route and the proposed altered routes are shown in the Figure below:

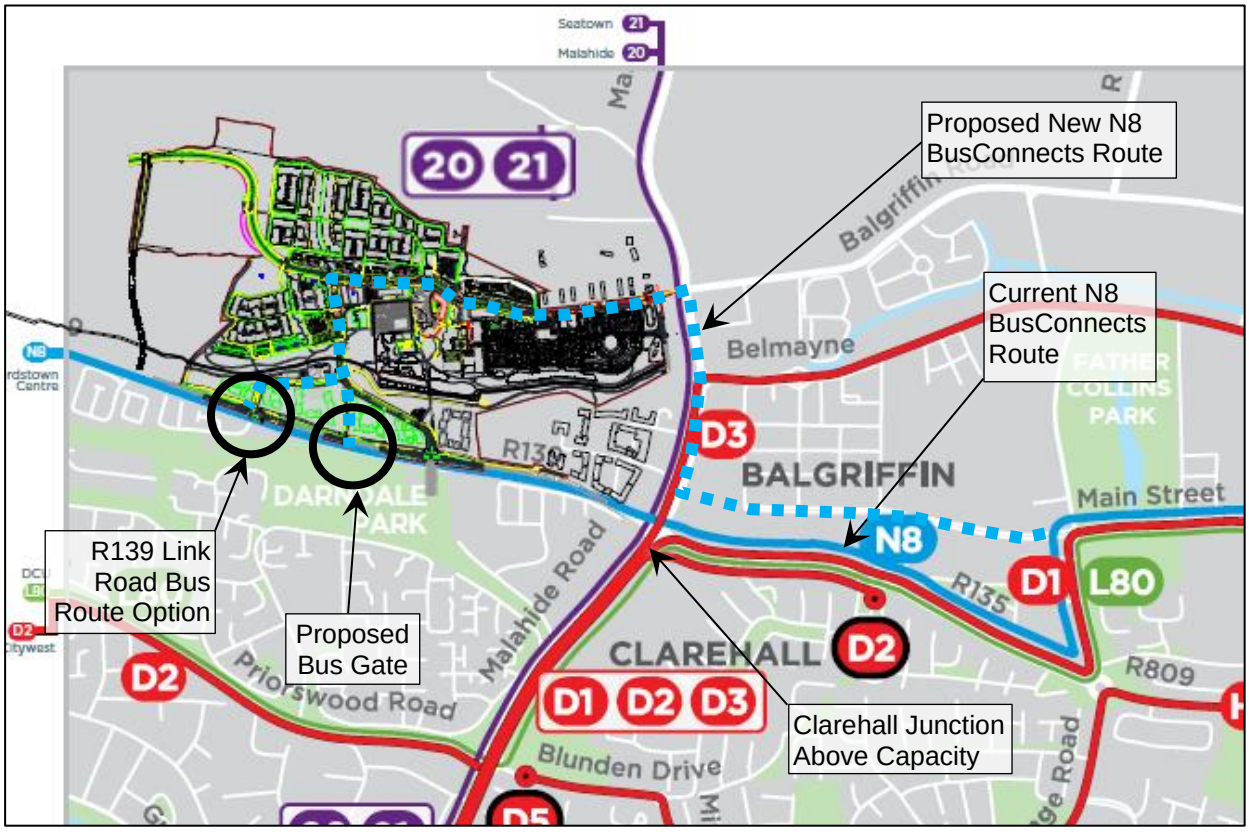


Figure 26 | *Current N8 Route and Proposed N8 Route through Belcamp*

This proposed altered route would avoid the Clarehall junction between R107 and R139, which is currently above capacity and suffers from long queues and delays. The Bus Gate also avoids any traffic, given that it provides bus-only access, and on-demand signal controls will ensure efficient wait times before turning onto the R139.

This proposed altered route provides several benefits:

- The new route would avoid the Clarehall junction between R107 and R139, which is currently above capacity and suffers from long queues and delays.
- The East–West Link Road is envisaged as a core bus route, and accordingly, this road is designed to comply with the principles of a Core Bus Corridor, including dedicated bus lanes, new bus stops, and segregated cycle lanes.
- The inclusion of a Bus Gate at the south of the site ensures that the bus route will follow a direct path and will avoid a meandering route through the site.
- The Bus Gate also avoids any traffic, given that it provides bus-only access, and on-demand signal controls will ensure efficient wait times before turning onto the R139.
- The new route will serve a large population in Belcamp.

The NTA advised that there are currently no proposals to bring one of the D routes through the Belcamp development. However, BusConnects routes are subject to future change depending on demand and future development. As such, emphasis has been placed on providing a robust design that can facilitate various future bus routes through the site.

Belcamp Parkway has therefore been designed to accommodate a possible future route for one of the D routes and has been designed with a 3.25m wide verge that can facilitate future bus lanes. This route would divert buses from the Malahide Road onto Belcamp Lane through the DCC Masterplan lands, south of the R139, through a signalised junction on the R139. This D route would not use the proposed Bus Gate, which is part of the N8 route. This will ensure a straight-through crossing of the R139, as shown in the Figure below.

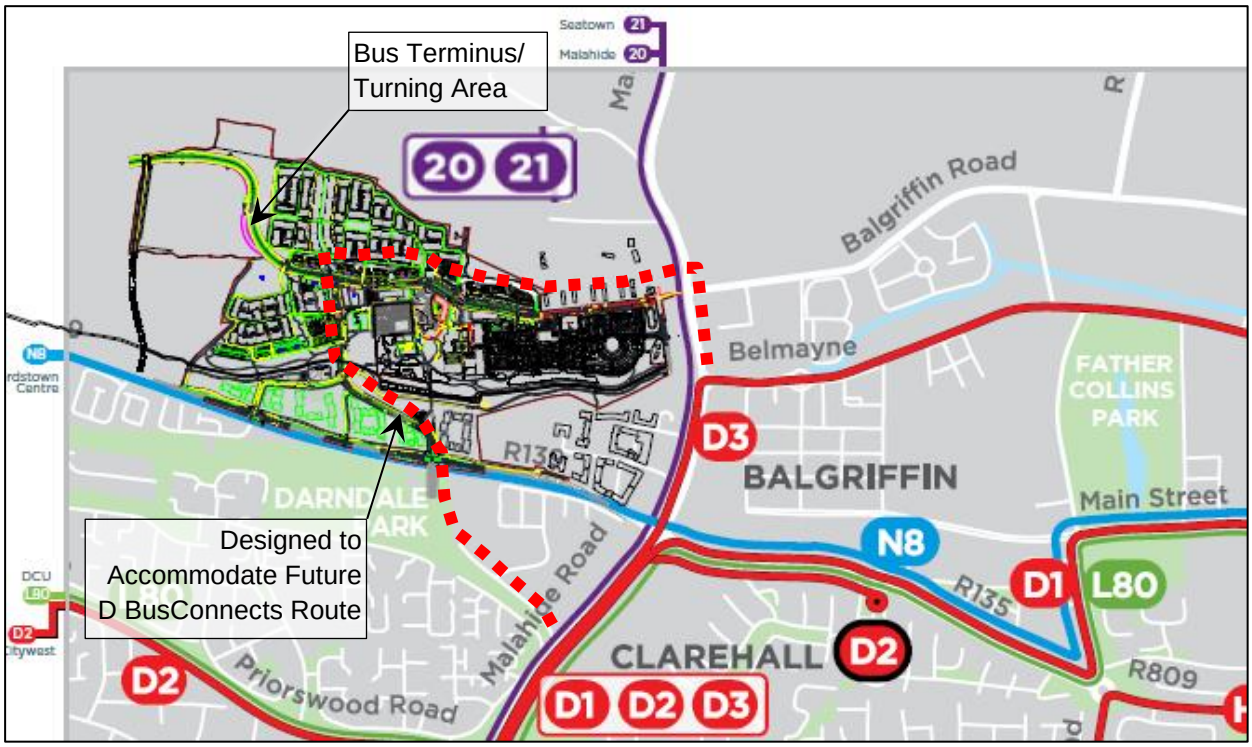


Figure 27 | *Possible Future D Route through Belcamp*

This proposed bus route through the subject lands can also facilitate possible future routes from DCC to the Airport, while avoiding the congested Clarehall junction. The Belcamp Parkway route from the R139 to the EWLR follows the alignment provided in FCC / DCC Development Plans, the Belcamp / Belmayne Masterplan and the South Fingal Transport Study.

A bus terminus/turning area is provided along the EWLR, within the open space at the west of the proposed Belcamp Development. This again allows for a robust design of bus routes that can come into Belcamp, turn around and travel back along the same route alignment.

Proposed routes and associated junctions have been auto-tracked using the same bus type used for the N8 and D routes, as provided by the NTA – refer to drawing 19-114-P1135 for swept path analysis of each of these bus routes.

For further information on the proposed bus facilities, refer also to Section 2.2 of the DMURS Statement of Design consistency, which accompanies this submission under separate cover.

5.8 Development Phasing

It is proposed to include the main internal transportation infrastructure as part of the first phase of development, including the EWLR, Belcamp Parkway and the Bus Gate. This will ensure that there is adequate transportation provision in place before the development is occupied.

This will also ensure the Belcamp Phasing will align with the BusConnects Phasing and immediately provide public transport to the Belcamp Development via the N8 service.

The proposed Phasing Plan for the subject development is shown in the Figure below:

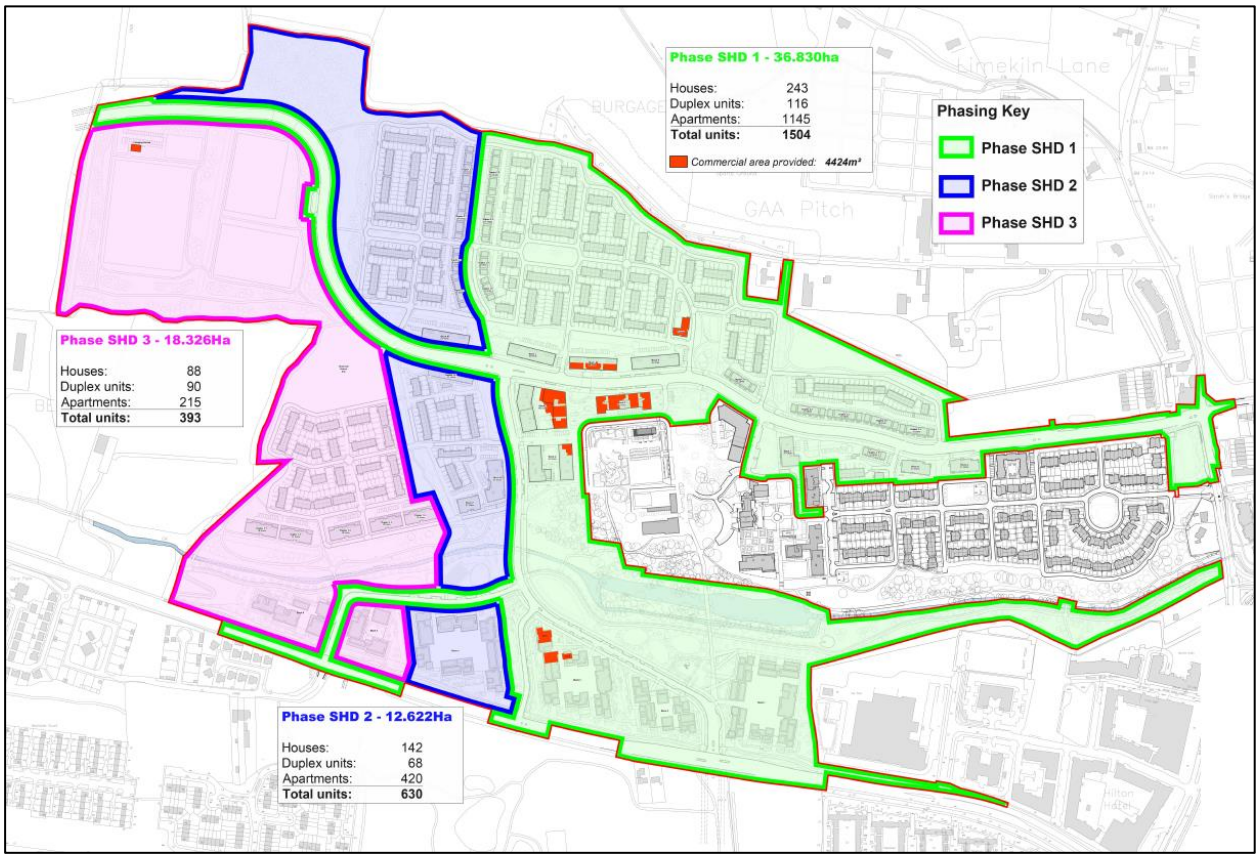


Figure 28 | *SHD Phasing Plan*

The proposed construction programme is indicated in the Table below:

Belcamp Programme	Start	Finish
Infrastructure (Main Roads)	Q1/2023	Q1/2025
SHD Phase 1	Q1/2023	Q3/2028
SHD Phase 2	Q3/2028	Q3/2030
SHD Phase 3	Q3/2030	Q4/2032

Table 9 | *Belcamp Construction Programme*

5.9 Related Reports

5.9.1 Traffic and Transport Assessment

As noted above, a comprehensive Traffic and Transport Assessment has been prepared by Waterman Moylan and accompanies this submission under separate cover. The Traffic and Transport Assessment provides a comprehensive review of all the potential transport impacts of the development, including a detailed assessment of the transportation systems provided and the impact of the proposed development on the surrounding environment and transportation network.

5.9.2 Travel Plan

A Travel Plan has been prepared by Waterman Moylan and accompanies this submission under separate cover. This Travel Plan is intended to deal with the typical day-to-day operational conditions at the site to assess, examine and manage the typical traffic that will be generated by the residential units during the operational phase of the development, and to propose measures to encourage residents to avail of public transport by improving awareness of public transport options and providing information on bus and train routes and frequencies.

5.9.3 DMURS Statement of Design Consistency

As noted above, a DMURS Statement of Design Consistency has been prepared by Waterman Moylan, in collaboration with other members of the multi-disciplinary design team, and accompanies this submission under separate cover. This report outlines specific design features that have been incorporated within the proposed scheme with the objective of delivering a design that is in compliance with the Design Manual for Urban Roads and Streets (DMURS).

5.9.4 Car Parking Strategy

A Car Parking Strategy has been prepared by Waterman Moylan and accompanies this submission under separate cover. This report assesses the car parking requirements for the development and sets out the car parking rationale and strategy to be employed at the site.

5.9.5 Sustainable Transport Strategy Study

A Sustainable Transport Strategy Study has been prepared by SYSTRA and accompanies this submission under separate cover. This report develops the principles and suggested measures for the Sustainable Transport Strategy. It includes strategic transport modelling and analysis using information gathered from desktop research, previous studies and planning applications, and data extracted from the National Transport Authority's Eastern Regional Model. The Sustainable Transport Strategy is intended to support and inform the Traffic and Transport Assessment prepared by Waterman Moylan.

5.9.6 Public Transport Capacity Assessment of Belcamp Site

An public transport capacity assessment has been carried out by traffic consultant Derry O'Leary, and accompanies this submission under separate cover.

6. ESBN Overheads

6.1 Existing ESBN Overheads

There are existing 38kV overhead power cables on the Belcamp site that stretch from the R139, at the existing Belcamp entrance, to the western boundary of the Belcamp site. A copy of the existing ESBN overhead power cable alignment with proposed infrastructure is indicated below.

