

Figure B-2: GSI 100k Bedrock Geology Map of the site.

According to the GSI Quaternary Soils Map (see Figure B-3) the survey area is underlain by "Till derived from Devonian Sandstones", shown in green. Areas of outcrop at or near the surface are shown in grey.

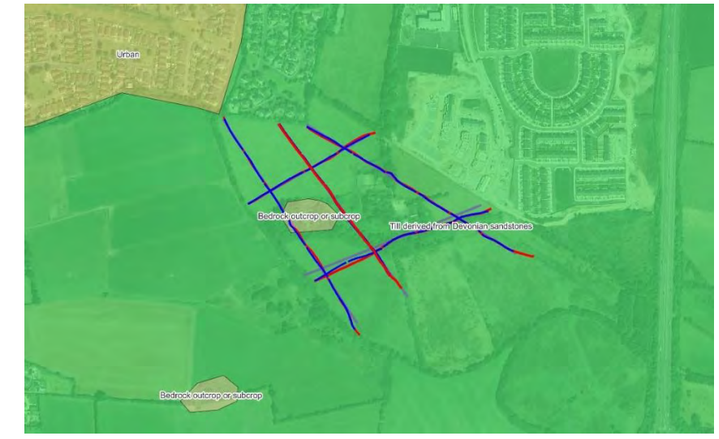


Figure B-3: Quaternary Sediments Map of the site.

All above mapping is available for free viewing on the Geological Survey of Ireland website at *https://www.gsi.ie/en-ie/Pages/default.aspx.* Both Figure B-2 and Figure B-3 contain Irish Public Sector

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C) Methodology

The geophysical techniques used were as follows:

C.1) 2D Electrical Resistivity Tomography (ERT)

This technique involved measuring electrical resistivity at the ground surface to image subsurface structures. A total of 5 no. profiles were collected along pre-determined lines (R1 to R5), with an electrode spacing of 5m with a total ERT length of 2015m.

An 84-channel ABEM LS2 resistivity meter was used. Multicore resistivity cables with 20 channels and stainless-steel electrodes were employed. Contact resistivities were checked and improved if necessary. The Wenner Alpha Array protocol was used.

C.2) Seismic Refraction Profiling (SRP)

Seismic waves were measured to determine subsurface layer Vp velocities. A total of 28 no. SRP profiles were recorded, following the same orientation as the ERT lines. A geophone spacing of 3m was used throughout with a total SRP length of 1990m. A 24-channel Geometrics Geode seismic system was used.

It is worth noting that seismic refraction theory is based on the increase in velocity with depth. This implies that low-velocity layers beneath higher-velocity ones may not be captured in seismic inversion. On the other hand, a significant positive velocity contrast between two layers is emphasized as the boundary between them during seismic inversion, which might be slightly shallower or deeper than the boundaries highlighted in direct investigations.

C.3) Data Processing and Interpretation:

Data processing and interpretation were carried out using specific software for each technique:

- ERT data was processed using Res2DInv software, with up to 5 iterations of inversion per profile. RMS errors for the inversions are provided in Table C-1.
- SRP data was processed using Plotrefa software. Velocity modelling, travel time plots, and layer thickness calculations were performed. RMS errors demonstrating the inversion acceptable limits are listed in

- Table C-2. S27 was a highly noisy profile and was beyond the acceptable limit hence, reacquired as profile S29.

Table C-1: RMS Errors for ERT inversion through RES2Dinv software (<15% low divergence inversion)

ERT Profile	RMS Error Inversion (%)	Iteration Number
R1	9.2%	4
R2	7.2%	5
R3	12.9%	4
R4	5.1%	5
R5	11.1%	4

Table C-2: RMS Errors for seismic refraction inversion through Plotrefa software (<2.5% low divergence inversion) *S27 was repeated as S29

Seismic Profile	RMS Error Inversion (ms)	RMS Error Inversion (%)
S1	0.6	1.4
S2	0.6	1.1
S3	0.3	1.3
S4	0.3	1.3
S5	0.5	1.1
S6	0.6	1.4
S7	0.5	2.1
S8	0.7	1.8
S9	0.7	1.8
S10	0.9	2.5
S11	0.6	1.2
S12	0.6	1.1
S13	0.8	2.2
S14	0.4	1.4
S15	0.3	1.8
S16	0.3	1.5
S17	0.4	1.1
S18	0.3	1.0
S19	0.5	2.1
S20	0.7	2.4
S21	0.6	1.4

S22	0.6	1.8
S23	0.5	1.4
S24	0.5	1.8
S25	0.5	1.5
S26	0.4	1.2
*S27	1.0	3.0
S28	0.5	2.2
S29	0.6	1.4

C.4) Geospatial Relocation:

Horizontal control and elevation were determined using an RTK-enabled GNSS receiver.

D) Results and Geophysical Interpretation

The survey profile positions, modelled profiles and geophysical interpretations are shown in APPENDIX A: Drawing No. P24077_GP_D01 to D06. These drawings are plotted at paper size ISO A3 and are also supplied in AutoCAD format.

The integration of seismic refraction and ERT results allowed for a comprehensive understanding of the subsurface conditions. Correlations between seismic velocities and resistivity values provided valuable information on the lithological composition and layer thicknesses. The combined interpretation helped in identifying potential geohazards.

The SRP refracted boundaries were used to establish top of rock and overburden / rock material strength characteristics across all profiles. The general geophysical interpretation is outlined in Table D-1.

Table D-1: Interpretation based on electrical resistivity and seismic velocity.

Resistivity (Ohm-m)	Vp velocity (m/s)	Interpretation
<550	<950	Sandy Gravelly CLAY
<2000	<2500	Weathered LIMESTONE
>2500	>2500	LIMESTONE

D.1) Geophysical Interpretation Summary

The uppermost layer, also known as overburden, consistently exhibited low P-wave velocities (Vp) and electrical resistivities (ERT). Specifically, the Vp values were consistently less than 950m/s and ERT values less than 600ohm-m which is interpreted to be a sandy gravelly CLAY composition, consistent with unconsolidated to semi-consolidated glacial deposits. The thickness of this overburden layer varied significantly across the survey profiles between c.2m to c.30m, with maximum thickness observed along profile R2 between chainages 410m and 420m. Conversely, the thinnest section of the overburden, measuring c.2m, identified along profile R5, indicating that the underlying rock is relatively shallow.

Immediately underlying the overburden, the subsequent layer was interpreted as a weathered LIMESTONE layer. This layer is characterised by intermediate Vp and ERT compared to the overlying and underlying materials. The Vp for this layer consistently exceeded 1200m/s, while the ERT values ranged between 700ohm-m and 2200ohm-m which are parameters that are consistent with limestone

that has undergone varying degrees of weathering, resulting in increased porosity and fracturing compared to fresh bedrock, but still possessing greater integrity than the unconsolidated overburden.

Underlying the highly weathered Limestone layer is the fresh bedrock layer interpreted as LIMESTONE. This layer is defined by its high Vp values that exceeded 2500m/s and ERT values greater than 2500ohm-m.

The physical properties (such as Vp and resistivity) of each lithology depend heavily on parameters such as porosity, density, permeability, directional fractures (anisotropy), minerals, and elastic modulus. The physical properties of each subsurface lithology can vary widely due to these mentioned parameters.

Seismic refraction theory is based on the increase in velocity with depth. This implies that low-velocity layers beneath higher-velocity ones may not be captured in seismic inversion. On the other hand, a significant positive velocity contrast between two layers is emphasised as the boundary between them during seismic inversion, which might be slightly shallower or deeper than the boundaries highlighted in direct investigations.

D.2) Anomalies

Our analysis of the inverted electrical resistivity tomography (ERT) and seismic refraction profile (SRP) sections revealed distinct variations in physical properties, suggestive of potential fault or karst zones. These areas of interest are delineated by black and purple polygons on specific profiles in APPENDIX A of this report. It is important to emphasise that these polygons represent anomalies indicative of faulting or karstification, and the actual extent of such features may deviate from the delineated boundaries. Moreover, the absence of such markers within the data does not preclude the presence of faults or karst zones, as limitations inherent in the range and resolution of our geophysical methods may hinder their detection.

Based on the inverted ERT, and SRP profiles, probable faulted/karstified zones have been identified along various profiles, as detailed in Table D-2.

Table D-2: Detected fault/Karst zones based on the inverted ERT and SRP profiles. Highlighted anomalies by blue colour are possible air-filled karst zones (void zones).

Distance		Profile Nu. (Anomaly Nu.)
FROM	TO	
205	215	R1 (A1)
105	140	R4 (A2)
180	245	R4 (A3)
130	160	R5 (A4)
170	220	R5 (A5)
240	275	R5 (A6)
305	350	R5 (A7)
380	420	R2 (B1)
315	355	R3 (B2)
405	480	R4 (B3

It is essential to highlight that the regions identified and interpreted as potential karstified zones have been recognised based on very low resistivity pockets within a predominant high resistivity zone. This low resistivity pockets may suggest the presence of clay filled voids.

D.3) Recommendations

This report recommends direct investigation to verify the geophysical interpretation at all highlighted anomalies.

D.4) Individual profile interpretation

In the below section the geophysical interpretation for all the acquired ERT profiles with their relevant SRP profiles are summarized.

D.4.i) R1, S1, S2, S3, S4

Profile R1 reveals a three-p layer subsurface stratigraphy comprising an overburden layer, a weathered limestone layer and a competent Limestone bedrock. The overburden, interpreted as a sandy gravelly CLAY, exhibits low Vp velocities (<1000m/s) and electrical resistivity <550ohm-m. Its thickness varies notably across the profile, ranging from c. 2m to 12m, possibly reflective of uneven erosional patterns. Beneath this, the weathered limestone layer shows intermediate geophysical characteristics with Vp values below 2500m/s and ERT values under 2000ohm-m.

The lowest unit, interpreted as competent Limestone bedrock is characterised by higher Vp values >2500m/s and ERT values exceeding 2500ohm-m, confirming its un-weathered and dense. An additional geophysical anomaly zone (A1) was identified between chainages 205m and 215m, presenting as a bull's eye low- resistivity feature embedded within a moderately high resistivity zone. This suggests localised clay infill or a karstic feature, warranting further geotechnical consideration.

D.4.ii) R2, S5, S6, S7, S8, S9, S10, S11

Profile R2 displays a similar stratigraphic structure to profile R1, comprising an overburden layer overlying weathered and competent Limestone units. The overburden is interpreted as a sandy gravelly CLAY, derived from glacial deposits. Its exhibits characteristic low Vp velocities <1000m/s and ERT<550ohm-m. This layer shows significant thickness variability along the profile, ranging from approximately 2m to a maximum of c.30m, indicative of possible erosional modification of bedrock surface.

A prominent feature along this profile is a shallow bedrock that rises towards the surface level between chainages 175m and 240m. This zone reflects a thinning or an absence of overburden, likely caused by bedrock topographic highs or erosional processes. The transition from weathered to competent limestone in this interval is marked by an increase in both Vp (>2500m/s) and ERT (>2500ohm-m), confirming the presence of fresh bedrock.

D.4.iii) R3, S24, S25, S26, S27, S28

Profile R3 exhibits the same three-layer stratigraphy observed in previous profiles, consisting of an overburden layer overlying weathered limestone and a deeper competent limestone bedrock. The overburden is interpreted as sandy gravelly CLAY with low geophysical properties (Vp <1000 m/s, ERT <550 ohm-m). Along this profile, the overburden is interpreted to be absent or thinning between chainages 0m and 145m, where the bedrock is exposed or lies very close to the surface, suggesting a topographic high in the limestone bedrock. It is important to note that it is most times difficult to capture and image very thin overburden layers at the surface level due to the limitation emerging from the survey spacings used.

This near-surface bedrock zone exhibits high resistivities (>2500 ohm-m), confirming the interpretation of the presence of a competent bedrock. Beyond chainage 305m, the resistivity model shows an obvious decline, particularly toward the southeastern end of the profile which is also present in profile R2 and slightly in R5. This pronounced drop may signify a fracture zone or fault structure, resulting in increased porosity or clay infill.

D.4.iv) R4, S12, S13, S14, S15, S16

Profile R4 reveals a consistent stratigraphic structure observed across previous profiles, comprising an overburden layer overlying weathered and competent limestone formations. The overburden is interpreted as a sandy gravelly CLAY, shows low Vp velocities <1000m/s and ERT<550ohm-m. The overburden thickness ranges from approximately 2m to a maximum of c.7m.

A zone of shallow bedrock exposure is evident between chainages 160m and 285m where the overburden thins or is absent, almost exposing near surface competent limestone. The underlying weathered and fresh limestone layers maintain expected geophysical patterns, with Vp increasing above 2500m/s and ERT exceeding 2500ohm-m in competent zones. However, the profile also includes two notable anomalous zones (A2 and A3). A2 (between chainage 105 to 140m) and A3 (between chainage 180m to 245m) presents a low resistivity pocket within a broader higher resistivity domain, indicative of a clay-filled saturation likely caused by fracture induced porosity and moisture retention.

D.4.v) R5, S17, S18, S19, S20, S21, S22, S23

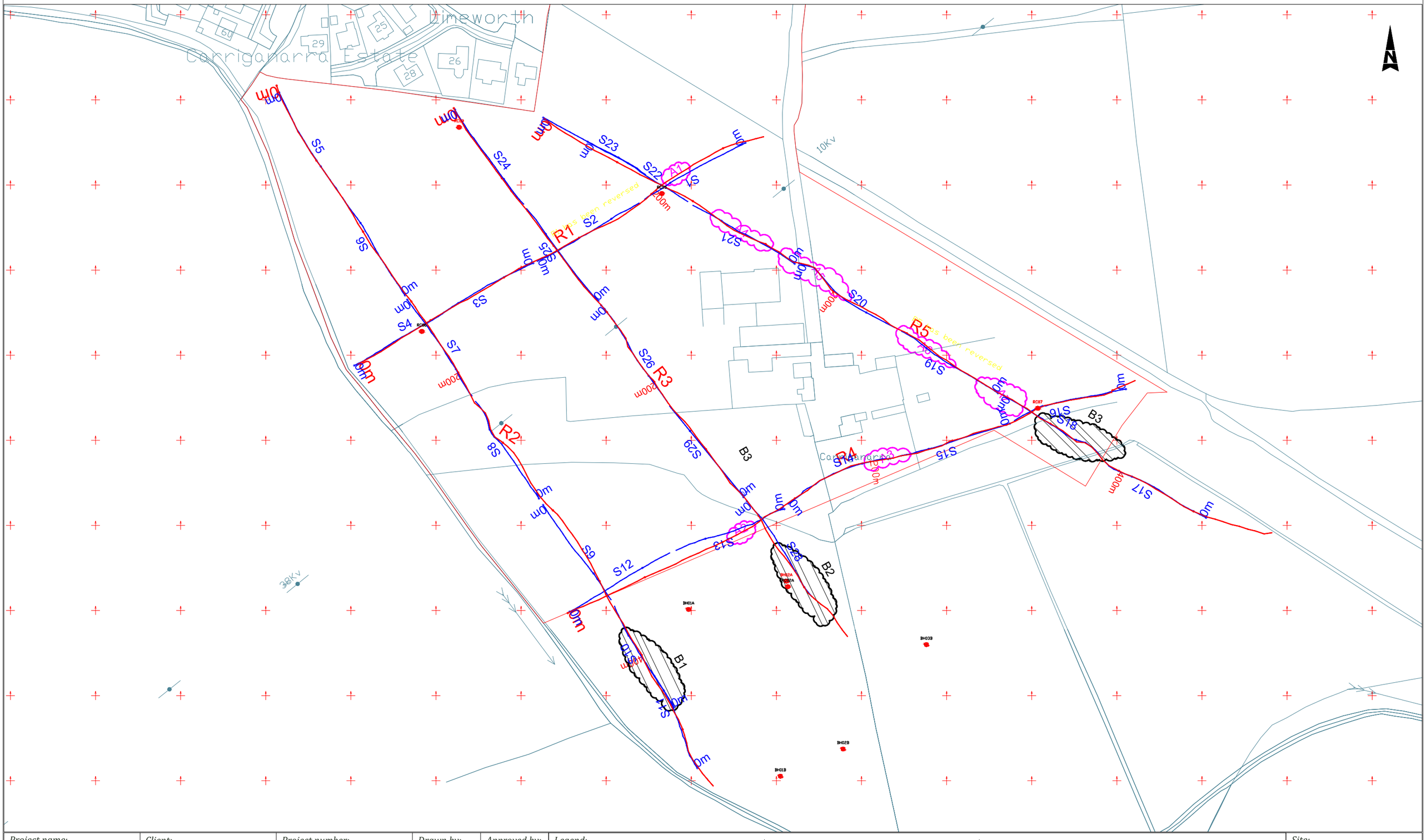
Profile R5 follows the same three-layer stratigraphic framework observed in previous profiles, comprising an overburden layer, weathered limestone, and a deeper competent limestone bedrock. The overburden, interpreted as sandy gravelly CLAY, is relatively thin across the profile, ranging from approximately 2m to 9.4m in thickness. It is marked by low resistivity (<550 ohm-m) and low seismic velocity (<1000 m/s). The underlying weathered and competent limestone units display expected geophysical trends, with the bedrock showing higher ERT (>2500 ohm-m) and Vp values above 2500 m/s, while transitional weathered zones exhibit intermediate values.