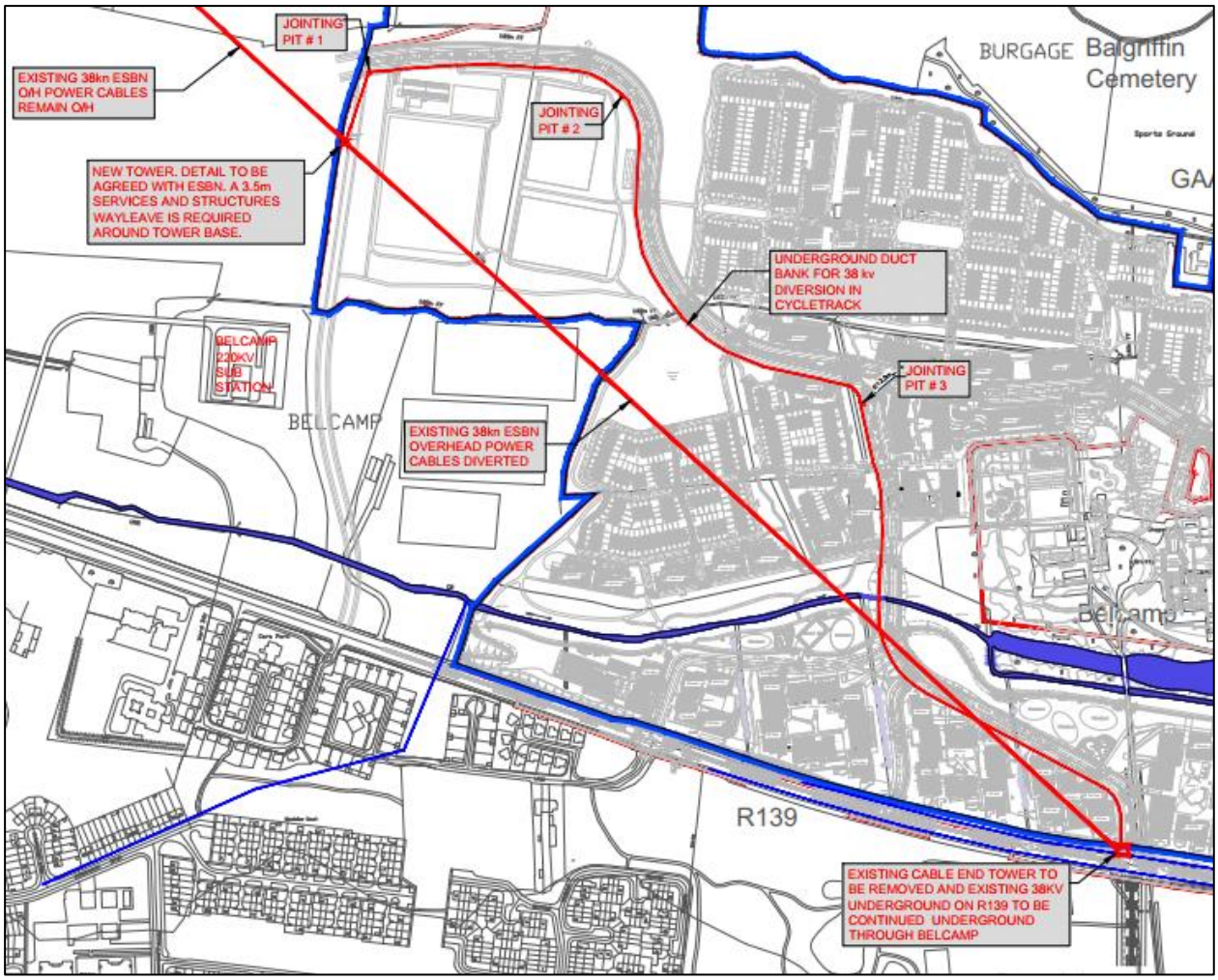


Figure 29 | *ESBN Records Showing 38kV Overhead Cables*

6.2 Proposed diversion of ESBN Overheads

Waterman Moylan made contact with ESBN's Alan Brown to review the proposed undergrounding of the 38 kv overheads through the site. The proposals were reviewed and ESBN provided guidance on the diversion format required to accommodate the new site layout.

A site meeting was held to review the existing cables and proposals to accommodate the new site layout.

It was agreed that a new 5 way duct bank be provided in the main distributor roads through the site for the undergrounded cables and a letter of support was provided by ESBN, dated 28 October 2021 (option B road layout). Another updated letter dated 29 April 2022 from Alan Brown was obtained for the revised EWLR arrangement, with the EWLR terminating on the western boundary to the north of Option B. A copy of this letter is provided in Appendix F.

As indicated above, a new 12m ESBN tower will be required on the western boundary, on the alignment of the existing overheads, to accommodate the continuation of the overhead system that will be necessary west of the western boundary. A copy of the details of the tower was provided by Alan Brown and is included in Appendix F and the exact size and location of all ESBN proposals are to be agreed at detail design stage.

Appendices

A. Irish Water Confirmation of Feasibility Letter

Darragh Aiken
Waterman Moylan
Eastopoint Business Park, Block S,
Alfie Byrne Road,
Dublin 3
D03H3F4

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

23 April 2020

Dear Jim Kenny,

Re: Connection Reference No CDS20001888 pre-connection enquiry -
Subject to contract | Contract denied

Connection for Housing Development of 4,651 units at Belcamp Lands, Malahide Road, Dublin.

Irish Water has reviewed your pre-connection enquiry in relation to water and wastewater connections at Belcamp Lands, Malahide Road, Dublin.

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

Water

- The connection should be installed on 600mm DI main in R139 road and should include installation of an offtake with a PRV controller and a bulk meter with associated telemetry system.
- Secondary connection should be installed on 300mm DI main in R139 with closed valve during normal operation.
- On site storage will be required for the average day peak week demand (1.45l/s) of the commercial section with 24 hours storage and 12 hours re-fill time.

Wastewater

- The connection into the 1050 mm trunk sewer is feasible without upgrade.
- The proposed development indicates that important Irish Water assets are present on the site (1050 mm and 375 mm sewer). Also, site for future wastewater treatment plant is adjacent to the Development. The Developer has to demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the infrastructure during and after the works. In advance of obtaining final planning permission the developer is requested to contact Irish Water to agree the required separation distances or proposed diversion associated with the infrastructure. For further information related to diversion please visit www.water.ie/connections/developer-services/diversions

More detailed Local Network Plan (Master Plan) of the Development Area, including water distribution and wastewater collection networks servicing the planned building blocks, is required. The Plan has to be reviewed and approved by Irish Water. The networks should be appropriately designed and suitably sized to provide effective and economical management of the networks with minimum number of pumping stations.

All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details. A design proposal for the water and wastewater infrastructure should be submitted to Irish Water for assessment.

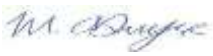
Prior to submitting your planning application, you are required to submit these design proposals to Irish Water for review.

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

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

If you have any further questions, please contact Marina Zivanovic Byrne from the design team on 01 89 25991 or email mzbyrne@water.ie. For further information, visit **www.water.ie/connections.**

Yours sincerely,



Maria O'Dwyer

Connections and Developer Services

B. Irish Water Statement of Design Acceptance

Darrgh Aiken
Waterman Moylan
Block S Eastpoint Business Park
Alfie Byrne Road
Dublin
D03 H3F4

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

28 April 2022

Re: Design Submission for Belcamp Lands, Malahide Road, Dublin (the "Development") (the "Design Submission") / Connection Reference No: CDS20001888

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: Fionán Ginty
Phone: 01 89 25734
Email: fginty@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- P2000 Drainage General Arrangement
- P2100 Drainage Layout Sheet 1 of 11
- P2101 Drainage Layout Sheet 2 of 11
- P2102 Drainage Layout Sheet 3 of 11
- P2103 Drainage Layout Sheet 4 of 11
- P2104 Drainage Layout Sheet 5 of 11
- P2105 Drainage Layout Sheet 6 of 11
- P2106 Drainage Layout Sheet 7 of 11
- P2107 Drainage Layout Sheet 8 of 11
- P2108 Drainage Layout Sheet 9 of 11
- P2109 Drainage Layout Sheet 10 of 11
- P2110 Drainage Layout Sheet 11 of 11

- P3000 Watermain District Metered Areas
- P3100 Watermain General Arrangement
- P3101 Watermain Layout Sheet 1 of 11
- P3102 Watermain Layout Sheet 2 of 11
- P3103 Watermain Layout Sheet 3 of 11
- P3104 Watermain Layout Sheet 4 of 11
- P3105 Watermain Layout Sheet 5 of 11
- P3106 Watermain Layout Sheet 6 of 11
- P3107 Watermain Layout Sheet 7 of 11
- P3108 Watermain Layout Sheet 8 of 11
- P3109 Watermain Layout Sheet 9 of 11
- P3110 Watermain Layout Sheet 10 of 11
- P3111 Watermain Layout Sheet 11 of 11

Additional Comments:

- The design submission, including proposed connection points, will be subject to further technical review at connection application stage.

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.

C. GDSDS Attenuation Calculations

Waterman Moylan
Engineering Consultants

Block S, EastPoint Business Park,
Alfie Byrne Road, Dublin D03 H3F4
t 01 664 8900 f 01 661 3618 e info@waterman-moylan.ie

Calculation By:	DA
Approved by:	MD

Input Data

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

Catchment A1
North Western Catchment

Total Site Area:	234,400m²	
Paved Area		
Total:	49%	*… Total paved area as a percentage of site area*
Drained:	100%	*… Proportion of paved area drained*
Soil Area		
Drained:	0%	*… Proportion of soil area drained*
Runoff Growth Factors:		
1-Year	0.85	*… Typical value for Dublin is 0.85*
30-Year	2.10	*… Typical value for Dublin is 2.10*
100-Year	2.60	*… Typical value for Dublin is 2.60*
Soil Type:	Type 4	*… From 1 to 5*
SAAR:	950mm	*… Values can be found at www.uksuds.com*
Climate Change Factor:	20%	*… 20% is typically used in Ireland*
Rain Data From:	A	*… A = Dublin Airport* *B = Ballinteer* *C = Bray* *D = Cork City*

SW Catchment Area A1:	234,400m²
Hard Area	117,200m²
PIMP	50.0%

SW Catchment Area A2:	318,300m²
Hard Area	127,300m²
PIMP	40.0%

Waterman Moylan
Engineering Consultants

Block S, EastPoint Business Park,
Alfie Byrne Road, Dublin D03 H3F4
t 01 664 8900 f 01 661 3618 e info@waterman-moylan.ie

Calculation By:	DA
Approved by:	MD

Project Data

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

Description		%	Area
Total Site Area		-	234,400m²
Paved Area	Total	49%	114,856m²
	Drained	100%	114,856m²
Soil Area	Total	51%	119,544m²
	Drained	0%	0m²

Soil Type:	Type 4
SPR Index (from FSR):	0.47
SAAR:	950mm
Rain Data:	Dublin Airport
Climate Change Factor:	20%

Greenfield Runoff:

$Q_{BARrural} = 0.00108 \times Area^{0.89} \times SAAR^{1.17} \times Soil^{2.17}$

Area = 0.2344km² … *Total site area in km²*
SAAR = 950mm … *Standard Average Annual Rainfall in mm*
SOIL = 0.47 … *The "SPR" index from FSR*

Note: Where a site is <0.5km², the $Q_{BARrural}$ formula should be applied for 0.5km² and the result factored based on the ratio of the actual site area and the applied area.

$Q_{BARrural} = 0.162m^3/s$
$Q_{BARrural} = 161.765$ l/s
$Q_{BARrural} = 6.901$ l/s/Ha

Return Period	1-year	30-year	100-year
Growth Factor	0.85	2.10	2.60
Q_{BAR} (l/s)	137.50	339.71	420.59
Q_{BAR} (l/s/Ha)	5.87	14.49	17.94
Allowable Discharge	161.76	161.76	161.76

Rainfall Data:

Rain Data From: Dublin Airport
Climate Change Factor: 20%

Duration	Return Period *(Years)*						
(Hours)	1	5	10	20	30	50	100
0.5	9.0	14.4	17.9	22.0	24.2	28.8	33.6
1	12.0	18.6	22.9	27.6	30.4	36.0	42.0
2	15.7	23.8	28.8	34.8	37.6	43.2	50.4
4	21.2	31.2	37.2	43.2	46.4	52.8	61.2
6	25.6	37.2	43.2	50.4	54.4	62.4	70.8
12	32.4	46.8	18.0	63.6	68.0	76.8	86.4

Waterman Moylan
Engineering Consultants

Block S, EastPoint Business Park,
Alfie Byrne Road, Dublin D03 H3F4
t 01 664 8900 f 01 661 3618 e info@waterman-moylan.ie

Calculation By:	DA
Approved by:	MD

Summary

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

Summary of GDSDS Calculations:

Criterion 1: River Protection Volume

Interception Volume	**344.57m³**
Treatment Volume	**1,033.70m³**

Criterion 2: River Regime Protection

1-in-1-Year Storm	994.90m³
1-in-30-Year Storm	2,357.50m³
1-in-100-Year Storm	1,546.36m³
Reduction of Long-Term Storage	-1,092.32m³
Volume Required	**3,806.44m³**

… Includes head-loss correction

Criterion 4: River Flood Protection

Long Term Storage *(no interception provided)*	**1,092.32m³**
Long Term Storage *(Interception provided)*	**747.75m³**

Total Attenuation Volume Requirement:

1-in-100 Year Storm

1-in-1-Year Storm	994.90m³
1-in-30-Year Storm	2,357.50m³
1-in-100-Year Storm	1,546.36m³
Total	**4,898.76m³**

The maximum attenuation volume required is 4,898.76m³

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Calculation By:	DA
Approved by:	MD

Criterion 1
River Protection Volume

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

1.1 Interception

Paved surfaces connected to drainage system	*234400m² x 0.49 x 0.75 =* 86,142.00m²	*234,400m² site area* *49% of the site is paved* *75% of the paved area*
Volume of Interception Storage	*86142m² x 5mm x 0.8 =* **344.57m³**	*Paved area directly drained* *5mm rainfall depth* *80% paved runoff factor*

1.2 Treatment Volume

Paved surfaces draining to river	*234400m² x 0.49 x 0.75 =* 86,142.00m²	*234,400m² site area* *49% of the site is paved* *75% of the paved area*
Volume of Treatment Storage	*86142m² x 15mm x 0.8 =* **1,033.70m³**	*Paved area directly drained* *15mm rainfall depth* *80% runoff from paved surfaces*

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Criterion 2
River Regime Protection

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

1-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff = Rainfall Rate x Area x Soil Type				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m³	l/s	m³	l/s	m³
0.5	50.00	574.3	0.0	574.3	1,033.7	161.8	291.2	412.5	742.5
1	33.33	382.9	0.0	382.9	1,378.3	161.8	582.4	221.1	795.9
2	21.83	250.8	0.0	250.8	1,805.5	161.8	1,164.7	89.0	640.8
4	14.75	169.4	0.0	169.4	2,439.5	161.8	2,329.4	7.6	110.1
6	11.83	135.9	0.0	135.9	2,935.7	135.9	2,935.7	0.0	0.0
12	7.50	86.1	0.0	86.1	3,721.3	86.1	3,721.3	0.0	0.0

30-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff = Rainfall Rate x Area x Soil Type				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m³	l/s	m³	l/s	m³
0.5	134.67	1,546.7	0.0	1,546.7	2,784.1	161.8	198.2	1,385.0	1,697.0
1	84.43	969.8	0.0	969.8	3,491.2	161.8	423.0	808.0	2,112.9
2	52.22	599.7	0.0	599.7	4,318	161.8	870.7	438.0	2,357.5
4	32.23	370.1	0.0	370.1	5,330	161.8	1,711.5	208.4	2,204.4
6	25.18	289.2	0.0	289.2	6,248	161.8	2,484.1	127.5	1,957.7
12	15.74	180.8	0.0	180.8	7,811	161.8	225.3	19.0	26.5

100-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff = Rainfall Rate x Area x Soil Type				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m³	l/s	m³	l/s	m³
0.5	186.67	2,144.0	0.0	2,144.0	3,859.2	161.8	33.8	1,982.2	414.6
1	116.67	1,340.0	0.0	1,340.0	4,824	161.8	149.4	1,178.2	1,088.2
2	70.00	804.0	0.0	804.0	5,789	161.8	370.4	642.2	1,470.6
4	42.50	488.1	0.0	488.1	7,029	161.8	766.4	326.4	1,546.4
6	32.78	376.5	0.0	376.5	8,132	161.8	1,118.3	214.7	1,484.3
12	20.00	229.7	0.0	229.7	9,924	161.8	-519.2	67.9	-218.1

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Criterion 4
River Flood Protection

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

Vol_{XS} = RD x A x 10 [(PIMP/100 x α0.8) + (1 - (PIMP/100))(β x Soil) - Soil]

Vol_{XS}			*… Extra runoff volume of development over Greenfield runoff*
RD	=	71 mm	*… Rainfall depth of the 100 year, 6 hour event mm*
A	=	23.440 Ha	*… Area of site*
PIMP	=	49%	*… Impermeable area of total site*
α0.8	=	100%	*… Proportion of paved area drained to drainage network or river with 80% runoff*
β	=	60%	*… Proportion of pervious area drained to the network or river*
Soil	=	0.47	*… SPR index*

Vol_{XS} = 1,092.32m³

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Calculation By:	DA
Approved by:	MD

Input Data

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

Catchment A2
North Western Catchment

Total Site Area:	318,300m²	
Paved Area		
Total:	30%	*… Total paved area as a percentage of site area*
Drained:	100%	*… Proportion of paved area drained*
Soil Area		
Drained:	0%	*… Proportion of soil area drained*
Runoff Growth Factors:		
1-Year	0.85	*… Typical value for Dublin is 0.85*
30-Year	2.10	*… Typical value for Dublin is 2.10*
100-Year	2.60	*… Typical value for Dublin is 2.60*
Soil Type:	Type 4	*… From 1 to 5*
SAAR:	950mm	*… Values can be found at www.uksuds.com*
Climate Change Factor:	20%	*… 20% is typically used in Ireland*
Rain Data From:	A	*… A = Dublin Airport* *B = Ballinteer* *C = Bray* *D = Cork City*

SW Catchment Area A1:	234,400m²
Hard Area	
PIMP	0.0%

SW Catchment Area A2:	318,300m²
Hard Area	127,300m²
PIMP	40.0%

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Calculation By:	DA
Approved by:	MD

Project Data

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

Description		%	Area
Total Site Area		-	318,300m²
Paved Area	Total	30%	95,490m²
	Drained	100%	95,490m²
Soil Area	Total	70%	222,810m²
	Drained	0%	0m²

Soil Type:	Type 4
SPR Index (from FSR):	0.47
SAAR:	950mm
Rain Data:	Dublin Airport
Climate Change Factor:	20%

Greenfield Runoff:

$Q_{BARrural} = 0.00108 \times Area^{0.89} \times SAAR^{1.17} \times Soil^{2.17}$

Area = 0.3183km² … *Total site area in km²*
SAAR = 950mm … *Standard Average Annual Rainfall in mm*
SOIL = 0.47 … *The "SPR" index from FSR*

Note: Where a site is <0.5km², the $Q_{BARrural}$ formula should be applied for 0.5km² and the result factored based on the ratio of the actual site area and the applied area.

$Q_{BARrural}$ = 0.220m³/s
$Q_{BARrural}$ = 219.666 l/s
$Q_{BARrural}$ = 6.901 l/s/Ha

Return Period	1-year	30-year	100-year
Growth Factor	0.85	2.10	2.60
Q_{BAR} (l/s)	186.72	461.30	571.13
Q_{BAR} (l/s/Ha)	5.87	14.49	17.94
Allowable Discharge	219.67	219.67	219.67

Rainfall Data:

Rain Data From: Dublin Airport
Climate Change Factor: 20%

Duration	Return Period *(Years)*						
(Hours)	1	5	10	20	30	50	100
0.5	9.0	14.4	17.9	22.0	24.2	28.8	33.6
1	12.0	18.6	22.9	27.6	30.4	36.0	42.0
2	15.7	23.8	28.8	34.8	37.6	43.2	50.4
4	21.2	31.2	37.2	43.2	46.4	52.8	61.2
6	25.6	37.2	43.2	50.4	54.4	62.4	70.8
12	32.4	46.8	18.0	63.6	68.0	76.8	86.4

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Calculation By:	DA
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Summary

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

Summary of GDSDS Calculations:

Criterion 1: River Protection Volume

Interception Volume	**286.47m³**
Treatment Volume	**859.41m³**

Criterion 2: River Regime Protection

1-in-1-Year Storm	580.01m³
1-in-30-Year Storm	1,647.71m³
1-in-100-Year Storm	1,119.38m³
Reduction of Long-Term Storage	734.66m³
Volume Required	**4,081.77m³**

… Includes head-loss correction

Criterion 4: River Flood Protection

Long Term Storage *(no interception provided)*	**-734.66m³**
Long Term Storage *(Interception provided)*	**-1,021.13m³**

Total Attenuation Volume Requirement:

1-in-100 Year Storm

1-in-1-Year Storm	580.01m³
1-in-30-Year Storm	1,647.71m³
1-in-100-Year Storm	1,119.38m³
Total	**3,347.10m³**

The maximum attenuation volume required is 3,347.10m³

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Calculation By:	DA
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Criterion 1
River Protection Volume

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

1.1 Interception

Paved surfaces connected to drainage system	*318300m² x 0.3 x 0.75 =* 71,617.50m²	*318,300m² site area* *30% of the site is paved* *75% of the paved area*
Volume of Interception Storage	*71617.5m² x 5mm x 0.8 =* **286.47m³**	*Paved area directly drained* *5mm rainfall depth* *80% paved runoff factor*

1.2 Treatment Volume

Paved surfaces draining to river	*318300m² x 0.3 x 0.75 =* 71,617.50m²	*318,300m² site area* *30% of the site is paved* *75% of the paved area*
Volume of Treatment Storage	*71617.5m² x 15mm x 0.8 =* **859.41m³**	*Paved area directly drained* *15mm rainfall depth* *80% runoff from paved surfaces*

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Calculation By:	DA
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Criterion 2
River Regime Protection

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

1-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff = Rainfall Rate x Area x Soil Type				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m³	l/s	m³	l/s	m³
0.5	50.00	477.5	0.0	477.5	859.4	219.7	395.4	257.8	464.0
1	33.33	318.3	0.0	318.3	1,145.9	219.7	790.8	98.6	355.1
2	21.83	208.5	0.0	208.5	1,501.1	208.5	1,501.1	0.0	0.0
4	14.75	140.8	0.0	140.8	2,028.2	140.8	2,028.2	0.0	0.0
6	11.83	113.0	0.0	113.0	2,440.7	113.0	2,440.7	0.0	0.0
12	7.50	71.6	0.0	71.6	3,093.9	71.6	3,093.9	0.0	0.0

30-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff = Rainfall Rate x Area x Soil Type				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m³	l/s	m³	l/s	m³
0.5	134.67	1,285.9	0.0	1,285.9	2,314.7	219.7	299.8	1,066.3	1,455.3
1	84.43	806.3	0.0	806.3	2,902.5	219.7	617.0	586.6	1,647.7
2	52.22	498.6	0.0	498.6	3,590	219.7	1,216.2	279.0	1,544.4
4	32.23	307.7	0.0	307.7	4,431	219.7	2,005.6	88.1	803.9
6	25.18	240.5	0.0	240.5	5,194	219.7	-153.3	20.8	-14.5
12	15.74	150.3	0.0	150.3	6,494	150.3	0.0	0.0	0.0

100-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff = Rainfall Rate x Area x Soil Type				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m³	l/s	m³	l/s	m³
0.5	186.67	1,782.5	0.0	1,782.5	3,208.5	219.7	98.6	1,562.8	701.3
1	116.67	1,114.1	0.0	1,114.1	4,011	219.7	272.1	894.4	1,108.1
2	70.00	668.4	0.0	668.4	4,813	219.7	547.9	448.8	1,119.4
4	42.50	405.8	0.0	405.8	5,844	219.7	671.5	186.2	569.1
6	32.78	313.0	0.0	313.0	6,761	219.7	-225.5	93.3	-95.8
12	20.00	191.0	0.0	191.0	8,250	191.0	0.0	0.0	0.0

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Criterion 4
River Flood Protection

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

Vol_{XS} = RD x A x 10 [(PIMP/100 x α0.8) + (1 - (PIMP/100))(β x Soil) - Soil]

Vol_{XS}			*… Extra runoff volume of development over Greenfield runoff*
RD	=	71 mm	*… Rainfall depth of the 100 year, 6 hour event mm*
A	=	31.830 Ha	*… Area of site*
PIMP	=	30%	*… Impermeable area of total site*
α0.8	=	100%	*… Proportion of paved area drained to drainage network or river with 80% runoff*
β	=	60%	*… Proportion of pervious area drained to the network or river*
Soil	=	0.47	*… SPR index*

Vol_{XS} = -734.66m³

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Calculation By:	DA
Approved by:	MD

Input Data

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

All DCC Lands

Total Site Area:	149,500m²	*… Drained area south of Mayne*
Paved Area		
Total:	32%	*… Total paved area as a percentage of site area*
Drained:	100%	*… Proportion of paved area drained*
Soil Area		
Drained:	0%	*… Proportion of soil area drained*
Runoff Growth Factors:		
1-Year	0.85	*… Typical value for Dublin is 0.85*
30-Year	2.10	*… Typical value for Dublin is 2.10*
100-Year	2.60	*… Typical value for Dublin is 2.60*
Soil Type:	Type 4	*… From 1 to 5*
SAAR:	948mm	*… Values can be found at www.uksuds.com*
Climate Change Factor:	20%	*… 20% is typically used in Ireland*
Rain Data From:	A	*… A = Dublin Airport* *B = Ballinteer* *C = Bray* *D = Cork City*

SW Catchment Area DCC 1:	78,300m²
Hard Area	30,342m²
PIMP	38.8%

SW Catchment Area DCC 2:	71,200m²
Hard Area	16,925m²
PIMP	23.8%

SW Catchment Area A1:	234,400m²
Hard Area	
PIMP	0.0%

SW Catchment Area A2:	318,300m²
Hard Area	127,300m²
PIMP	40.0%

Catchments revised to include all in one areas east of main road to north over Mayne

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Project Data

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

Description		%	Area
Total Site Area		-	149,500m²
Paved Area	Total	32%	47,267m²
	Drained	100%	47,267m²
Soil Area	Total	68%	102,233m²
	Drained	0%	0m²

Soil Type:	Type 4
SPR Index (from FSR):	0.47
SAAR:	948mm
Rain Data:	Dublin Airport
Climate Change Factor:	20%

Greenfield Runoff:

$Q_{BARrural} = 0.00108 \times Area^{0.89} \times SAAR^{1.17} \times Soil^{2.17}$

Area = 0.1495km² … *Total site area in km²*
SAAR = 948mm … *Standard Average Annual Rainfall in mm*
SOIL = 0.47 … *The "SPR" index from FSR*

Note: Where a site is <0.5km², the $Q_{BARrural}$ formula should be applied for 0.5km² and the result factored based on the ratio of the actual site area and the applied area.

$Q_{BARrural}$ = 0.103m³/s
$Q_{BARrural}$ = 102.919 l/s
$Q_{BARrural}$ = 6.884 l/s/Ha

Return Period	1-year	30-year	100-year
Growth Factor	0.85	2.10	2.60
Q_{BAR} (l/s)	87.48	216.13	267.59
Q_{BAR} (l/s/Ha)	5.85	14.46	17.90
Allowable Discharge	102.92	102.92	102.92

Rainfall Data:

Rain Data From: Dublin Airport
Climate Change Factor: 20%

Duration	Return Period *(Years)*						
(Hours)	1	5	10	20	30	50	100
0.5	9.0	14.4	17.9	22.0	24.2	28.8	33.6
1	12.0	18.6	22.9	27.6	30.4	36.0	42.0
2	15.7	23.8	28.8	34.8	37.6	43.2	50.4
4	21.2	31.2	37.2	43.2	46.4	52.8	61.2
6	25.6	37.2	43.2	50.4	54.4	62.4	70.8
12	32.4	46.8	18.0	63.6	68.0	76.8	86.4

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Summary

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

Summary of GDSDS Calculations:

Criterion 1: River Protection Volume

Interception Volume	**141.80m³**
Treatment Volume	**425.40m³**

Criterion 2: River Regime Protection

1-in-1-Year Storm	300.19m³
1-in-30-Year Storm	826.07m³
1-in-100-Year Storm	575.02m³
Reduction of Long-Term Storage	256.42m³
Volume Required	**1,957.69m³**

… Includes head-loss correction

Criterion 4: River Flood Protection

Long Term Storage *(no interception provided)*	**-256.42m³**
Long Term Storage *(Interception provided)*	**-398.22m³**

Total Attenuation Volume Requirement:

1-in-100 Year Storm

1-in-1-Year Storm	300.19m³
1-in-30-Year Storm	826.07m³
1-in-100-Year Storm	575.02m³
Total	**1,701.28m³**

The maximum attenuation volume required is 1,701.28m³

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Criterion 1
River Protection Volume

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

1.1 Interception

Paved surfaces connected to drainage system	*149500m² x 0.3161072240802 68 x 0.75 =* 35,450.25m²	*149,500m² site area* *32% of the site is paved* *75% of the paved area*
Volume of Interception Storage	*35450.25m² x 5mm x 0.8 =* **141.80m³**	*Paved area directly drained* *5mm rainfall depth* *80% paved runoff factor*

1.2 Treatment Volume

Paved surfaces draining to river	*149500m² x 0.3161072240802 68 x 0.75 =* 35,450.25m²	*149,500m² site area* *32% of the site is paved* *75% of the paved area*
Volume of Treatment Storage	*35450.25m² x 15mm x 0.8 =* **425.40m³**	*Paved area directly drained* *15mm rainfall depth* *80% runoff from paved surfaces*

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Calculation By:	DA
Approved by:	MD

Criterion 2
River Regime Protection

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

1-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff = Rainfall Rate x Area x Soil Type				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m³	l/s	m³	l/s	m³
0.5	50.00	236.3	0.0	236.3	425.4	102.9	185.3	133.4	240.1
1	33.33	157.6	0.0	157.6	567.2	102.9	370.5	54.6	196.7
2	21.83	103.2	0.0	103.2	743.0	102.9	741.0	0.3	2.0
4	14.75	69.7	0.0	69.7	1,004.0	69.7	1,004.0	0.0	0.0
6	11.83	55.9	0.0	55.9	1,208.1	55.9	1,208.1	0.0	0.0
12	7.50	35.5	0.0	35.5	1,531.5	35.5	1,531.5	0.0	0.0

30-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff = Rainfall Rate x Area x Soil Type				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m³	l/s	m³	l/s	m³
0.5	134.67	636.5	0.0	636.5	1,145.8	102.9	138.9	533.6	720.3
1	84.43	399.1	0.0	399.1	1,436.7	102.9	287.1	296.2	826.1
2	52.22	246.8	0.0	246.8	1,777	102.9	569.3	143.9	795.9
4	32.23	152.3	0.0	152.3	2,193	102.9	981.7	49.4	471.2
6	25.18	119.0	0.0	119.0	2,571	102.9	689.3	16.1	107.9
12	15.74	74.4	0.0	74.4	3,214	74.4	0.0	0.0	0.0

100-Year Return Period
(Climate Change Factor = 20%)

Duration	Rainfall Rate	Runoff = Rainfall Rate x Area x Soil Type				Discharge		Storage	
		Paved	Green	Total	Volume	Rate	Volume	Rate	Volume
Hours	*(l/s/Ha)*	l/s	l/s	l/s	m³	l/s	m³	l/s	m³
0.5	186.67	882.3	0.0	882.3	1,588.2	102.9	44.5	779.4	336.7
1	116.67	551.4	0.0	551.4	1,985	102.9	125.9	448.5	548.5
2	70.00	330.9	0.0	330.9	2,382	102.9	259.6	227.9	575.0
4	42.50	200.9	0.0	200.9	2,893	102.9	361.9	98.0	344.5
6	32.78	154.9	0.0	154.9	3,347	102.9	113.2	52.0	57.2
12	20.00	94.5	0.0	94.5	4,084	94.5	0.0	0.0	0.0

Waterman Moylan
Engineering Consultants

Block S, EastPoint Business Park,
Alfie Byrne Road, Dublin D03 H3F4
t 01 664 8900 f 01 661 3618 e info@waterman-moylan.ie

Calculation By:	DA
Approved by:	MD

Criterion 4
River Flood Protection

Project Name	Belcamp SHD
Project Number	19-114
Client	Gannon Homes
Architect	CCK / Wilson Architecture
Status	Planning
Date	29/04/2022

Vol_{XS} = RD x A x 10 [(PIMP/100 x α0.8) + (1 - (PIMP/100))(β x Soil) - Soil]

Vol_{XS}			*… Extra runoff volume of development over Greenfield runoff*
RD	=	71 mm	*… Rainfall depth of the 100 year, 6 hour event mm*
A	=	14.950 Ha	*… Area of site*
PIMP	=	32%	*… Impermeable area of total site*
α0.8	=	100%	*… Proportion of paved area drained to drainage network or river with 80% runoff*
β	=	60%	*… Proportion of pervious area drained to the network or river*
Soil	=	0.47	*… SPR index*

Vol_{XS} = -256.42m³

D. Lake Rehabilitation Method Statement by IE Consulting

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

Belcamp Development

Lake Rehabilitation - Method Statement

Introduction

The Primary Objective of this Method Statement is to provide the Contractor with a clear methodology for rehabilitating the lake at the site of the proposed Belcamp Development located in Belcamp, Dublin 17. The works include the following:

- Dewatering the lake
- Removal, management and safe disposal of silt from the lake
- Assessment of the integrity of the existing lake liner and recommendations for repair works

This method statement is required to provide operatives and other affected parties with the safety provisions and methods to be implemented for completion of the lake rehabilitation works. It shall be incorporated into the Contractor's own Method Statement for completion of the works under the Contactor's role as PSCS. The Method Statement shall also be reviewed and agreed in advance with Waterman Moylan under their role as PSDP.

Description of Work

Site Location: Belcamp College, Belcamp, Dublin 17

Project Number: IE1471

Client: Gannon Homes Ltd.

Date of Commencing Site Works: TBC

Duration of Site Work: TBC

Description of Work: Prepare a method statement for the lake de-watering, removal, management and safe disposal of silt and assessment of lake liner integrity.

Methodology

1. The contractor shall provide with 48 hours' notice of intended start date on site for lake dewatering works

2. The downstream end of the lake currently has leak in the lake wall at the base as shown in *Figure 1*, *Appendix A,* and on Drawing Number *IE1471-001-A*, *Appendix B*, enclosed herein. This is located at the lake water level control weir at the eastern end of the lake. It is proposed to utilise this leak to drain the lake gradually to avoid any potential impact downstream in terms of flooding and generation of silt.

3. There are two inflow points into the lake, one of these from the Mayne River to the south-west and a second is from a small drainage to the north-east of the western section of the lake. The Mayne River inflow to the lake is located at the south- western end of the lake where a direct feed is taken from the river via control structure as shown in *Figure 2* in *Appendix A.* This feeder stream shall be blocked off using an existing concrete plug located in the River Bed at this location as shown in *Figure 3, Appendix A* and on Drawing Number *IE1471-001-A*, *Appendix B*, enclosed herein. The second inflow into the lake shall be diverted back into the Mayne River upstream of the existing feed to the lake as shown on Drawing Number *IE1471-001-A*, *Appendix B.*

4. The lake shall be allowed to drain gradually until such time that silt bed is visible at the surface. Regular inspections of the lake bed shall be carried out to determine if it is dewatered to a point where solid silt material can be removed.

5. Low lying tree limbs shall be identified for trimming by the Contractor and the Tree Specialist. Tree limbs which may inhibit the removal of silt and rehabilitation of the lake shall be removed by a qualified Tree Surgeon. The Tree Surgeon shall be consulted on the method tree limb removal and when these works should be carried out.