Significantly, four anomalous zones (A4–A7) were identified along the profiles. These anomalies are characterized by distinct low-resistivity materials embedded within high-resistivity zones, extending down toward the base of the model. This possibly suggests the downward migration or seepage of clay-rich materials through porous or fractured limestone pathways, possibly linked to vertical or inclined discontinuities in the bedrock. Also, possible fault zones were identified along profiles R2, R3 and R4 where the resistivity model showed an obvious decline, particularly toward the southeastern end of the profiles and have been identified as B1, B2, and B3 in the cross section drawings in APPENDIX A.

APPENDIX A: DRAWINGS

Drawing Number	Description	Scale
P24077_GP_D01	Location Map	1:1000 @ A3
P24077_GP_D02	Location Map with Geophysical Results and Interpreted Cross-Sections – R1	1:550 @ A3
P24077_GP_D03	Location Map with Geophysical Results and Interpreted Cross-Sections – R2	1:700 @ A3
P24077_GP_D04	Location Map with Geophysical Results and Interpreted Cross-Sections – R3	1:700 @ A3
P24077_GP_D05	Location Map with Geophysical Results and Interpreted Cross-Sections – R4	1:700 @ A3
P24077_GP_D06	Location Map with Geophysical Results and Interpreted Cross-Sections – R5	1:700 @ A3

FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS, R1, R2, R3, R4, R5
SCALE 1:1000



Project name: Carriganarra LRD	*Client:* M&OS GROUP	*Project number:* P24077	*Drawn by:* DH	*Approved by:* HP	
Sheet Title: LOCATION MAP OF GEOPHYSICAL PROFILES, R1, R2, R3, R4, R5	*Terra Surveyclient:* PRIORITY GEOTECHNICAL LTD.	*Drawing number:* P24077_Gp_D01	*CRS:* ITM (EPSG 2157)		
	Survey by: TERRA SURVEY UNIT C WEST CORK BUSINESS & TECH PARK, CLONAKILTY, CO. CORK, P85 RV08 T: +353 21 483 1184 E: info@hydrosurvey.com	*Revision:* Rev.03	*Datum:* OD Malin (EPSG 7959)		
			Scale: As stated A3	*Issue date:* 09/06/2025	

Legend:

Location Map
- Seismic profile
- ERT profile
- MASW profile
- RC01 Rotary core
- BH01 Cable percussion borehole
- TP01 Trial pit
- Possible area of karst
- Possible area of faulting

Geophysical pseudosection
- Seismic refraction boundaries with P-wave velocities (m/s)
- ground surface SRP profile
- ground surface ERT Profile

ERT boundaries and resistivity colour scale (Ωm)
0 | 100 | 250 | 350 | 400 | 550 | 700 | 800 | 900 | 1200 | 1700 | 2200 | 3000 | 4000 | 5000 | 6500 | 8000

P-Wave Velocity colour scale (km/s)
0.5 | 0.8 | 1 | 1.5 | 2 | 2.5 | 2.6 | 2.9 | 3 | 3.2 | 3.8 | 4 | 4.3 | 4.75 | 5 | 5.5

Geophysical interpretation
- R6 Intersection of another named profile
- BH22 Approx location of named site investigation work
- Change in overburden boundary
- Rock surface boundary
- Change in rock boundary

Overburden types: Sand, Gravel, Clay, Silt, Sandy CLAY, Sandy gravelly CLAY, Sandy GRAVEL, GRAVEL

Rock types: Low Weathered LIMESTONE, Highly Weathered LIMESTONE

Possible area of faulting
Possible area of karst

Site:

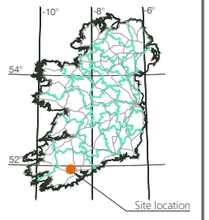
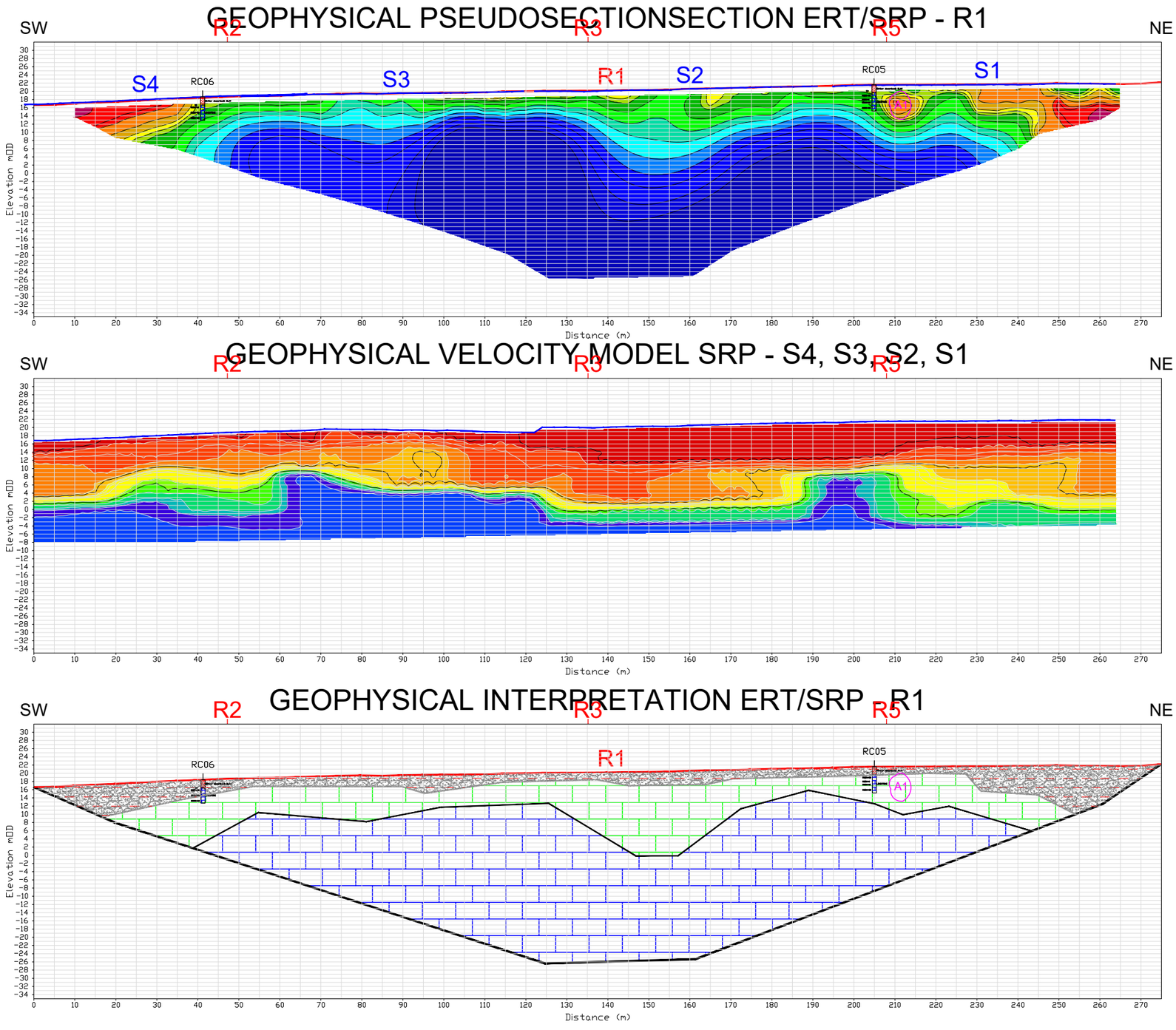


FIGURE 1: GEOPHYSICAL PSEUDOSECTION AND INTERPRETATION SECTIONS OF PROFILE R1
SCALE 1:550



Project name: **Carriganarra LRD**	*Client:* **M&OS GROUP**	*Project number:* **P24077**	*Drawn by:* **DH**	*Approved by:* **HP**	
	Terra Survey client: **PRIORITY GEOTECHNICAL LTD.**	*Drawing number:* **P24077_Gp_D02**	*CRS:* **ITM (EPSG 2157)**		
Sheet Title: **GEOPHYSICAL PSEUDOSECTION AND INTERPRETATION SECTIONS OF PROFILE R1**	*Survey by:* **TERRA SURVEY** UNIT C WEST CORK BUSINESS & TECH PARK, CLONAKILTY, CO. CORK, P85 RV08 T: +353 21 483 1184 E: info@hydrosurvey.com	*Revision:* **Rev.03**	*Datum:* **OD Malin (EPSG 7959)**		
			Scale: **As stated A3**	*Issue date:* **09/06/2025**	

Legend:

Location Map
- Seismic profile
- ERT profile
- MASW profile
- RC01 Rotary core
- BH01 Cable percussion borehole
- TP01 Trial pit
- Possible area of karst
- Possible area of faulting

Geophysical pseudosection
Seismic refraction boundaries with P-wave velocities (m/s)
- ground surface SRP profile
- ground surface ERT Profile

ERT boundaries and resistivity colour scale (Ωm)
0 100 250 350 400 550 700 800 900 1200 1700 2200 3000 4000 5000 6500 8000

P-Wave Velocity colour scale (km/s)
0.5 0.8 1 1.5 2 2.5 2.6 2.9 3 3.2 3.8 4 4.3 4.75 5 5.5

Geophysical interpretation
- R6 Intersection of another named profile
- BH22 Approx location of named site investigation work
- Change in overburden boundary
- Rock surface boundary
- Change in rock boundary

Overburden types: Sand, Gravel, Clay, Silt, Sandy CLAY, Sandy gravelly CLAY, Sandy GRAVEL, GRAVEL

Rock types: Low Weathered LIMESTONE, Highly Weathered LIMESTONE

- Possible area of faulting
- Possible area of karst

Site:

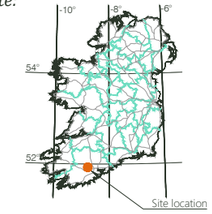
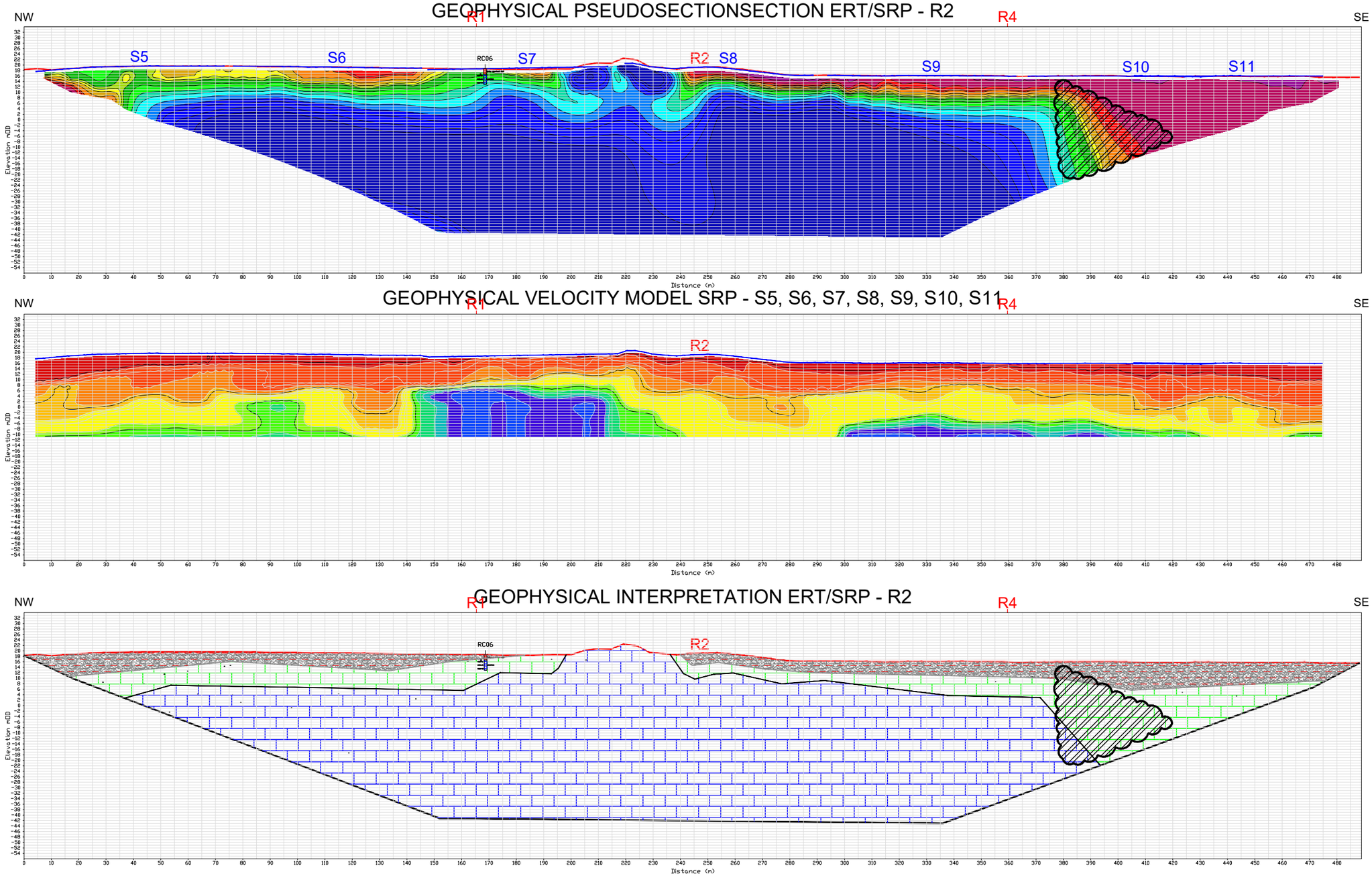


FIGURE 1: GEOPHYSICAL PSEUDOSECTION AND INTERPRETATION SECTIONS OF PROFILE R2
SCALE 1:750



Project name:
Carriganarra LRD

Sheet Title:
GEOPHYSICAL PSEUDOSECTION AND INTERPRETATION SECTIONS OF PROFILE R2

Client:
M&OS GROUP

Terra Surveyclient:
PRIORITY GEOTECHNICAL LTD.