6. The Contractor shall provide 48 hours' notice of intended start date on site for silt removal. An Engineer from IE Consulting shall be present on the first day of silt removal and advise on the most appropriate method of excavation.

7. It is proposed to create two points of entry into the lake for the removal of silt. The location of these entry points are shown in *Drawing Number IE1471-001-A* in *Appendix B*. A hardcore stone filled haulage ramp shall be constructed at each point of entry to the lake prior to any silt removal.

8. At each entry point the excavator driver shall position the machine at the lake edge and excavate an area of silt at the base of the lake to allow the machine to enter the lake without sinking into the silt. The excavator driver shall work their way around the lake drawing the silt back to the entry point for loading into dumper trucks.

9. Dumper trucks shall reverse down the haulage road at each entry point for silt loading from excavator.

10. The Contractor shall provide an excavation plan and stockpiling plan, including a labelled site plan for each stockpile location. A survey of the silt depths in the lake was carried out by McDonald Surveys. Refer to Appendix C for plan and cross section survey drawings. An additional drawing has been prepared showing the approximate depths of silt on plan and the total estimated volume of silt in 'Area 1' and 'Area 2' – Refer to Drawing Number *IE1471-002-A* in *Appendix B* for details.

11. The silt removed shall be stockpiled into volumes of no greater than 1500m^3 per pile in a designated storage area agreed in advance with the Engineer from IE Consulting. Each silt stockpile area shall be bunded with square straw bales to contain the silt in one location on the down-gradient side of the stockpile to prevent washout.

12. Representative bulk samples shall be taken from each 1500m^3 stockpile for WAC testing and analysis. Following analysis results the stockpiles shall be disposed of as directed by the Engineer from IE Consulting.

13. The lake bed shall be inspected by the Contractor and an Engineer from IE Consulting once the silt has been removed by a walkover survey. Areas of repair shall be identified on a plan and proposed remediation measures agreed and documented on site.

14. A vibratory tamping roller shall be used for the compaction of existing clay liner material with the lake bed. In the event that additional clay liner material is required an approved source of Puddle Clay such as Ballycrystal Enterprises, Geeshill, Tullamore, Co Offaly, shall be imported to the site.

15. In advance of delivery, puddle clay shall be worked off-site into the required plastic condition by adding sufficient water as necessary to achieve a smooth homogenous consistency (approximate moisture content:- mid-way between the liquid and plastic limits). Puddle clay delivered to site shall be set down in approved areas which shall be protected/reinstated in accordance with the requirements of the Engineer from IE Consulting. Stockpiled puddle clay shall be covered to protect it from the deleterious effects of sun, wind, rain or frost.

16. The puddle clay shall be placed in layers not exceeding 150mm consolidated thickness and compacted to remove all interstices.

17. Before placing additional layers of puddle clay the surface of each previous layer shall be cleaned of all slurry surplus material and water so that the clay to be placed will integrate and bind with that already placed.

18. At all bed and bank junctions between the original and reinstated linings, the existing puddle clay shall be benched to a depth of 150mm over a minimum distance of 1.0m to form a good lap between the original and new materials.

APPENDIX A

Photographs

Figure 1 – Existing leak in lake wall at downstream end

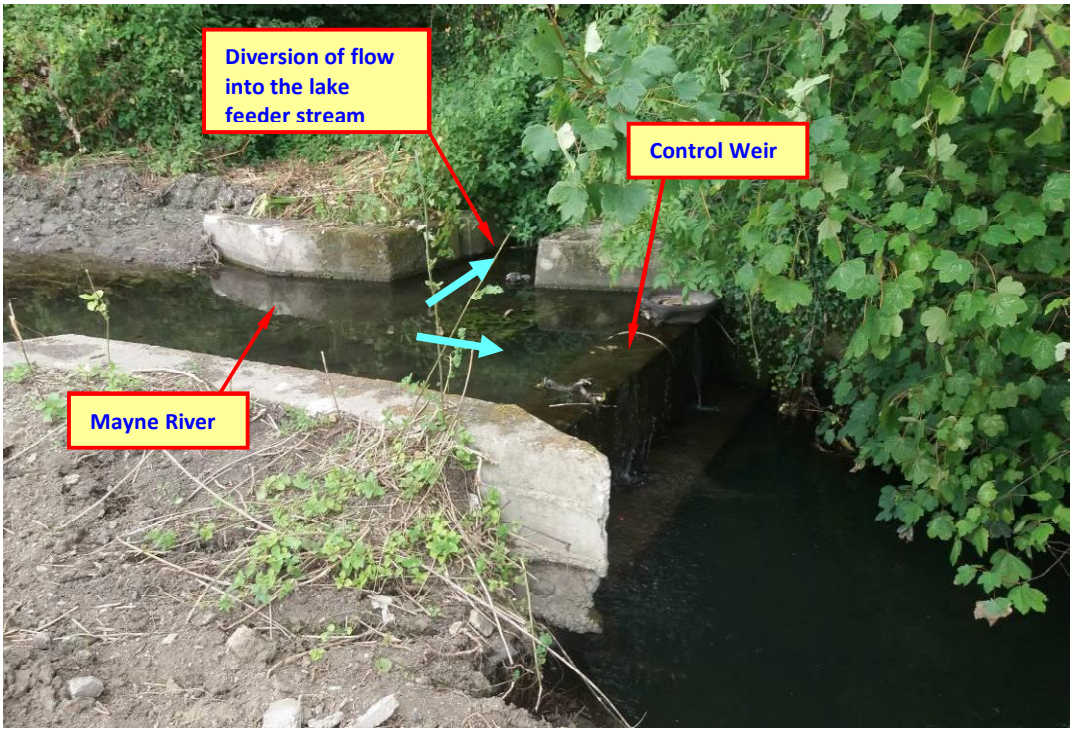


Figure 2 – Lake feed from Mayne River

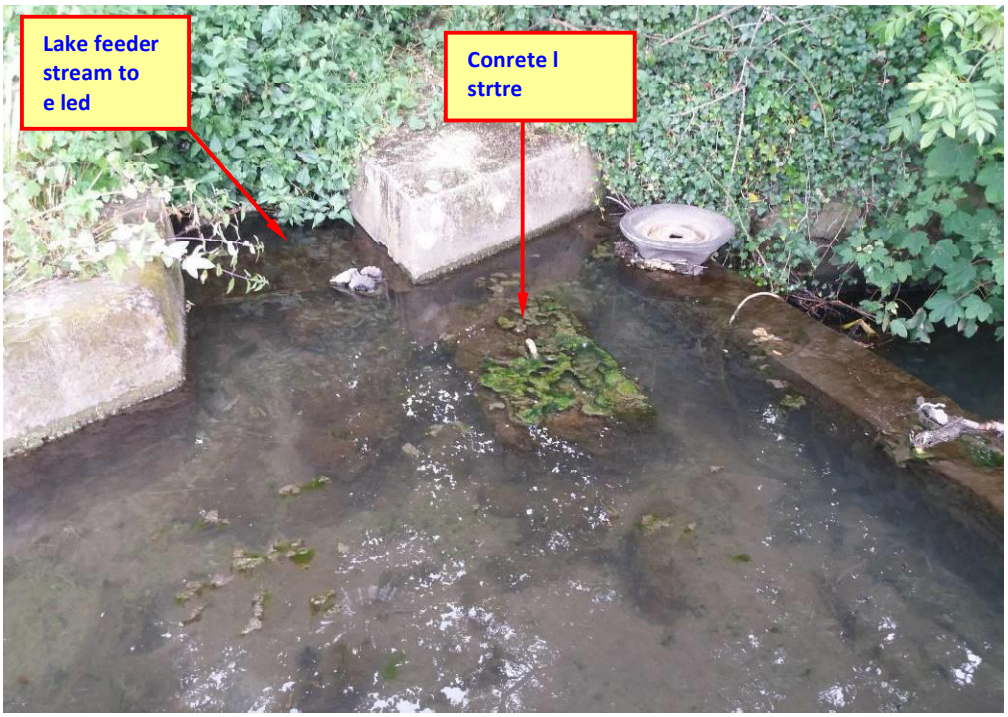
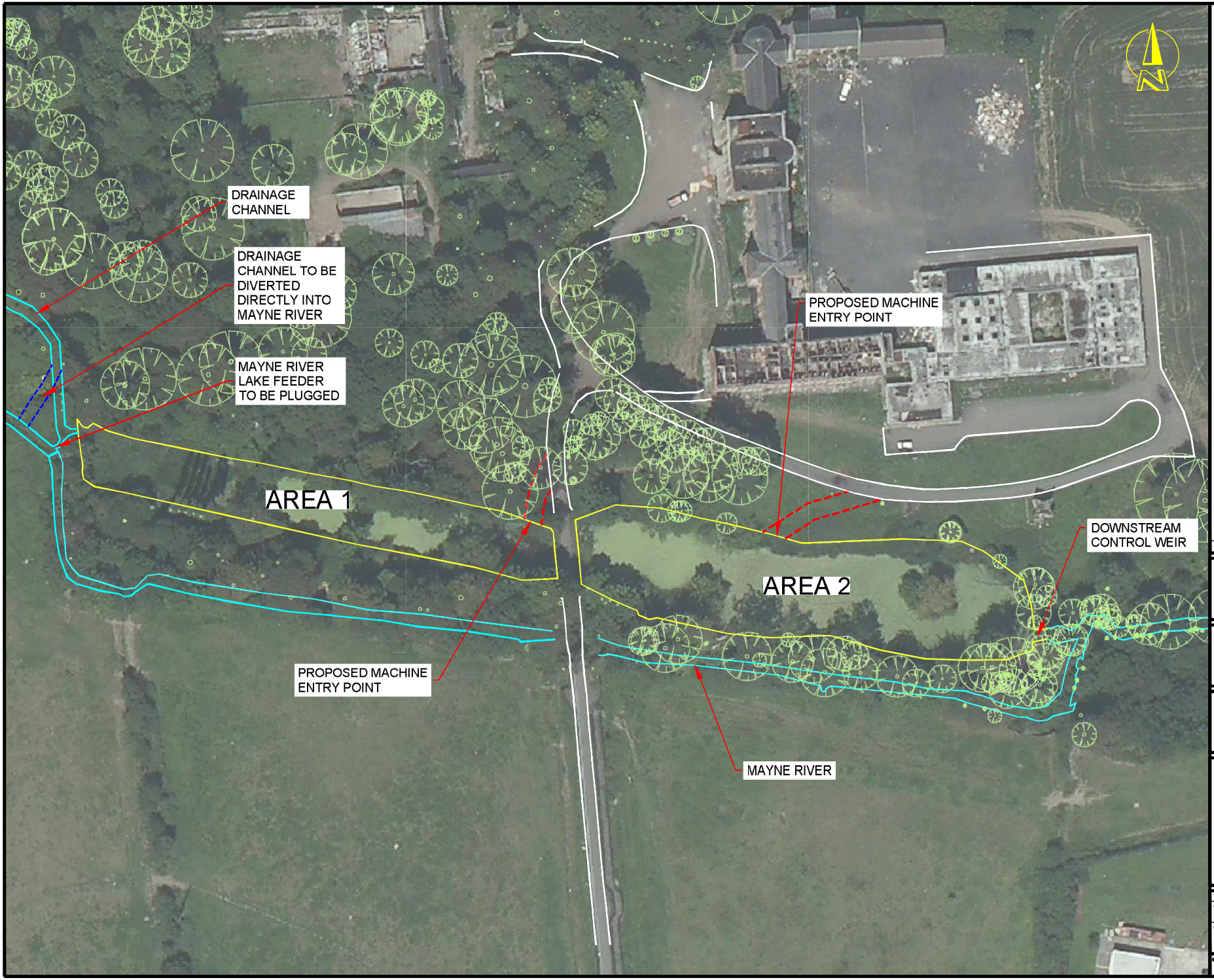


Figure – lug for lake feeder stream

APPENDIX B

Drawing Number IE1471-001-A

Drawing Number IE1471-002-A



LEGEND

rev.	date	amendment	drn	ckd
A	22.08.17	INFORMATION	NOM	PMS

PROPOSED BELCAMP DEVELOPMENT

LAKE REHABILITATION METHOD STATEMENT

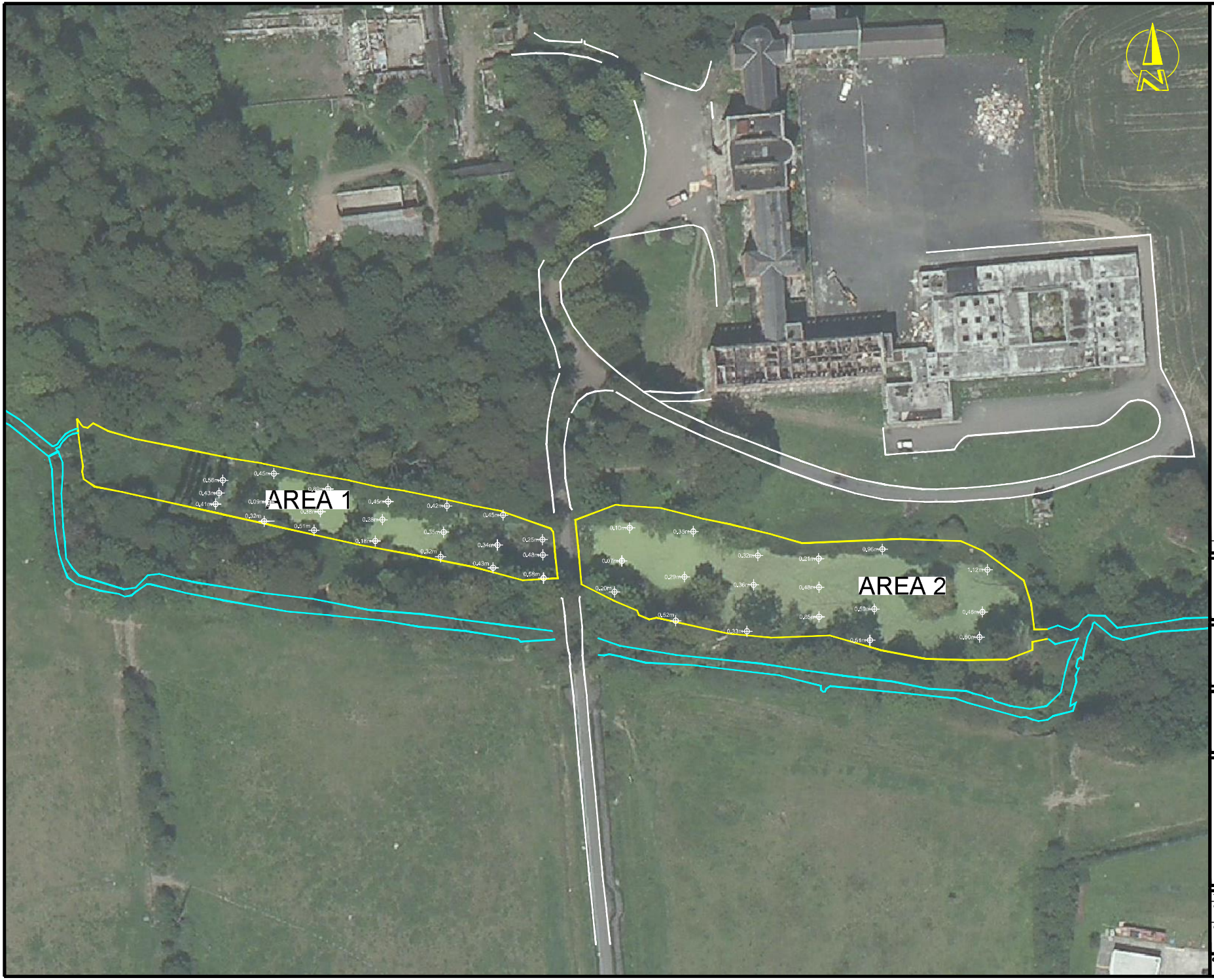
PROPOSED LAKE REHABILITATION WORKS

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

INNOVATION CENTRE
GREEN ROAD
CARLOW

TELEPHONE: 059 91 33084
FAX: 059 91 40499
EMAIL: info@ece.ie

file location:	N:\IE1471\DRAWINGS	scale:	1:1000 A3
drawing status:	INFORMATION	datum:	MALIN
		drawn:	NOM
drawing no.	rev	checked:	PMS
IE1471-001	A	approved:	JK
		date:	22.08.2017



LEGEND

rev.	date	amendment	drn	ckd
A	22.08.17	INFORMATION	NOM	PMS

PROPOSED BELCAMP DEVELOPMENT

LAKE REHABILITATION METHOD STATEMENT

LAKE SILT DEPTHS

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

INNOVATION CENTRE
GREEN ROAD
CARLOW

TELEPHONE: 059 91 33084
FAX: 059 91 40499
EMAIL: info@ece.ie

file location:	N:\IE1471\DRAWINGS	scale:	1:1000 A3
drawing status:	INFORMATION	datum:	MALIN
		drawn:	NOM
drawing no.	rev	checked:	PMS
IE1471-002	A	approved:	JK
		date:	22.08.2017

APPENDIX C

McDonald Lake Survey Drawings

ANNOTATIONS :

Notes:
Do not scale this drawing

Project Specific Legend:

Project Specific Notes:
This Mc Donald Surveys cross section survey has been referenced to supplied PCA Ltd survey station 8001. Drawing no: 170703FB_Bellcamp_Combined_0401050L has been used for background mapping.