Survey by:
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Project number:
P24077

Drawing number:
P24077_Gp_D03

Revision:
Rev.03

Drawn by: **DH**

Approved by: **HP**

CRS:
ITM (EPSG 2157)

Datum:
OD Malin (EPSG 7959)

Scale: **As stated A3**

Issue date: **09/06/2025**

Legend:

Location Map
- Seismic profile
- ERT profile
- MASW profile
- RC01 Rotary core
- BH01 Cable percussion borehole
- TP01 Trial pit
- Possible area of karst
- Possible area of faulting

Geophysical pseudosection
Seismic refraction boundaries with P-wave velocities (m/s)
- ground surface SRP profile
- ground surface ERT Profile

ERT boundaries and resistivity colour scale (Ωm)
0 | 100 | 250 | 350 | 400 | 550 | 700 | 800 | 900 | 1200 | 1700 | 2200 | 3000 | 4000 | 5000 | 6500 | 8000

P-Wave Velocity colour scale (km/s)
0.5 | 0.8 | 1 | 1.5 | 2 | 2.5 | 2.6 | 2.9 | 3 | 3.2 | 3.8 | 4 | 4.3 | 4.75 | 5 | 5.5

Geophysical interpretation
- R6 Intersection of another named profile
- BH22 Approx location of named site investigation work
- Change in overburden boundary
- Rock surface boundary
- Change in rock boundary

Overburden types: Sand, Gravel, Clay, Silt, Sandy CLAY, Sandy gravelly CLAY, Sandy GRAVEL, GRAVEL

Rock types: Low Weathered LIMESTONE, Highly Weathered LIMESTONE, Possible area of faulting, Possible area of karst

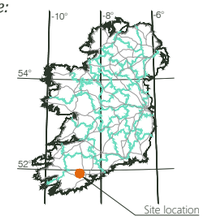
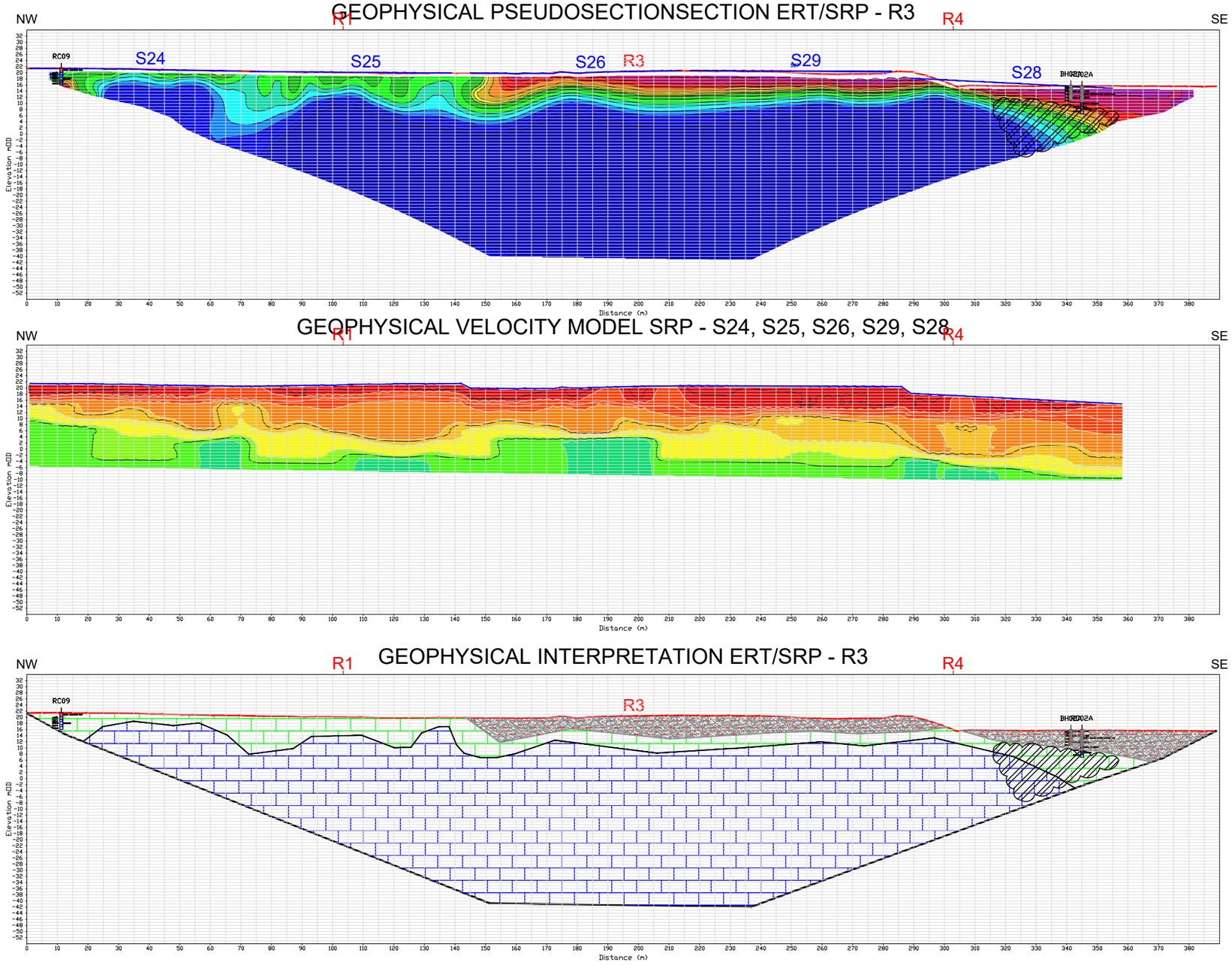
Site:


FIGURE 1: GEOPHYSICAL PSEUDOSECTION AND INTERPRETATION SECTIONS OF PROFILE R3
SCALE 1:750



Project name: **Carriganarra LRD**	*Client:* M&OS GROUP	*Project number:* P24077	*Drawn by:* DH	*Approved by:* HP	
Sheet Title: GEOPHYSICAL PSEUDOSECTION AND INTERPRETATION SECTIONS OF PROFILE R3	*Terra Surveyclient:* PRIORITY GEOTECHNICAL LTD.	*Drawing number:* P24077_Gp_D04	*CRS:* ITM (EPSG 2157)		
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			Scale: As stated A3	*Issue date:* 09/06/2025	

Legend:

Location Map
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- MASW profile
- RC01 Rotary core
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- TP01 Trial pit
- Possible area of karst
- Possible area of faulting

Geophysical pseudosection

Seismic refraction boundaries with P-wave velocities (m/s)
- ground surface SRP profile
- ground surface ERT Profile

ERT boundaries and resistivity colour scale (Ωm)
0 | 100 | 250 | 350 | 400 | 550 | 700 | 800 | 900 | 1200 | 1700 | 2200 | 3000 | 4000 | 5000 | 6500 | 8000

P-Wave Velocity colour scale (km/s)
0.5 | 0.8 | 1 | 1.5 | 2 | 2.5 | 2.6 | 2.9 | 3 | 3.2 | 3.8 | 4 | 4.3 | 4.75 | 5 | 5.5

Geophysical interpretation
- R6 Intersection of another named profile
- BH22 Approx location of named site investigation work
- Change in overburden boundary
- Rock surface boundary
- Change in rock boundary

Overburden types: Sand, Gravel, Clay, Silt, Sandy CLAY, Sandy gravelly CLAY, Sandy GRAVEL, GRAVEL

Rock types: Low Weathered LIMESTONE, Highly Weathered LIMESTONE, Possible area of faulting, Possible area of karst

Site:

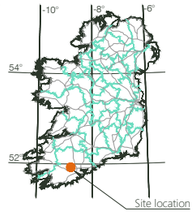
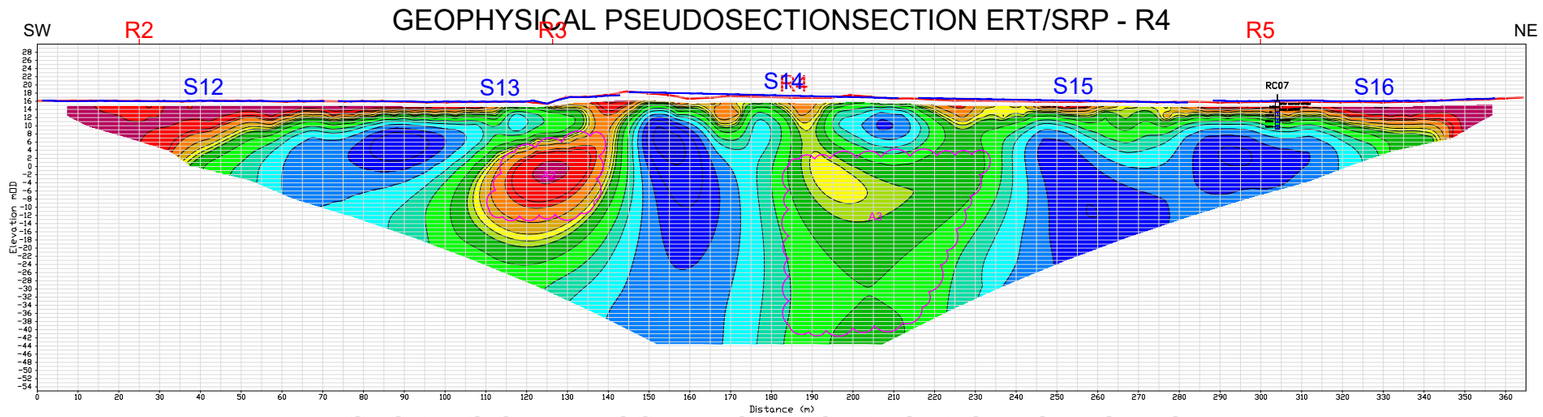
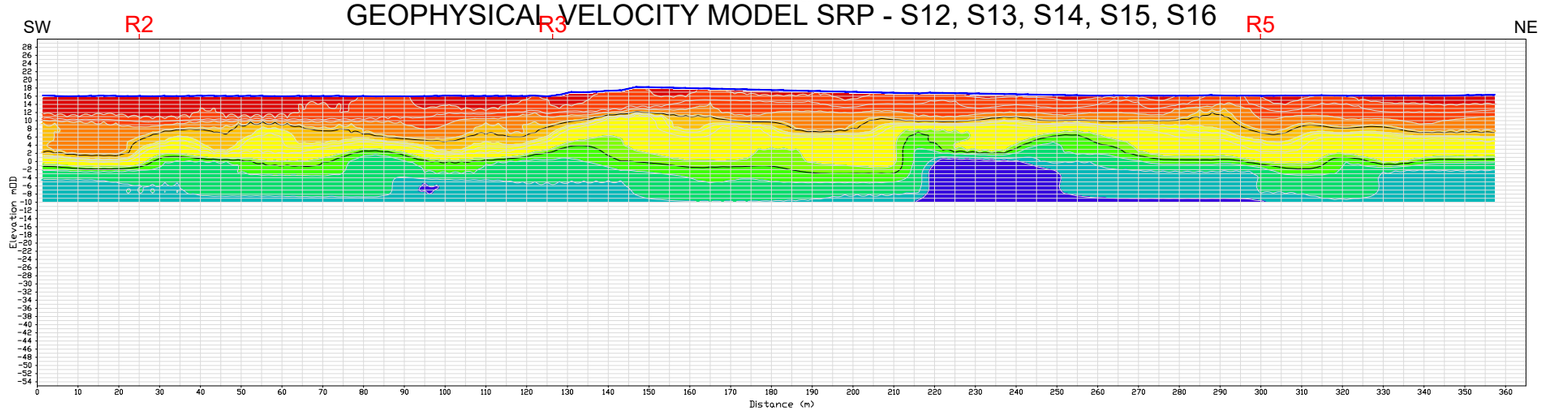
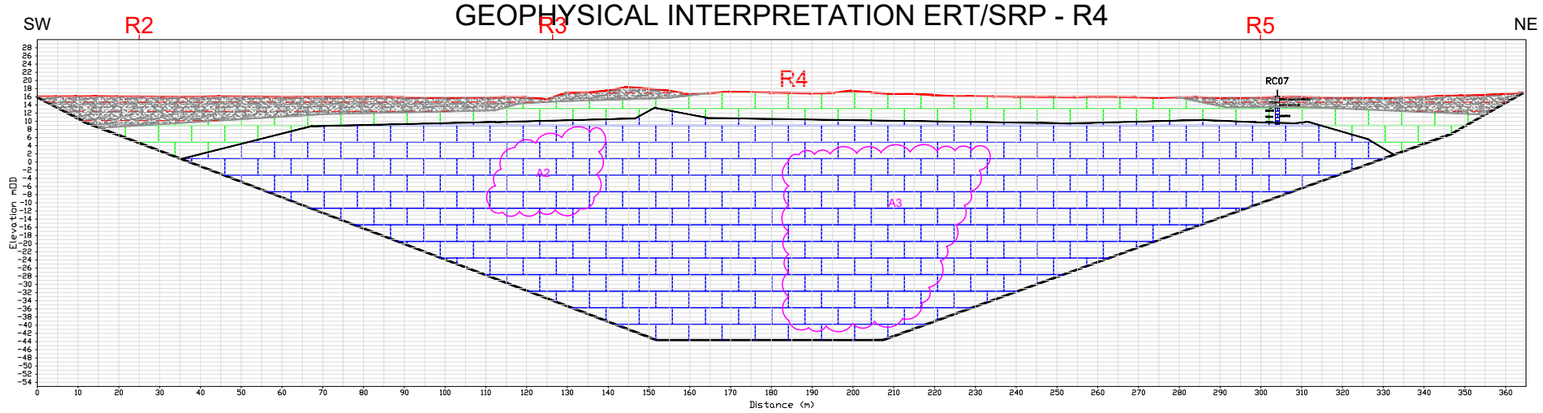


FIGURE 1: GEOPHYSICAL PSEUDOSECTION AND INTERPRETATION SECTIONS OF PROFILE R4
SCALE 1:750







Project name: **Carriganarra LRD**	*Client:* **M&OS GROUP**	*Project number:* **P24077**	*Drawn by:* **DH**	*Approved by:* **HP**	
Sheet Title: **GEOPHYSICAL PSEUDOSECTION AND INTERPRETATION SECTIONS OF PROFILE R4**	*Terra Surveyclient:* **PRIORITY GEOTECHNICAL LTD.**	*Drawing number:* **P24077_Gp_D05**	*CRS:* **ITM (EPSG 2157)**		
	Survey by: **TERRA SURVEY** UNIT C WEST CORK BUSINESS & TECH PARK, CLONAKILTY, CO. CORK, P85 RV08 T: +353 21 483 1184 E: info@hydrosurvey.com	*Revision:* **Rev.03**	*Datum:* **OD Malin (EPSG 7959)**		
			Scale: **As stated A3**	*Issue date:* **09/06/2025**	

Legend:

Location Map
- Seismic profile
- ERT profile
- MASW profile
- RC01 Rotary core
- BH01 Cable percussion borehole
- TP01 Trial pit
- Possible area of karst
- Possible area of faulting

Geophysical pseudosection

Seismic refraction boundaries with P-wave velocities (m/s)
- ground surface SRP profile
- ground surface ERT Profile

ERT boundaries and resistivity colour scale (Ωm)
0 | 100 | 250 | 350 | 400 | 550 | 700 | 800 | 900 | 1200 | 1700 | 2200 | 3000 | 4000 | 5000 | 6500 | 8000

P-Wave Velocity colour scale (km/s)
0.5 | 0.8 | 1 | 1.5 | 2 | 2.5 | 2.6 | 2.9 | 3 | 3.2 | 3.8 | 4 | 4.3 | 4.75 | 5 | 5.5

Geophysical interpretation
- R6 Intersection of another named profile
- BH22 Approx location of named site investigation work
- Change in overburden boundary
- Rock surface boundary
- Change in rock boundary

Overburden types: Sand, Gravel, Clay, Silt, Sandy CLAY, Sandy gravelly CLAY, Sandy GRAVEL, GRAVEL

Rock types: Low Weathered LIMESTONE, Highly Weathered LIMESTONE

- Possible area of faulting
- Possible area of karst

Site:

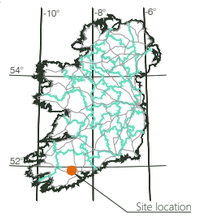
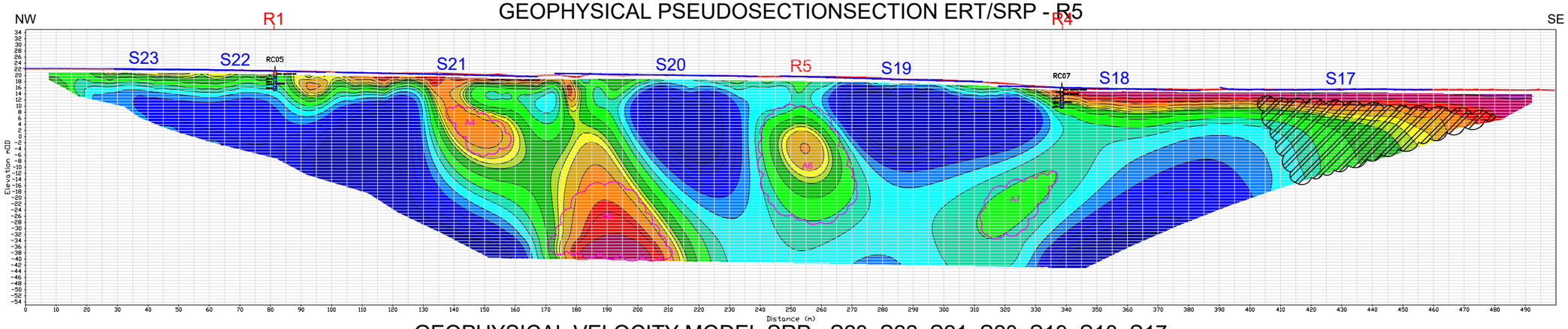
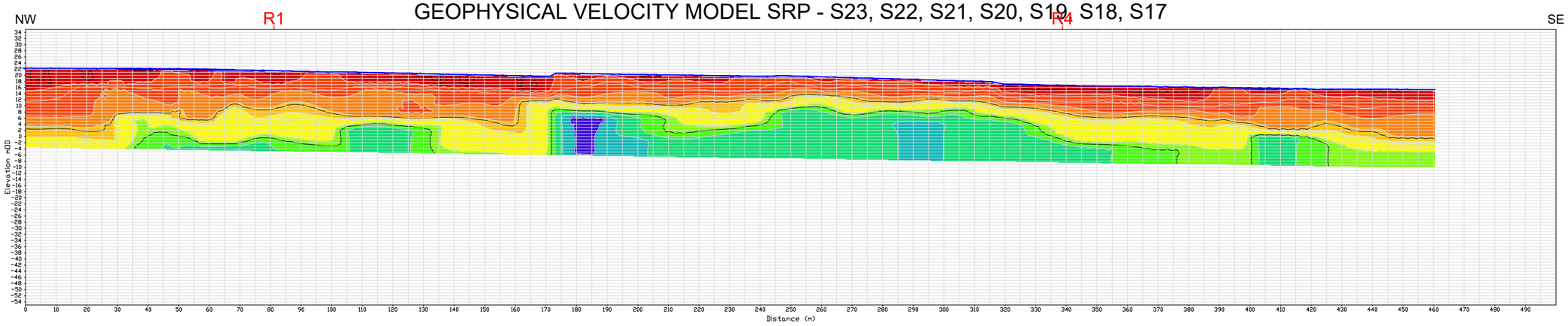


FIGURE 1: GEOPHYSICAL PSEUDOSECTION AND INTERPRETATION SECTIONS OF PROFILE R5
SCALE 1:750

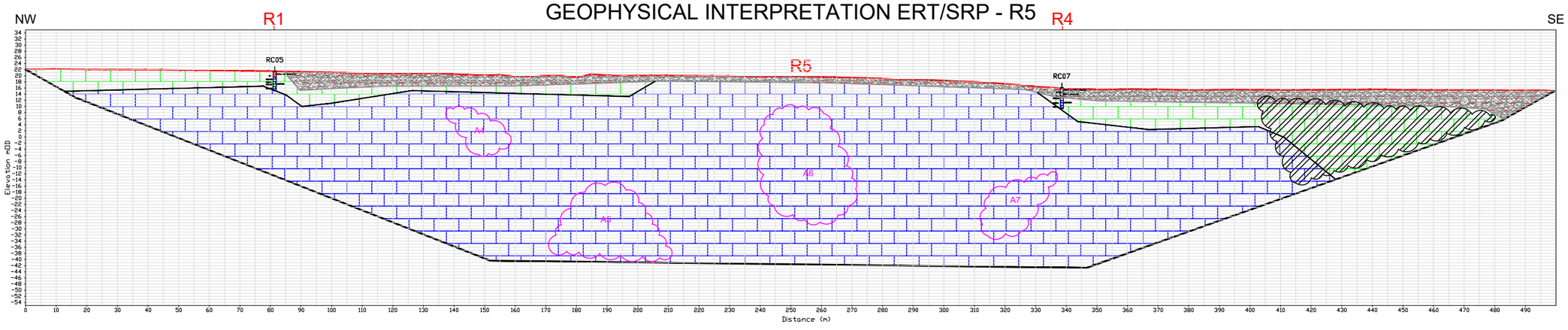
GEOPHYSICAL PSEUDOSECTIONSECTION ERT/SRP - R5



GEOPHYSICAL VELOCITY MODEL SRP - S23, S22, S21, S20, S19, S18, S17



GEOPHYSICAL INTERPRETATION ERT/SRP - R5



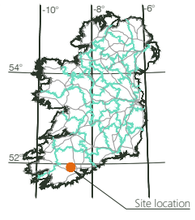
Project name: **Carriganarra LRD**	*Client:* M&OS GROUP	*Project number:* P24077	*Drawn by:* DH	*Approved by:* HP	*Legend:*
Sheet Title: GEOPHYSICAL PSEUDOSECTION AND INTERPRETATION SECTIONS OF PROFILE R5	*Terra Surveyclient:* PRIORITY GEOTECHNICAL LTD.	*Drawing number:* P24077_Gp_D06	*CRS:* ITM (EPSG 2157)		
	Survey by: TERRA SURVEY UNIT C WEST CORK BUSINESS & TECH PARK, CLONAKILTY, CO. CORK, P85 RV08 T: +353 21 483 1184 E: info@hydrosurvey.com	*Revision:* Rev.03	*Datum:* OD Malin (EPSG 7959)		
			Scale: As stated A3	*Issue date:* 09/06/2025	

Location Map
Seismic profile
ERT profile
MASW profile
RC01 Rotary core
BH01 Cable percussion borehole
TP01 Trial pit
Possible area of karst
Possible area of faulting

Geophysical pseudosection
Seismic refraction boundaries with P-wave velocities (m/s)
ground surface SRP profile
ground surface ERT Profile
ERT boundaries and resistivity colour scale (Ω.m)
0 100 250 350 400 550 700 800 900 1200 1700 2200 3000 4000 5000 6500 8000
P-Wave Velocity colour scale (km/s)
0.5 0.8 1 1.5 2 2.5 2.6 2.9 3 3.2 3.8 4 4.3 4.75 5 5.5

Geophysical interpretation
R6 Intersection of another named profile
BH22 Approx location of named site investigation work
Change in overburden boundary
Rock surface boundary
Change in rock boundary
Overburden types: Sand, Gravel, Clay, Silt, Sandy CLAY, Sandy gravelly CLAY, Sandy GRAVEL, GRAVEL
Rock types: Low Weathered LIMESTONE, Highly Weathered LIMESTONE
Possible area of faulting
Possible area of karst

Site:



REFERENCES

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KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

GENERAL

m	Meter
mm	Millimetres
BGL	Below existing ground level
mOD	Level to OD Malin
TP	Trial Pit
ST	Slit Trench
CP	Cable Percussion Borehole
RC	Rotary Cored Borehole
IP	Inspection Pit
FP	Foundation Pit
DP	Dynamic Probe
Geobore S	Geobore S Borehole

SAMPLES

B	Bulk disturbed sample
D	Small disturbed sample
U	Undisturbed sample
WS	Dynamic sample/ window sample
ENV	Environmental sample
SPLTLS	Split spoon sample
CBR	California Bearing Ratio mould sample

RECOVERY AND ROCK QUALITY

TCR %	Total Core Recovery (% of Core Run)
SCR %	Solid Core Recovery (length of core having at least one full diameter as % of core run) RQD
RQD %	Rock Quality Designation (length of solid core greater than 100mm as % of core run)
FI	Fracture Index (Measured over length of core run)
NI	Non intact
AVG	Average distance between fractures
MAX	Maximum distance between fractures
MIN	Minimum distance between fractures

GROUNDWATER

Strike

Level after standing

IN-SITU TESTING

N	Standard Penetration Test - Blows required to drive 300mm after seating drive
C	Standard Penetration Test - 60Cone
S	Standard Penetration Test – Split Spoon

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation

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Drilled By	KC		Borehole No.	**BH01A**	
Logged By	VS			Sheet 1 of 1	
Project Name	Carriganarra LRD - Site Investigation	**Project No.**	P24077	**Co-ords**	560063.67E - 569707.66N
Hole Type	CP				
Location	Ballincollig, Co. Cork			**Level**	15.97 m OD
Scale	1:50				
Client	Murnane O'Shea Ltd.			**Date**	24/07/2024 - 24/07/2024

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Firm, brown, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to medium, sub-angular to sub-rounded.
		0.00	SPT (C)	N=9 (2,2/3,2,2,2)				
		0.50	SPT (C)	N=8 (2,4/3,2,2,1)				
		1.00 - 2.00	B		1.00	14.97		Soft to firm and stiff at depth, purple, slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded with fine.
		1.00	SPT (C)	N=8 (2,1/2,2,2,2)				
		1.50	SPT (C)	N=7 (3,2/1,2,2,2)				
		2.00 - 2.50	B					
		2.00	SPT (C)	N=76 (5,5/14,13,24,25)				
					2.50	13.47		End of Borehole at 2.500m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
2.50	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.30	2.50	01:00	Chisel.