REV:	DESCRIPTION:	DATE:	BY:	APP:

Mc Donald Surveys
Crossalaney
Carlingford
Co. Louth
office@mcdgeo.com
Phone: 042 9373040
MCDS Geo Surveyors Ltd t/a Mc Donald Surveys
Surveying Consultancy Service / Topographic Surveys
Setting Out/ As-Built, Control, Building Surveys / Volumetric and Street Scape Surveys

Client:
PCA Ltd on behalf of
Waterman Moylan

Project Name:
Bellcamp Pond Survey
Cross section location plan

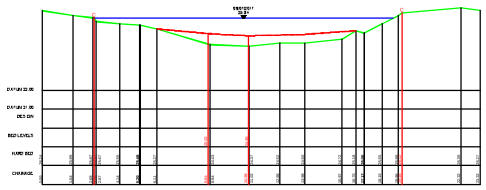
Drawn by:	Date:	Checked by:	Date:	Plot Scale:
CH	28/07/2017	ZB	28/07/2017	1:1000

Grid:	Note:
IRISH TRANSVERSE MERCATOR(ITM) USING VRS	Survey referenced to PCA Ltd Control

Datum:	Cad Drawing No:	Rev:
O.S. DATUM(Malin Head)	3034-Bellcamp Pond -LP-1	

Drawing number / Rev.

P645-29BALL-XS-001



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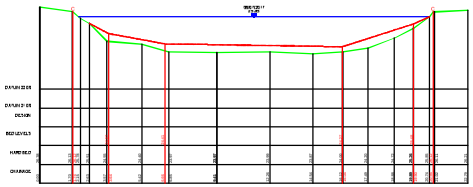
Mike11 Chainage:Chainage_52.7m
Open Channel



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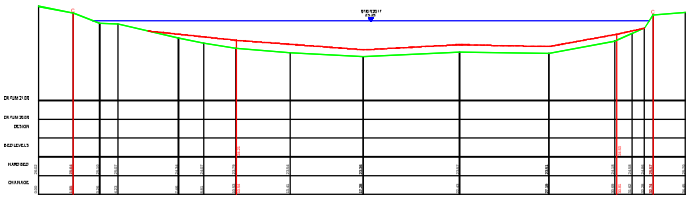

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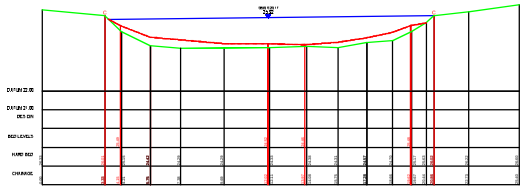

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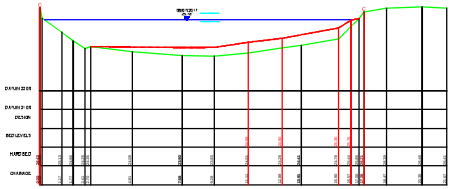

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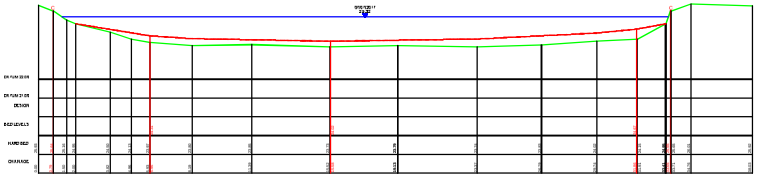

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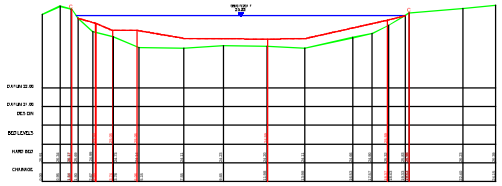

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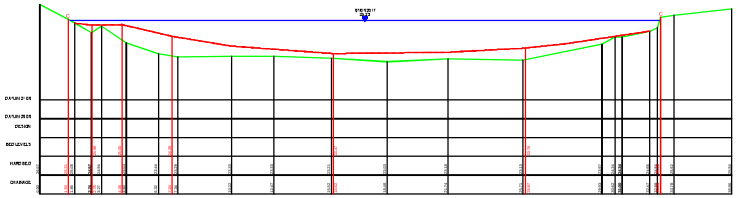

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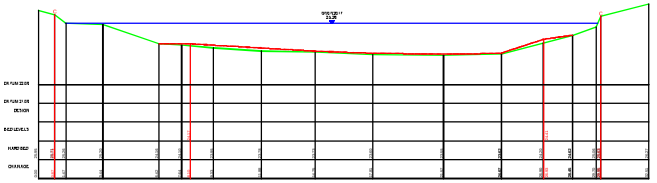

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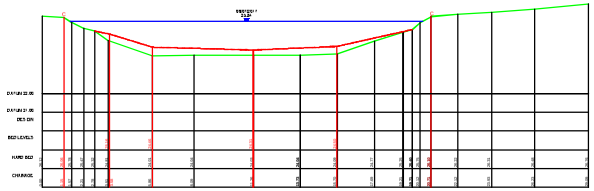

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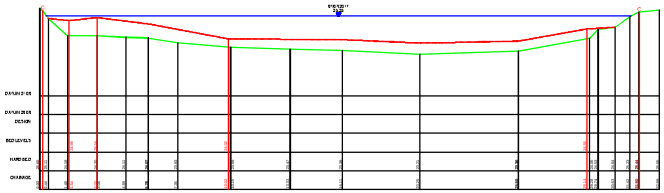

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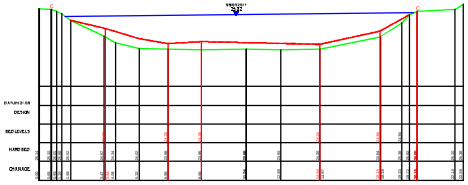

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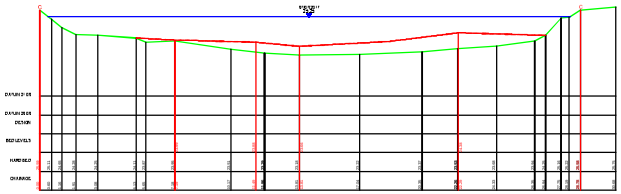

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LEGEND:

- Profile/Hard Bed
- Bridge/Structure
- Water
- Silt
- Fence
- Soffit Level
- Invert Level
- Annotation
- River Crest
- Section Title

Notes:
1. This survey has been carried out to OSI Malin Head Datum.

Rev.	Rev. Date	Purpose of revision	Drawn	Checked	Approved
0	11/10/2012	1 ST REVISION	KB	****	----

Mc Donald Surveys

Client: P.C.A. Ltd
on behalf of Waterman Moylan

Project: CFRAMS Survey Contract 6
Work Package 4

Drawing title: Bellcamp Pond
Cross Sections Sheet 1 of 1

Drawing status:

Scale	1:100H:1:100V @ A0	DO NOT SCALE
MCDS No.	3034	

Drawing number: 3034-BELLCAMP POND-XS-1 Rev: 0

E. Water Quality Report by IE Consulting

Surface Water Quality Assessment of the River Mayne

Belcamp, Malahide Road, Balgriffin, Dublin 17

April 2022

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

Surface Water Quality Assessment of the River Mayne

Client: Waterman Moylan on behalf of Gannon Homes

Location: Belcamp, Malahide Road, Balgriffin, Dublin 17

Date: 20th April 2022

Document Control

PROJECT NUMBER: IE1471-2		DOCUMENT REF: IE1471-2-5236-ISSUE			
2.0	ISSUE	K Murphy	J Keohane	D Aiken	20/04/2022
1.0	Draft	K Murphy	J Keohane	D Aiken	24/02/2022
Revision	Purpose Description	Originated	Checked	Reviewed	Date

CARLOW OFFICE: INNOVATION CENTRE, GREEN ROAD, CARLOW, R93 W248
Tel: 059 91 33084 Email: info@iece.ie Web: www.iece.ie

NEWRY OFFICE: 1 RDC HOUSE, WIN BUSINESS PARK, NEWRY, BT35 6PH
Tel: 048 302 57974 Email: info@iece.ie Web: www.iece.ie

Contents

List of Figures

List of Tables

Appendices

1. Introduction

Waterman Moylan Consulting Engineers retained IE Consulting on behalf of Gannon Homes to undertake surface water sampling on the River Mayne which is adjacent to an on-going development site adjacent to the townland of Belcamp in Fingal, County Dublin.

A portion of flow from the River Mayne overtops a weir to feed two large ponds on the development site at Belcamp before discharging back to the River Mayne downstream.

The location of the River Mayne is shown on Figure 1.

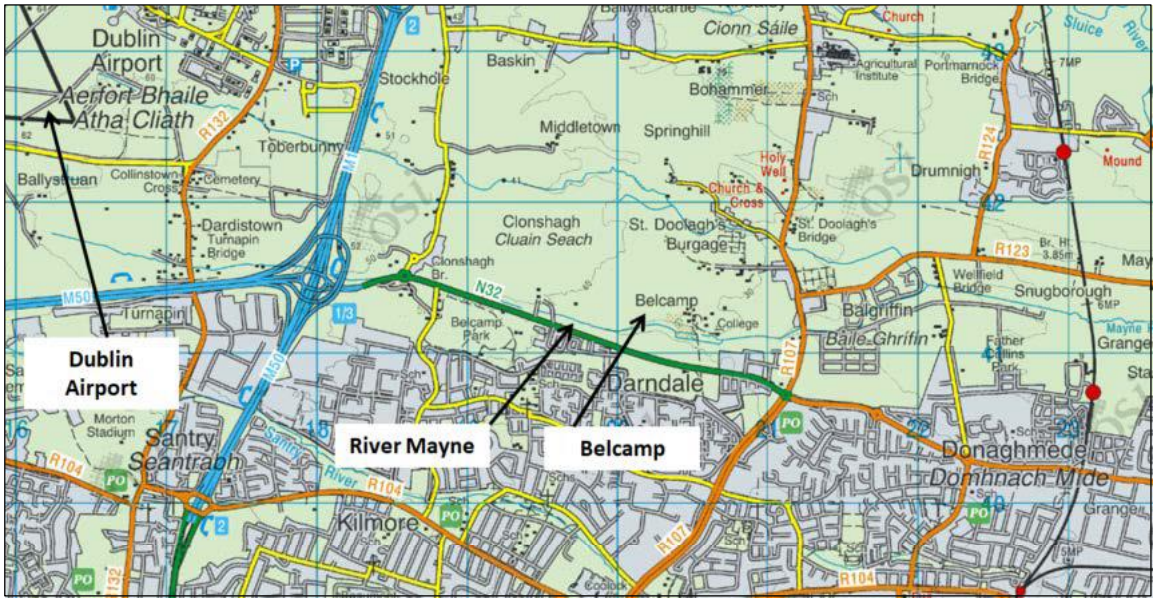

Figure 1 – River Mayne (OSI, 2022)

2. River Mayne

2.1. Catchment

The River Mayne rises in the vicinity of the eastern portion of Dublin Airport, and flows eastward under the M1/M50 interchange, towards the Irish Sea where it discharges to Baldoyle Bay.

The River Mayne (IE_EA_09M030500) is located in the Liffey and Dublin Bay Hydrometric Area (HA: 09). Baldoyle Bay is designated a Special Area of Conservation (SAC) and Special Protection Area (SPA) and is mapped as a proposed Natural Heritage Area (pNHA) (EPA, 2022).

Overall, the catchment area is relatively small, with the EPA mapping reporting an area of c. 7.768 km^2 (EPA, 2022). The catchment characteristics are outlined in Table 1.

Table 1 – Catchment Characteristics

Parameter	River Mayne Catchment (EPA, 2022)
Catchment Area	7.768 km^2
Rainfall/SAAR	685 mm
Evapotranspiration	560 mm
Q_{95} Flow – River Mayne	0.022 m^3/s

The 2018 Corine Land Cover mapping shows the land use in the catchment to be dominated by agriculture (arable) and artificial surfaces (which includes urban, industrial, commercial, construction and transport uses) (EPA, 2022). The catchment mapping is shown in Figure 2.

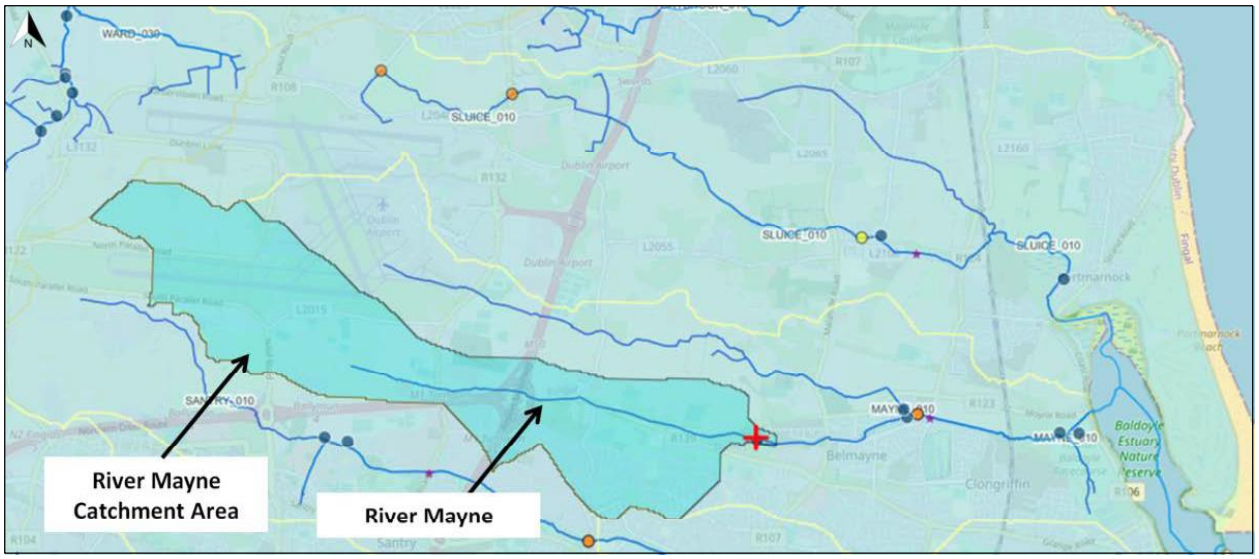

Figure 2 – Catchment Area (EPA, 2022)

2.2. Water Framework Directive

The EU Water Framework (WFD) aims to improve water quality across all EU member states. Surface water features such as rivers, lakes, estuaries and coastal waters are assigned one of five categories of status, based on the results of a chemical and ecological assessment. The five category statuses are as follows: High (top rank); Good; Moderate; Poor; and Bad (lowest rank).

The River Mayne was assigned a 'poor status' for the 2013 – 2018 WFD monitoring period (EPA, 2022).

The water body has been classified as 'at risk' of not achieving good status for the next WFD monitoring period (EPA, 2022).

The EPA Catchments Units has identified nutrients as the main risk to the surface water quality of the River Mayne. The EPA monitoring station, located at the Hole in the Wall Bridge Road, c. 1.35 km to the east of the site (downstream) indicates ammonia and total nitrogen as showing upward trends, while orthophosphate is displaying a downward trend (Catchments, 2022).

The River Mayne is shown in Figure 3, while Pond 2 is shown in Figure 4.

Figure 3 – River Mayne – downstream of SP6

Figure 4 – Pond 2

3. Sampling & Laboratory Analysis

3.1. Sampling

The water sampling was completed by a hydrogeologist from IE Consulting on the 1st February 2022.

A total of 10 samples were collected: 7 from the River Mayne, 2 from the ponds and 1 from a manhole to the north east of the proposed development site.

The samples were collected as grab samples, from the bank of the river, pond and manhole.

Manhole keys were required to lift and open the manhole.

The sampling was undertaken in line with BS EN ISO 5667-14:2016 *Water quality - sampling. Guidance on quality assurance and quality control of environmental water sampling and handling*.

The following bottles were used for sample collection:

- 1 x 500 ml plastic bottle – BOD analysis
- 1 x 500 ml plastic bottle – Inorganics
- 1 x 500 ml glass bottle and 2 x 40 ml glass vials – Organics (glycol, hydrocarbons, PAH, Phenols, TOC)

- 1 x 100 ml bottle with sulphuric acid preservative – Ammonia
- 1 x 100 ml bottle with nitric acid preservative, filtered on site – Metals

Physical observations of colour, odour, sheen and turbidity along with unstable hydrochemical parameters were measured at the time of sampling.

The samples were placed in a clean, secure cooler box with a temperature blank and ice packs.

The samples were delivered by IE Consulting to the DHL Depot in the Dublin Airport Logistics Park immediately after sampling, for delivery to the laboratory.

3.2. Laboratory Analysis

The samples were analysed by Element Materials Technology (formerly Exova Jones) in Deeside, UK. Element Materials Technology is a UKAS accredited laboratory.

The list of parameters for analysis was agreed with the project ecologist and hydrologist from IE Consulting.

The samples were scheduled for the following list of parameters: nutrients (nitrogen/phosphorous), chloride, TOC, BOD, dissolved oxygen, pH, electrical conductivity, sulphate, metals, PAHs, phenols, extractable petroleum hydrocarbons and glycol.

Glycol is the primary ingredient in anti-freeze.

The results were issued to IE Consulting who completed a QA/QC check on the analysis.

The certificates of laboratory analysis are contained in Appendix B.

3.3. Comparison to Regulations

The surface water quality data was compared to the following regulations:

- S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009
- S.I. No. 327/2012 - European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2012.
- S.I. No. 77/2019 - European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019

- S.I. No. 659/2021 - European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2021

The results of the analysis were compared to the Maximum Allowable Concentration (MAC) Environmental Quality Standard (EQS) for inland surface waters. Where no MAC EQS value was available, the AA (Annual Average) EQS value was applied for inland surface waters.

The 2022 sampling results were also compared to a previous round of sampling completed in September 2017.

The tabulated surface water quality database is contained in Appendix A.

4. Discussion of Surface Water Quality

4.1. Onsite Measurements

The onsite measurements collected during sampling are outlined in Table 2.

The two ponds were found to be stagnant water bodies. The inflow to pond 1 was blocked, and there was no flow recorded out of pond 2.

SP4 was moved to an area of the pond 1, where it was possible to access water for sample collection.

It was not possible to access SP1, due to the presence of wild horses, barbed wire fencing and dense overgrowth. The sample point was moved to the east, and collected at the earliest possible opportunity along the water course.

Throughout the entire length of the River Mayne, significant volumes of fly tipped household waste, building materials (rubble, blocks and temporary fencing panels), tents, sleeping bags and horse faeces were noted in the river, and along the banks.

The sample point locations are shown on IE Consulting Drawing IE1471-2-5236-001-A.

A tabulated surface water quality database is contained in Appendix A.

Certificates of laboratory analysis are contained in Appendix B.

Table 2 – Onsite Measurements

Sample Point	Target	Temperature (°C)	pH (pH Units)	Electrical Conductivity (µS/cm)	Physical Observations
SP1 Upstream	River Mayne	9.7	7.93	750	Clear, no odour, no sheen, no turbidity
SP2	River Mayne	10.3	7.94	785	Clear, no odour, no sheen, no turbidity
SP3	River Mayne	9.2	7.92	654	Clear, no odour, no sheen, no turbidity
SP4	Pond 1	11.3	7.81	1549	Strong rotten egg odour, black hue within clear water column, no sheen, no turbidity. Eutrophication evident in pond – green algae on surface. Stagnant water body.
SP5	River Mayne	9.2	7.99	651	Clear, no odour, no sheen, no turbidity
SP6	River Mayne	9.2	8.26	669	Clear, no odour, no sheen, no turbidity
SP7	Pond 2	10.7	7.79	1256	Clear, no odour, no turbidity, nonpetroleum sheen evident on water. Eutrophication evident in pond – green algae on surface. Stagnant water body.
SP8	River Mayne	9.2	7.87	659	Clear, no odour, no sheen, no turbidity
SP9 Downstream	River Mayne	9.7	7.91	662	Clear, no odour, no sheen, no turbidity
Manhole	Surface Water Drain	9.8	8.51	727	Clear, no odour, no sheen, no turbidity

SP – Sample Point

SW – Surface Water Sampling Point (used in 2017 report)

rev.	date	amendment	dm	cd
A	24.02.22	ISSUE	KM	JK

SURFACE WATER QUALITY ASSESSMENT - 2022

RIVER MAYNE, BELCAMP, MALAHIDE ROAD, DUBLIN 17

SAMPLE POINT LOCATION MAP

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL
CARLOW OFFICE:
INNOVATION CENTRE
GREEN ROAD
CARLOW
NEWRY OFFICE:
1 RDC HOUSE
WIN BUSINESS PARK
NEWRY BT35 6PH

file location: N:\ie1471-2\DRAWINGS
drawing status: PLANNING
drawing no.: IE1471-2-5236
rev: A
scale: 1:1 A3
datum: MALIN
drawn: KM
checked: JK
approved: JK
date: 24/02/2022

4.2. Results of Analysis

Nutrients

Chloride concentrations are higher at the upstream locations (SP1: 93.8 mg/l, SP2: 77 mg/l) versus the downstream location (SP9: 51.3 mg/l). The chloride concentrations are considered to be elevated for a stream which flows within an urban setting. Sources of chloride within the catchment include runoff from salted roads and agriculture.

Pond 1 reported chloride at 91.8 mg/l, and Pond 2 at 46.1 mg/l. Chloride concentrations in the ponds are concentrated due to evapotranspiration in the stagnant water body.

Sulphate concentrations are slightly elevated across all sample points, which is typical of a stream in an urban environment. Sulphate was significantly elevated in both Pond 1 (778.4 mg/l) and Pond 2 (603.3 mg/l).

Ammonia concentrations exceeded the 0.065 mg/l environmental quality standards (EQS) as set out in SI77/2019 for all sample points on the River Mayne and are slightly elevated; however this is typical of a stream in an urban environment.

SP1 reported the highest ammonia concentration in February 2022, which may be associated with the discharge of a raw sewerage overflow upstream of the sample point. However, no discharge point was found during sampling due to the dense overgrowth, but a foul smell was noted in the area around SP1.

Ammonia concentrations are higher in Pond 1 (12.61 mg/l) in comparison to Pond 2 (0.55 mg/l). This is associated with vegetation die back in the pond and overhead trees shredding their leaves which leads to a stagnant water body.

Total nitrogen was reported to be low in all samples on the River Mayne and in Pond 2. Pond 1 reported a high total concentration of 117.4 mg/l. The manhole reported a total nitrogen concentration of 3 mg/l, which is low.

Molybdate Reactive Phosphorus (MRP) was elevated in both Pond 1 (1.34 mg/l) and Pond 2 (0.09 mg/l) in February 2022, which is likely associated with the stagnant, anoxic nature of the ponds. The manhole sample reported MPR at 0.16 mg/l.

Biological Oxygen Demand (BOD) is low for all samples collected on the River Mayne. The highest BOD was reported in Pond 1 (SP4; 5 mg/l) which is likely due to the eutrophication occurring in the stagnant water mass.

Total Organic Carbon (TOC) values are consistently low, except for Pond 1 which reported TOC as 26 mg/l. This is attributed to the decay or plant material and organic matter within the stagnant pond.

pH values are slightly alkali on all samples, but are within the expected range of SI77/2019 for hard waters.

Metals

Arsenic, cadmium, copper, nickel and mercury were reported at the laboratory of detection.

Lead was reported at the laboratory limit of detection (7 ug/l) in all samples, except for Pond 1 where it was detected at 7 ug/l.

Total dissolved chromium concentrations reported in the range of 1.5 – 2.2 ug/l, which is low.

Polycyclic Aromatic Hydrocarbons (PAH)

Trace concentrations of pyrene were reported on the River Mayne and both ponds. All other PAH's were reported at the laboratory limit of detection on all samples.

Hydrocarbons

No hydrocarbons were detected in any of the samples analysed. Mineral oil was reported at the limit of detection in all samples. No iridescent sheens or hydrocarbon odours were observed during sampling onsite.

Phenols

All phenols were reported at the laboratory limit of detection. In some instances, the limit of detection was above the environmental quality standard.

Glycol

Glycol is the main chemical ingredient in anti-freeze.

SP1 and SP2 reported trace concentrations of propylene glycol (13 ug/l). These concentrations are low and there is no increasing or decreasing trend between the upstream and downstream sample points.

The manhole sample reported propylene glycol at 43 ug/l, which is likely attributed to runoff from passing vehicles coolant systems.

The sample point locations are shown on IE Consulting Drawing IE1471-2-5236-001-A.

A tabulated surface water quality database is contained in Appendix A.

Certificates of laboratory analysis are contained in Appendix B.

5. Conclusions

1. The River Mayne was assigned a 'poor status' for the 2013 – 2018 WFD monitoring period (EPA, 2022). The water body has been classified as 'at risk' of not achieving good status for the next WFD monitoring period (EPA, 2022).
2. The River Mayne's catchment is dominated by several pressures, evident from aerial imagery such as urban development, agriculture, transport and industry. The stream has in addition been subject to significant fly tipping of municipal waste and construction/demolition materials by rogue operators outside of the secured construction compound.
3. Despite the catchment pressures, the water quality in the River Mayne is considered to be good for a number of parameters. Concentrations of metals were found to be low or at the laboratory limit of detection. No hydrocarbons or phenols were detected in 2022.
4. Trace concentrations of propylene glycol were reported at the two upstream sampling locations on the River Mayne.
5. Trace concentrations of pyrene were reported on the River Mayne and in both ponds.
6. Pond 1 and Pond 2 display poor water quality. Pond 1 is a large, stagnant, slow moving, anoxic water mass with elevated concentrations of ammonia, total nitrogen, chloride, sulphate and BOD. Pond 2 has better water quality than Pond 1.
7. The manhole sample has good water quality, with slightly elevated concentrations of ammonia, MRP, chloride and a trace concentration propylene glycol.

8. Because of its setting the River Mayne is susceptible to impacts from a wide range of urban pressures as well as uncontrolled activities.

6. References

Bing, 2022. Microsoft Corporation – Bing Mapping Aerial View. Accessed 13th December 2021.

Catchments, 2022. WFD Risk & Water Quality. Environmental Protection Agency Catchments Unit,

EPA, 2022. EPA GIS Portal. Environmental Protection Agency. Department of Communications, Climate Action & Environment. Government of Ireland

S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009

S.I. No. 77/2019 - European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019

S.I. No. 659/2021 - European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2021

Appendices

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

Appendix A

Surface Water Quality Database

River Mayne Surface Water Quality Database

IE Consulting

IE1471-2-5236

Parameter	SI272/2009 Surface Water Regulations as ameneded by SI327/2012, SI386/2015, SI77/2019 & SI569/2021	SI77/2019 Surface Water Regulations	Units	Sample ID	SP1	SP1	SP2	SP2	SP3	SP3	SP4	SP4	SP5	SP5
				Depth	13/09/2017	01/02/2022	13/09/2017	01/02/2022	13/09/2017	01/02/2022	13/09/2017	01/02/2022	13/09/2017	01/02/2022
				Sampled Date	River Mayne	River Mayne	River Mayne	River Mayne	River Mayne	River Mayne	Pond 1	Pond 1	River Mayne	River Mayne
Metals	-	-		LOD/Lab	EJ	EMT	EJ	EMT	EJ	EMT	EJ	EMT	EJ	EMT
Dissolved Arsenic	25	-	ug/l	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Dissolved Cadmium	0.6	0.6	ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Dissolved Chromium	32	-	ug/l	<1.5	<1.5	1.9	<1.5	<1.5	<1.5	1.7	<1.5	<1.5	<1.5	2.2
Dissolved Copper	30	-	ug/l	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7
Dissolved Lead	7.2	-	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	7	<5	<5
Dissolved Mercury	0.07	0.07	ug/l	<1	<0.01	<1	<0.01	<1	<0.01	<1	<0.01	<1	<0.01	<1
Dissolved Nickel	20	-	ug/l	<2	<2	<2	2	<2	<2	<2	2	<2	<2	<2
Dissolved Zinc	50	-	ug/l	<3	16	16	16	16	19	15	15	<3	15	16
Polyaromatic Hydrocarbons (PAH)	-	-	-	-										
Naphthalene	2.4	-	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	-	-	ug/l	<0.005	<0.013	<0.005	<0.013	<0.005	<0.013	<0.005	<0.013	<0.005	<0.013	<0.005
Acenaphthene	-	-	ug/l	<0.005	<0.013	<0.005	<0.013	<0.005	<0.013	<0.005	<0.013	0.005	<0.013	<0.005
Fluorene	-	-	ug/l	<0.005	<0.014	<0.005	<0.014	<0.005	<0.014	<0.005	<0.014	0.005	<0.014	<0.005
Phenanthrene	-	-	ug/l	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	0.039	<0.011	<0.005
Anthracene	0.4	0.1	ug/l	<0.005	<0.013	<0.005	0.013	<0.005	<0.013	<0.005	0.013	<0.005	<0.013	<0.005
Fluoranthene	1	-	ug/l	<0.005	<0.012	<0.005	<0.012	<0.005	<0.012	<0.005	<0.012	0.022	<0.012	<0.005
Pyrene	-	-	ug/l	<0.005	<0.013	0.017	<0.013	0.015	<0.013	0.014	<0.013	0.015	<0.013	0.014
Benzo(a)anthracene	-	-	ug/l	<0.005	<0.015	<0.005	<0.015	<0.005	<0.015	<0.005	<0.015	<0.005	<0.015	<0.005
Chrysene	-	-	ug/l	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	0.012	<0.011	<0.005
Benzo(bk)fluoranthene	-	-	ug/l	<0.008	<0.018	<0.008	<0.018	<0.008	<0.018	<0.008	<0.018	<0.008	<0.018	<0.008
Benzo(a)pyrene	0.1	0.27	ug/l	<0.005	<0.016	<0.005	<0.016	<0.005	<0.016	<0.005	<0.016	<0.005	<0.016	<0.005
Indeno(123cd)pyrene	0.002	-	ug/l	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005
Dibenzo(ah)anthracene	-	-	ug/l	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.005
Benzo(ghi)perylene	0.002	0.0082	ug/l	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005
PAH 16 Total			ug/l	<0.173	<0.195	<0.173	<0.195	<0.173	<0.195	<0.173	<0.195	<0.173	<0.195	<0.173
Benzo(b)fluoranthene	0.03	0.017	ug/l	<0.008	<0.01	<0.008	<0.01	<0.008	<0.01	<0.008	<0.01	<0.008	<0.01	<0.008
Benzo(k)fluoranthene	0.03	0.017	ug/l	<0.008	<0.01	<0.008	<0.01	<0.008	<0.01	<0.008	<0.01	<0.008	<0.01	<0.008
PAH Surrogate % Recovery	-	-	%	<0	83	88	83	89	70	91	83	83	77	83
Hydrocarbons	-	-	-	-										
EPH >C8-C10	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	-	<10
EPH >C10-C12	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	-	<10
EPH >C12-C16	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	-	<10
EPH >C16-C21	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	-	<10
EPH >C21-C35	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	-	<10
EPH >C35-C40	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	-	<10
EPH >C8-C40	-	-	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C8-C40 Mineral Oil (Calculation)	-	-	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Phenols	-	-	-	-										
Resorcinol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01
Catechol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01
Phenol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01
m/p-cresol	-	-	mg/l	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02
o-cresol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01
Total cresols	-	-	mg/l	<0.03	-	<0.03	-	<0.03	-	<0.03	-	<0.03	-	<0.03
Xylenols	-	-	mg/l	<0.06	-	<0.06	-	<0.06	-	<0.06	-	<0.06	-	<0.06
1-naphthol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01
2,3,5-trimethyl phenol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01
2-isopropylphenol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01
Total Speciated Phenols HPLC	46	-	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Inorganics	-	-	-	-										
Sulphate as SO4	-	-	mg/l	<0.5	121.2	86.7	122.4	89	82.1	88.2	125.2	778.4	127.9	92.9
Chloride	-	-	mg/l	<0.3	-	93.8	-	77.7	-	51	-	91.8	-	50
Nitrate as NO3	-	-	mg/l	<0.2	-	6.4	-	4.5	-	6	-	<0.2	-	6.1
Nitrite as NO2	-	-	mg/l	<0.02	-	0.29	-	0.2	-	0.2	-	<0.02	-	0.19
Ammoniacal Nitrogen as NH4	High status: ≤ 0.040 (mean) or ≤ 0.090 (95%ile) Good status: ≤ 0.065 (mean) or ≤ 0.140 (95%ile)	High status: ≤ 0.040 (mean) or ≤ 0.090 (95%ile) Good status: ≤ 0.065 (mean) or ≤ 0.140 (95%ile)	mg/l	<0.03	0.12	0.41	0.10	0.21	0.08	0.17	0.10	12.61	0.10	0.14
MRP Ortho Phosphate as P	High status: ≤ 0.025 (mean) or ≤0.045 (95%ile) Good status: ≤ 0.035 (mean) or ≤0.075 (95%ile)	High status: ≤ 0.025 (mean) or ≤0.045 (95%ile) Good status: ≤ 0.035 (mean) or ≤0.075 (95%ile)	mg/l	<0.03	-	<0.03	-	<0.03	-	<0.03	-	1.34	-	<0.03
Biological Oxygen Demand (BOD)	High status ≤1.3 (mean) or ≤2.2 (95%ile) Good status ≤1.5 (mean) or ≤2.6 (95%ile)	High status ≤1.3 (mean) or ≤2.2 (95%ile) Good status ≤1.5 (mean) or ≤2.6 (95%ile)	mg/l	<1	4	2	<1	1	1	1	<1	5	1	1
Dissolved Oxygen (DO) - See Note 1	-	-	mg/l	<1	8	9	9	8	6	9	9	2	9	9
Electrical Conductivity	-	-	uS/cm	<2	610	855	541	821	453	731	567	2189	579	731
pH	6.0< pH < 9.0 (Hard Water)	6.0< pH < 9.0 (Hard Water)	pH units	<0.01	7.70	8.32	7.73	8.22	7.46	8.27	7.82	7.42	7.91	8.36
Total Organic Carbon	-	-	mg/l	<2	4	3	4	2	5	2	4	26	5	2
Total Nitrogen	-	-	mg/l	<0.5	-	1.5	-	1.7	-	2	-	117.4	-	2
Glycol	-	-	-	-										
Monoethylene glycol	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	-	<10
Propylene glycol	-	-	ug/l	<10	-	13	-	13	-	<10	-	<10	-	<10
Diethylene glycol	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	-	<10
Triethylene glycol	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	-	<10
Thiodiglycol	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	-	<10

SP - Sample Point

EJ - Exova Jones

EMT - Element Materials Technology

LOD - Limit of Detection (LOD shown is for 2022 Analysis)

Not analysed for, denoted via symbol: -

Note 1: Dissolved Oxygen analysed for in laboratory, thereforenot representative of site conditions

River Mayne Surface Water Quality Database

IE Consulting

IE1471-2-5236

Parameter	SI272/2009 Surface Water Regulations as amended by SI327/2012, SI386/2015, SI77/2019 & SI569/2021	SI77/2019 Surface Water Regulations	Units	Sample ID	SP6	SP6	SP7	SP7	SP8	SP8	SP9	SP9	Manhole
				Depth	13/09/2017	01/02/2022	13/09/2017	01/02/2022	13/09/2017	01/02/2022	13/09/2017	01/02/2022	01/02/2022
				Sampled Date	River Mayne	River Mayne	Pond 2	Pond 2	River Mayne	River Mayne	River Mayne	River Mayne	Drain
Metals	-	-		LOD/Lab	EJ	EMT	EJ	EMT	EJ	EMT	EJ	EMT	EMT
Dissolved Arsenic	25	-	ug/l	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Dissolved Cadmium	0.6	0.6	ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Dissolved Chromium	32	-	ug/l	<1.5	<1.5	2	<1.5	2	<1.5	1.7	<1.5	<1.5	<1.5
Dissolved Copper	30	-	ug/l	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7
Dissolved Lead	7.2	-	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved Mercury	0.07	0.07	ug/l	<1	<0.01	<1	<0.01	<1	<0.01	<1	<0.01	<1	<1
Dissolved Nickel	20	-	ug/l	<2	2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Zinc	50	-	ug/l	<3	8	15	14	8	12	13	13	14	15
Polyaromatic Hydrocarbons (PAH)	-	-	-	-									
Naphthalene	2.4	-	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	-	-	ug/l	<0.005	<0.013	<0.005	<0.013	<0.005	<0.013	<0.005	<0.013	<0.005	<0.005
Acenaphthene	-	-	ug/l	<0.005	<0.013	<0.005	<0.013	<0.005	<0.013	<0.005	<0.013	<0.005	<0.005
Fluorene	-	-	ug/l	<0.005	<0.014	<0.005	<0.014	<0.005	<0.014	<0.005	<0.014	<0.005	<0.005
Phenanthrene	-	-	ug/l	<0.005	<0.011	<0.005	<0.011	0.005	<0.011	<0.005	<0.011	<0.005	<0.005
Anthracene	0.4	0.1	ug/l	<0.005	0.013	<0.005	<0.013	<0.005	<0.013	<0.005	<0.013	<0.005	<0.005
Fluoranthene	1	-	ug/l	<0.005	<0.012	<0.005	<0.012	<0.005	<0.012	<0.005	<0.012	<0.005	<0.005
Pyrene	-	-	ug/l	<0.005	<0.013	0.013	<0.013	0.007	<0.013	0.013	<0.013	0.012	<0.005
Benzo(a)anthracene	-	-	ug/l	<0.005	<0.015	<0.005	<0.015	<0.005	<0.015	<0.005	<0.015	<0.005	<0.005
Chrysene	-	-	ug/l	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.005
Benzo(bk)fluoranthene	-	-	ug/l	<0.008	<0.018	<0.008	<0.018	<0.008	<0.018	<0.008	<0.018	<0.008	<0.008
Benzo(a)pyrene	0.1	0.27	ug/l	<0.005	<0.016	<0.005	<0.016	<0.005	<0.016	<0.005	<0.016	<0.005	<0.005
Indeno(123cd)pyrene	0.002	-	ug/l	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.005
Dibenzo(ah)anthracene	-	-	ug/l	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.005	<0.005
Benzo(ghi)perylene	0.002	0.0082	ug/l	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.011	<0.005	<0.005
PAH 16 Total			ug/l	<0.173	<0.195	<0.173	<0.195	<0.173	<0.195	<0.173	<0.195	<0.173	<0.173
Benzo(b)fluoranthene	0.03	0.017	ug/l	<0.008	<0.01	<0.008	<0.01	<0.008	<0.01	<0.008	<0.01	<0.008	<0.008
Benzo(k)fluoranthene	0.03	0.017	ug/l	<0.008	<0.01	<0.008	<0.01	<0.008	<0.01	<0.008	<0.01	<0.008	<0.008
PAH Surrogate % Recovery	-	-	%	<0	76	91	76	90	77	89	70	88	89
Hydrocarbons	-	-	-	-									
EPH >C8-C10	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	<10
EPH >C10-C12	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	<10
EPH >C12-C16	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	<10
EPH >C16-C21	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	<10
EPH >C21-C35	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	<10
EPH >C35-C40	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	<10
EPH >C8-C40	-	-	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C8-C40 Mineral Oil (Calculation)	-	-	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Phenols	-	-	-	-									
Resorcinol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	<0.01
Catechol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	<0.01
Phenol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	<0.01
m/p-cresol	-	-	mg/l	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	<0.02
o-cresol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	<0.01
Total cresols	-	-	mg/l	<0.03	-	<0.03	-	<0.03	-	<0.03	-	<0.03	<0.03
Xylenols	-	-	mg/l	<0.06	-	<0.06	-	<0.06	-	<0.06	-	<0.06	<0.06
1-naphthol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	<0.01
2,3,5-trimethyl phenol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	<0.01
2-isopropylphenol	-	-	mg/l	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	<0.01
Total Speciated Phenols HPLC	46	-	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Inorganics	-	-	-	-									
Sulphate as SO4	-	-	mg/l	<0.5	92.1	89.7	128.1	603.3	119	90.7	98.3	91.6	76.4
Chloride	-	-	mg/l	<0.3	-	51.5	-	46.1	-	52	-	51.3	44.5
Nitrate as NO3	-	-	mg/l	<0.2	-	4	-	2.5	-	4.1	-	5.4	13.5
Nitrite as NO2	-	-	mg/l	<0.02	-	0.15	-	0.03	-	0.14	-	0.11	<0.02
Ammoniacal Nitrogen as NH4	High status: ≤ 0.040 (mean) or ≤ 0.090 (95%ile) Good status: ≤ 0.065 (mean) or ≤ 0.140 (95%ile)	High status: ≤ 0.040 (mean) or ≤ 0.090 (95%ile) Good status: ≤ 0.065 (mean) or ≤ 0.140 (95%ile)	mg/l	<0.03	0.50	0.09	0.10	0.55	0.15	0.07	0.14	0.06	0.24
MRP Ortho Phosphate as P	High status: ≤ 0.025 (mean) or ≤0.045 (95%ile) Good status: ≤ 0.035 (mean) or ≤0.075 (95%ile)	High status: ≤ 0.025 (mean) or ≤0.045 (95%ile) Good status: ≤ 0.035 (mean) or ≤0.075 (95%ile)	mg/l	<0.03	-	<0.03	-	0.09	-	<0.03	-	<0.03	0.16
Biological Oxygen Demand (BOD)	High status ≤1.3 (mean) or ≤2.2 (95%ile) Good status ≤1.5 (mean) or ≤2.6 (95%ile)	High status ≤1.3 (mean) or ≤2.2 (95%ile) Good status ≤1.5 (mean) or ≤2.6 (95%ile)	mg/l	<1	2	<1	<1	1	<1	<1	1	1	2
Dissolved Oxygen (DO) - See Note 1	-	-	mg/l	<1	3	10	9	11	9	10	9	10	10
Electrical Conductivity	-	-	uS/cm	<2	596	743	605	1646	572	739	529	742	784
pH	6.0< pH < 9.0 (Hard Water)	6.0< pH < 9.0 (Hard Water)	pH units	<0.01	7.54	8.3	7.95	8.12	7.88	8.31	7.73	8.35	8.25
Total Organic Carbon	-	-	mg/l	<2	5	<2	5	6	5	2	5	2	2
Total Nitrogen	-	-	mg/l	<0.5	-	1.6	-	1.3	-	1	-	1.7	3
Glycol	-	-	-	-									
Monoethylene glycol	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	<10
Propylene glycol	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	43
Diethylene glycol	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	<10
Triethylene glycol	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	<10
Thiodiglycol	-	-	ug/l	<10	-	<10	-	<10	-	<10	-	<10	<10

SP - Sample Point

EJ - Exova Jones

EMT - Element Materials Technology

LOD - Limit of Detection (LOD shown is for 2022 Analysis)

Not analysed for, denoted via symbol: -

Note 1: Dissolved Oxygen analysed for in laboratory, therefore not representative of site conditions

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

Appendix B

Certificates of Laboratory Analysis

Element Materials Technology
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Deeside
CH5 2UA

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IE Consulting
Innovation Centre
Green Road
Carlow
Co Carlow

Attention :	Kevin Murphy
Date :	17th February, 2022
Your reference :	IE1471-2
Our reference :	Test Report 22/1597 Batch 1
Location :	Belcamp
Date samples received :	2nd February, 2022
Status :	Final Report
Issue :	1

Ten samples were received for analysis on 2nd February, 2022 of which ten were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Client Name: IE Consulting
Reference: IE1471-2
Location: Belcamp
Contact: Kevin Murphy
EMT Job No: 22/1597

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

EMT Sample No.	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70			
Sample ID	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8	SP9	Manhole			
Depth											Please see attached notes for all abbreviations and acronyms		
COC No / misc													
Containers	V H HN P B OD G	V H HN P B OD G	V H HN P B OD G	V H HN P B OD G	V H HN P B OD G	V H HN P B OD G	V H HN P B OD G	V H HN P B OD G	V H HN P B OD G	V H HN P B OD G			
Sample Date	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022			
Sample Type	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022	LOD/LOR	Units	Method No.
Dissolved Arsenic#	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	ug/l	TM30/PM14
Dissolved Cadmium#	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM30/PM14
Total Dissolved Chromium#	1.9	<1.5	1.7	<1.5	2.2	2.0	2.0	1.7	<1.5	<1.5	<1.5	ug/l	TM30/PM14
Dissolved Copper#	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	ug/l	TM30/PM14
Dissolved Lead#	<5	<5	<5	7	<5	<5	<5	<5	<5	<5	<5	ug/l	TM30/PM14
Dissolved Mercury#	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM30/PM14
Dissolved Nickel#	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM30/PM14
Dissolved Zinc#	16	16	15	<3	16	15	8	13	14	15	<3	ug/l	TM30/PM14
PAH MS													
Naphthalene#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ug/l	TM4/PM30
Acenaphthylene#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
Acenaphthene#	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
Fluorene#	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
Phenanthrene#	<0.005	<0.005	<0.005	0.039	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
Anthracene#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
Fluoranthene#	<0.005	<0.005	<0.005	0.022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
Pyrene#	0.017	0.015	0.014	0.015	0.014	0.013	0.007	0.013	0.012	<0.005	<0.005	ug/l	TM4/PM30
Benzo(a)anthracene#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
Chrysene#	<0.005	<0.005	<0.005	0.012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
Benzo(bk)fluoranthene#	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	ug/l	TM4/PM30
Benzo(a)pyrene#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
Indeno(123cd)pyrene#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
Dibenzo(ah)anthracene#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
Benzo(ghi)perylene#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	ug/l	TM4/PM30
PAH 16 Total#	<0.173	<0.173	<0.173	<0.173	<0.173	<0.173	<0.173	<0.173	<0.173	<0.173	<0.173	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	ug/l	TM4/PM30
PAH Surrogate % Recovery	88	89	91	83	83	91	90	89	88	89	<0	%	TM4/PM30
EPH >C8-C10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM5/PM30
EPH >C10-C12#	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM5/PM30
EPH >C12-C16#	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM5/PM30
EPH >C16-C21#	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM5/PM30
EPH >C21-C35#	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM5/PM30
EPH >C35-C40#	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM5/PM30
EPH >C8-C40	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM5/PM30
C8-C40 Mineral Oil (Calculation)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM5/PM30
Resorcinol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Catechol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Phenol#	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
m/p-cresol	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/l	TM26/PM0
o-cresol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0

Element Materials Technology

Client Name: IE Consulting
Reference: IE1471-2
Location: Belcamp
Contact: Kevin Murphy
EMT Job No: 22/1597

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

EMT Sample No.	1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-70	LOD/LOR	Units	Method No.
Sample ID	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8	SP9	Manhole			
Depth													
COC No / misc													
Containers	V H HN P BOD G	V H HN P BOD G	V H HN P BOD G	V H HN P BOD G	V H HN P BOD G	V H HN P BOD G	V H HN P BOD G	V H HN P BOD G	V H HN P BOD G	V H HN P BOD G			
Sample Date	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022	01/02/2022			
Sample Type	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022	02/02/2022			
Total cresols#	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/l	TM26/PM0
Xylenols#	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	mg/l	TM26/PM0
1-naphthol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
2,3,5-trimethyl phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
2-isopropylphenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Total Speciated Phenols HPLC	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/l	TM26/PM0
Sulphate as SO4#	86.7	89.0	88.2	778.4	92.9	89.7	603.3	90.7	91.6	76.4	<0.5	mg/l	TM38/PM0
Chloride#	93.8	77.7	51.0	91.8	50.0	51.5	46.1	52.0	51.3	44.5	<0.3	mg/l	TM38/PM0
Nitrate as NO3#	6.4	4.5	6.0	<0.2	6.1	4.0	2.5	4.1	5.4	13.5	<0.2	mg/l	TM38/PM0
Nitrite as NO2#	0.29	0.20	0.20	<0.02	0.19	0.15	0.03	0.14	0.11	<0.02	<0.02	mg/l	TM38/PM0
MRP Ortho Phosphate as P	<0.03	<0.03	<0.03	1.34	<0.03	<0.03	0.09	<0.03	<0.03	0.16	<0.03	mg/l	TM38/PM0
Monoethylene glycol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM179/PM0
Propylene glycol	13	13	<10	<10	<10	<10	<10	<10	<10	43	<10	ug/l	TM179/PM0
Diethylene glycol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM179/PM0
Triethylene glycol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM179/PM0
Thiodiglycol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM179/PM0
Ammoniacal Nitrogen as NH4#	0.41	0.21	0.17	12.61	0.14	0.09	0.55	0.07	0.06	0.24	<0.03	mg/l	TM38/PM0
BOD (Settled)#	2	1	1	5	1	<1	1	<1	1	2	<1	mg/l	TM58/PM0
Dissolved Oxygen	9	8	9	2	9	10	11	10	10	10	<1	mg/l	TM58/PM0
Electrical Conductivity @25C#	855	821	731	2189	731	743	1646	739	742	784	<2	uS/cm	TM76/PM0
pH#	8.32	8.22	8.27	7.42	8.36	8.30	8.12	8.31	8.35	8.25	<0.01	pH units	TM73/PM0
Total Organic Carbon#	3	2	2	26	2	<2	6	2	2	2	<2	mg/l	TM60/PM0
Total Nitrogen	1.5	1.7	2.0	117.4	2.0	1.6	1.3	1.0	1.7	3.0	<0.5	mg/l	TM38/TM125/PM0

Please see attached notes for all abbreviations and acronyms

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: IE Consulting
Reference: IE1471-2
Location: Belcamp
Contact: Kevin Murphy

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/1597						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/1597

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

All solid results are expressed on a dry weight basis unless stated otherwise.

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/1597

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.				
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.	Yes			
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes			
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.				
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.	Yes			
TM38/TM125	Total Nitogen/Organic Nitrogen by calculation	PM0	No preparation is required.				

EMT Job No: 22/1597

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM58	APHA SMEWW 5210B:1999 22nd Edition. Comparible with ISO 5815:1989. Measurement of Biochemical Oxygen Demand. When cBOD (Carbonaceous BOD) is requested a nitrification inhibitor is added which prevents the oxidation of reduced forms of nitrogen, such as am	PM0	No preparation is required.				
TM58	APHA SMEWW 5210B:1999 22nd Edition. Comparible with ISO 5815:1989. Measurement of Biochemical Oxygen Demand. When cBOD (Carbonaceous BOD) is requested a nitrification inhibitor is added which prevents the oxidation of reduced forms of nitrogen, such as am	PM0	No preparation is required.	Yes			
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.	Yes			
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM76	Modified US EPA method 120.1 (1982). Determination of Specific Conductance by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM179	Determination of Glycols using LCMS	PM0	No preparation is required.				

F. ESB Networks Letter of Support

NETWORKS

esbnetworks.ie

Na Coille Móire Way, Baile Formaid, Baile Átha Cliath 8, Éire
Fón +353 1 454 3813 / 454 3814 Fáics +353 1 415 0701

Kylemore Way, Ballyfermot, Dublin 8, Ireland
Phone +353 1 454 3813 / 454 3814 Fax +353 1 415 0701

Ms.Susan McClafferty,
Gerrard Gannon Properties,
Kinvara House,
52 Northumberland Road,
Dublin 4.

Planning Ref: TBC **Date: 26/10/2021**

Our Ref: ESB-AB-Gannon Homes (Belcamp Strategic Housing Development).

RE: ESB's observation to the proposed development of Gannon Homes (Belcamp Strategic Housing Development).

A Chara,

On behalf of ESB Networks I have reviewed the proposed development at the **Belcamp Strategic Housing Development** Area and based on the drawings received (Drawing No 19-114-S028B Proposed Layout Showing Existing ESBN 38kv Overheads) to this office on the 05/10/2021 also ESB met with the developer Gannon homes and their consultants Waterman & Moylan Consulting Engineers and ESB have the following observations.

- It is important to note that diversions (where possible) can take several months due to factors including alternative route availability, wayleave serving, cable easements, road opening licenses and planning permission requirements.
- On behalf of ESB Networks I can confirm that discussions have taken place with Gannon Homes in respect of the underground of existing *Grange/Collinstown 38KV overhead line* crossing the site.
- I confirm that ESB Networks are working with Gannon Homes to underground the 38kV overhead electrical line that traverses the site. Subject to further design development and agreement between all parties it is technically viable for the existing overhead ESB 38kV Line to be re-routed safely underground through the proposed residential site.

- Further meetings are required between the various concerned parties to consider the ESB *Grange/Collinstown 38KV overhead line* diversions and cable routing options through the wider Belcamp areas and site.
- The ***Collinstown 38KV overhead line*** is vital to the local electrical infrastructure and ESB thinks it important that its presence be taken into account in any development of this site.
- Before starting work it is essential that you have all up-to-date copies of the ESB cable and/or overhead records for all voltages at this location and that these are kept on site at all times while work is proceeding, and understood by all on site. It is important to make contact with this office at the earliest opportunity to ensure they have a clear understanding of the constraints that may apply where conflicts with ESB high voltage networks arise;

Please find attached following documents (with accompanying links) relating to safe working in the vicinity of our networks:

1. Avoidance of Electrical Hazards When Working Near Overhead Lines

<<http://www.esb.ie/esbnetworks/downloads/overhead_lines_electrical_hazards.pdf>>

2. Avoidance of Electrical Hazards when Digging

<<http://www.esb.ie/esbnetworks/downloads/esb_networks_avoidances_of_electrical_hazards_when_digging.pdf>>

3. Trench & Ducting Specifications.

http://www.esb.ie/esbnetworks/en/download_documents/builders_developers/specifications_duct.jsp

If you have any queries on the above please do not hesitate to contact me.

Regards,

Alan Brown.

38kV Design Engineering Officer,

ESB Networks,

HV Construction North,

Kylemore Way, Dublin 8.

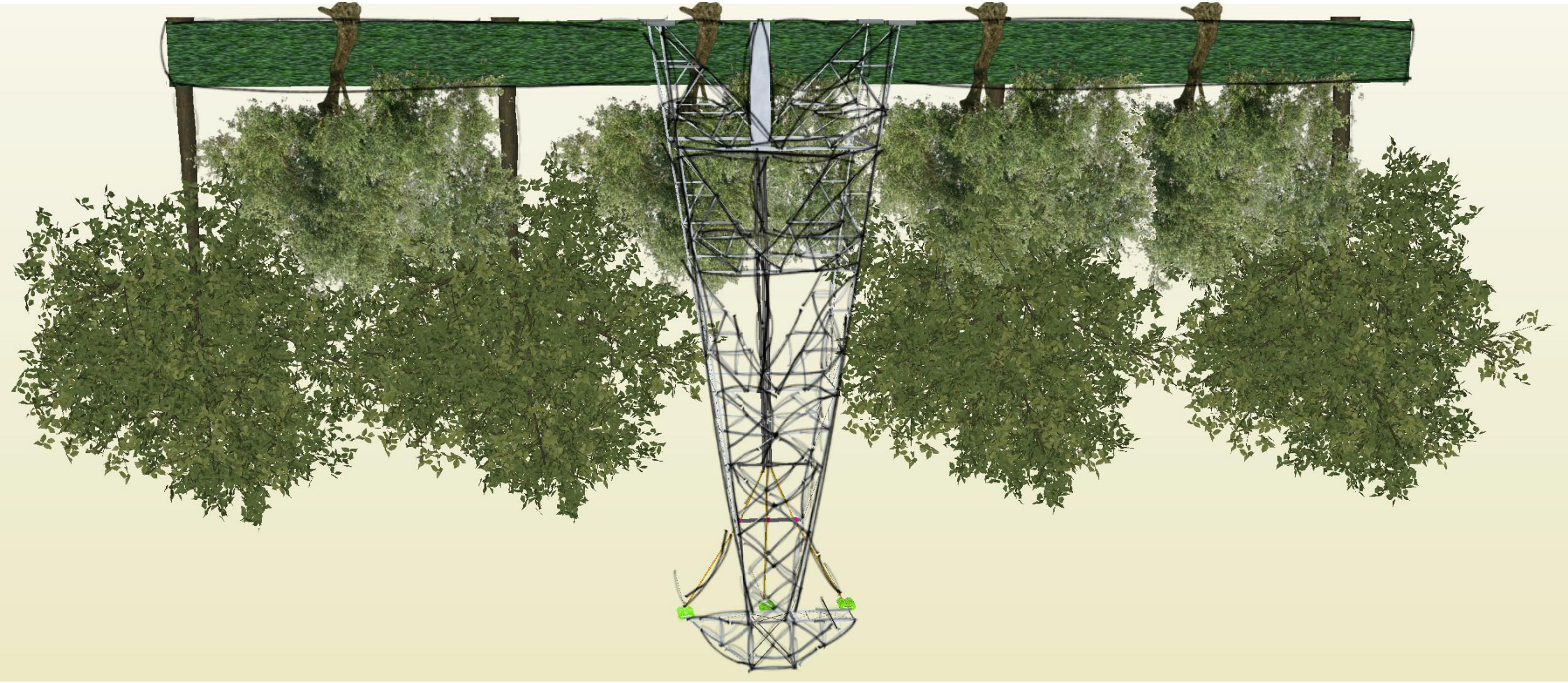
Mail to alan.brown@esb.ie, Mobile 0879273970

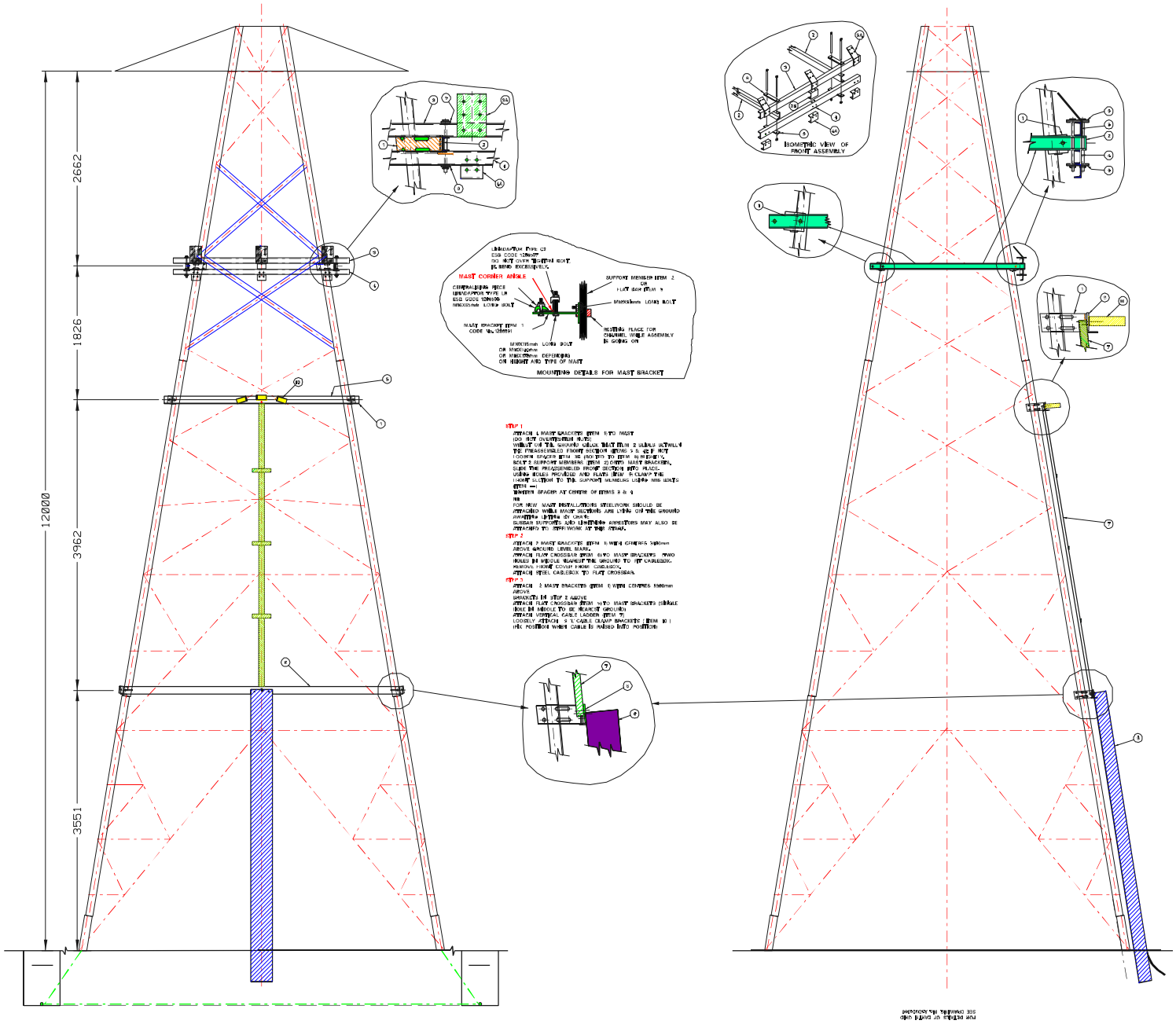
Copy:

Mr. D. Duhy, HV Lines/Cables Engineer, Project delivery, Dublin, ESB Networks, Inchicore, Dublin.8

Mr. P. Moran, HV Lines/Cables Construction Supervisor, Project delivery, Dublin, ESB Networks, Inchicore, Dublin.8

38kV Line Termination Mast Photograph
Showing Typical 38kV Underground
Cable to Overhead Line Terminations





A3 CAD	1	2	3	4	5	6	7	8	9	10

Rev	Revision Description
1	CHANGED PEN DEFINITION FOR PRINT PURPOSES AT REV 1.

Purpose of issue – Preliminary unless indicated

Tender ☐ Client Approval ☑ Construction ☐ As-built ☐ Revised ☐

ESB International

ESBI Engineering & Facility Management Ltd
Stephen Court, 18/21 St Stephen's Green, Dublin 2 Ireland
Telephone +353-1-703 8000 Fax +353-1-661-6399
www.esbi.ie
Registered Office as above
Registered in Ireland No. 155248

Client: ESB Networks

Production Unit: High Voltage Engineering

Project: LV MV AND 38KV LINES ESB NETWORKS

Contract: N/A

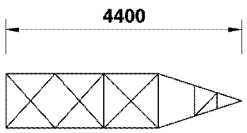
Drawing Title: ARRANGEMENT OF STEELWORK ON TYPE 61 END MAST 12M LONG FOR TERMINATING XLPE CABLE

Drawn	Produced	Verified	Approved	Approved date
J.P.F	N.Power	J.Doyle	J.Doyle	11/08/06

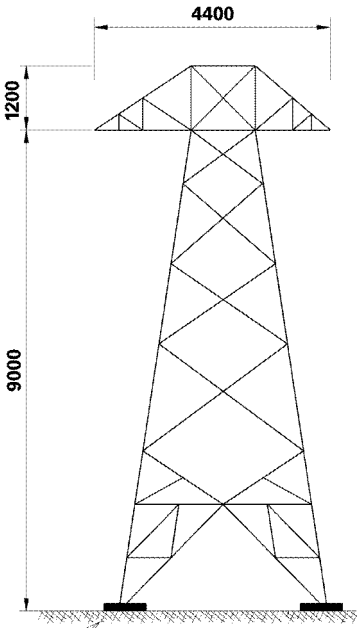
Client Ref	No. of Shts	Size	Scale
204988	1	A3	N/A

Drawing Number: PG567-D020-007-001-002 SHEET REV

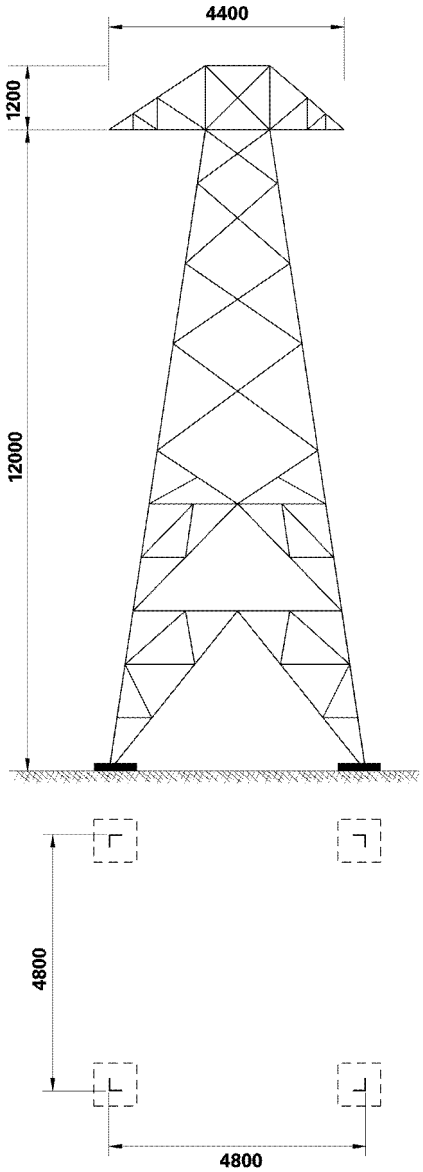
A3 CAD



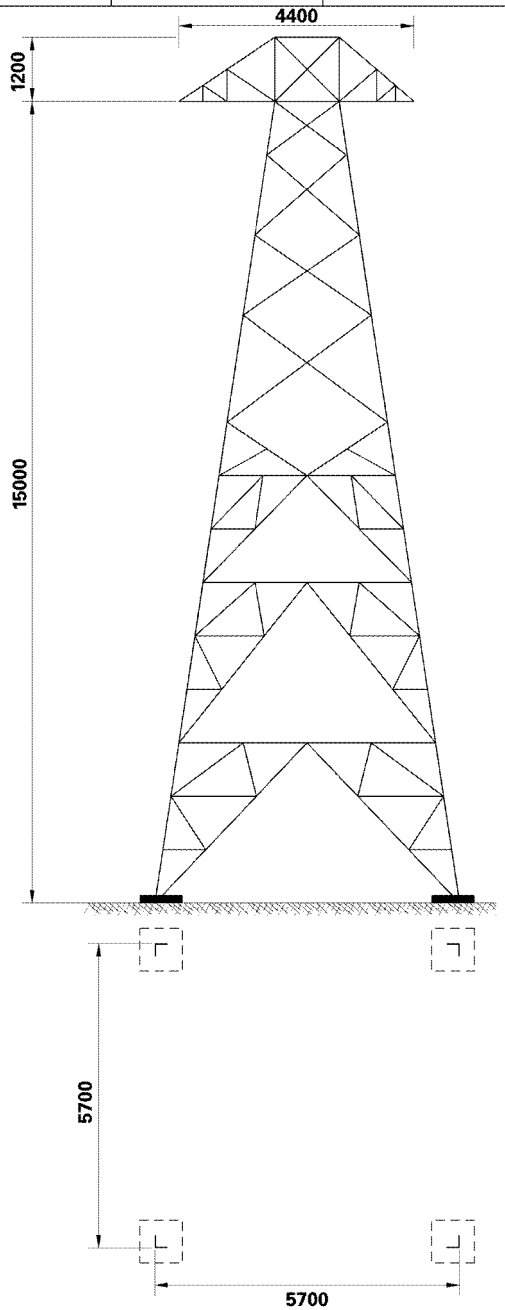
PLAN OF CROSSARM



BASE FOOTPRINT (9M MAST)



BASE FOOTPRINT (12M MAST)



BASE FOOTPRINT (15M MAST)

NOTES :
INTERNAL BRACING MAY CHANGE DEPENDING ON SUPPLIER.

Rev	Revision Description

Purpose of issue – Preliminary unless indicated
Tender ☐ Client Approval ☐ Construction ☐ As-built ☐ Revised ☐

ESB International
ESBI Engineering & Facility Management Ltd
Stephen Court, 18/21 St Stephen's Green, Dublin 2 Ireland
Telephone +353-1-703 8000 Fax +353-1-661-5359
www.esbi.ie
Registered Office as above
Registered in Ireland No. 155249

Client: ESB NETWORKS

Project: GENERIC LINES DOCUMENTS

Contract: N/A

Production Unit: High Voltage Engineering

Drawing Title: 38kV LINES / PLANNING APPLICATION
TYPE "H"
LATTICE STEEL MAST TYPE 63C
9M, 12M, 15M HEIGHTS

Drawn	Produced	Verified	Approved	Approved date
E.Lawlor	E.Lawlor	J.Eustace	P.Ennis	29/08/08

Client Ref	No. of Shts	Size	Scale
TC205748		A3	1:100

Drawing Number: PG567-D020-213-010-000

SHEET REV

UK and Ireland Office Locations