Remarks

Cable percussion borehole terminated at 2.50m bgl, refusal on broken limestone.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	24/07/2024 08:00	0.00	Start of shift.
Dry.	24/07/2024 18:00	2.50	End of borehole.

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Drilled By	KC	Borehole No.	**BH01B**
Logged By	VS		Sheet 1 of 1

Project Name	Carriganarra LRD - Site Investigation	**Project No.**	P24077	**Co-ords**	560117.64E - 569609.66N
Location	Ballincollig, Co. Cork			**Level**	16.00 m OD
Client	Murnane O'Shea Ltd.			**Date**	24/07/2024 - 25/07/2024

Hole Type	Scale
CP	1:50

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine.
		0.00	SPT (C)	N=12 (3,2/2,4,3,3)				
		0.50	SPT (C)	N=10 (4,3/2,2,3,3)				
		1.00 - 2.00	B		1.00	15.00		Soft, brown, slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is fine.
		1.00	SPT (C)	N=7 (2,2/1,2,2,2)				
		1.50	SPT (C)	N=11 (4,3/2,2,4,3)				
		2.00 - 3.00	B					
		2.00	SPT (C)	N=10 (2,2/1,2,3,4)				
		3.00 - 4.00	B		3.00	13.00		Soft becoming firm, brownish purple, slightly sandy CLAY. Sand is fine to coarse.
		3.00	SPT (C)	N=7 (3,2/2,1,2,2)				
		4.00 - 5.00	B					*4.00m: Locally very soft deposits*
		4.00	SPT (C)	N=0 (0,0/0,0,0,0)				
		5.00 - 6.00	B					
		5.00	SPT (C)	N=8 (2,2/2,1,2,3)				
		6.00 - 7.00	B		6.00	10.00		Brownish black purple, slightly sandy CLAY. Sand is fine to coarse.
		6.00	SPT (C)	N=10 (3,3/2,2,3,3)				
		7.00 - 8.00	B					
		7.00	SPT (C)	N=16 (2,2/2,4,5,5)				
		8.00	SPT (C)	25 (19,20/25 for 150mm)				
					8.30	7.70		End of Borehole at 8.300m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
8.30	200	200

Equipment Dando 2000.

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
8.20	8.30	01:00	Chisel.

Remarks

Cable percussion borehole terminated at 8.30m bgl, refusal on very hard gravel and angular cobbles.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	24/07/2024 08:00	0.00	Start of shift.
Dry	24/07/2024 18:00	5.00	End of shift.
Dry	25/07/2024 08:00	5.00	Start of shift.
Dry	25/07/2024 18:00	8.30	End of borehole.

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Drilled By	KC	Borehole No.	**BH02A**
Logged By	NS		Sheet 1 of 1

Project Name	Carriganarra LRD - Site Investigation	**Project No.**	P24077	**Co-ords**	560121.11E - 560122.00N
Location	Ballincollig, Co. Cork			**Level**	15.93 m OD
Client	Murnane O'Shea Ltd.			**Date**	18/07/2024 - 23/07/2024

Hole Type	Scale
CP	1:50

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Firm, pale brown, slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse.
		0.50	SPT (C)	N=12 (2,2/3,2,3,4)				
		1.00 - 2.00	B		1.00	14.93		Firm to stiff, pale brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		1.00	SPT (C)	N=16 (2,2/3,4,6,3)				
		1.50	SPT (C)	N=9 (2,2/1,2,3,3)				
		2.00 - 3.00	B					
		2.00	SPT (C)	N=17 (4,3/4,3,6,4)				
		3.00 - 4.00	B		3.00	12.93		Dense, brown, slightly sandy slightly clayey GRAVEL with low to high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular with Limestone lithology. Cobbles are sub-angular to sub-rounded with Limestone lithology and between 63-300mm in diameter.
		3.00	SPT (C)	N=39 (2,2/2,11,12,14)				
		4.00 - 5.00	B					
		4.00	SPT (C)	N=46 (7,6/9,11,12,14)				
		5.00	SPT (C)	N=41 (11,9/9,9,12,11)	5.00	10.93		End of Borehole at 5.000m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
2.20	1.90	20		See shift data.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
5.00	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
5.30	5.30	01:00	Chisel.

Remarks

Cable percussion borehole terminated at 5.00m bgl, refusal on broken rock.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/07/2024 08:00	0.00	Start of shift.
Dry.	18/07/2024 18:00	1.00	End of shift.
Dry.	23/07/2024 08:00	1.00	Start of shift.
2.00	23/07/2024 18:00	5.00	End of borehole.

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Drilled By	Borehole No.
KC	**BH02B**
Logged By	Sheet 1 of 1
MH	

Project Name	Carriganarra LRD - Site Investigation	**Project No.** P24077	**Co-ords**	560154.47E - 569625.63N	**Hole Type** CP
Location	Ballincollig, Co. Cork		**Level**	15.72 m OD	**Scale** 1:50
Client	Murnane O'Shea Ltd.		**Date**	25/07/2024 - 26/07/2024	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00	SPT (C)	N=15 (2,3/4,4,3,4)				Soft to firm, greyish brown, SILT.
		0.50	SPT (C)	N=7 (2,2/2,1,2,2)				
		1.00	SPT (C)	N=12 (3,2/4,3,2,3)				
		1.50	SPT (C)	N=13 (4,4/3,3,4,3)				
		2.00	SPT (C)	N=7 (2,2/1,2,2,2)	2.00	13.72		Soft, purplish brown, slightly sandy SILT. Sand is fine.
		3.00	SPT (C)	N=0 (0,0/0,0,0,0)	3.00	12.72		Soft to firm, purplish brown, SILT.
		4.00	SPT (C)	N=9 (2,2/2,3,2,2)				
		5.00	SPT (C)	N=15 (2,2/3,4,4,4)				
		6.00	SPT (C)	N=55 (3,3/55 for 230mm)				*6.00m: Locally 'stiff' deposits.*
		6.40	SPT (C)	50 (25 for 0mm/50 for 0mm)	6.40	9.32		End of Borehole at 6.400m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
6.40	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
6.30	6.40	01:00	Chisel.

Remarks

Cable percussion borehole terminated at 6.40m bgl, refusal on dense angular gravel.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	25/07/2024 08:00	0.00	Start of shift.
Dry	25/07/2024 18:00	5.00	End of shift.
Dry	26/07/2024 08:00	5.00	Start of shift.
Dry	26/07/2024 18:00	6.40	End of borehole.

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Drilled By	Borehole No.
KC	**BH03.5B**
Logged By	Sheet 1 of 1
MH	

Project Name	Carriganarra LRD - Site Investigation	**Project No.** P24077	**Co-ords**	560217.00E - 569708.00N	**Hole Type** CP
Location	Ballincollig, Co. Cork		**Level**	16.11 m OD	**Scale** 1:50
Client	Murnane O'Shea Ltd.		**Date**	08/08/2024 - 09/08/2024	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Soft, brown, slightly sandy SILT. Sand is fine.
		0.00	SPT (C)	N=2 (2,0/0,0,1,1)				
		0.50	SPT (C)	N=6 (0,0/0,2,2,2)				
		1.00 - 2.00	B					
		1.00	SPT (C)	N=5 (1,1/2,1,1,1)				
		1.50	SPT (C)	N=6 (2,2/1,2,1,2)				
		2.00 - 3.00	B		2.00	14.11		Firm, purplish brown, slightly sandy SILT. Sand is fine to coarse.
		2.00	SPT (C)	N=9 (1,1/2,3,2,2)				
		3.00 - 4.00	B					
		3.00	SPT (C)	N=11 (2,2/3,2,2,4)				
		4.00 - 5.00	B					
		4.00	SPT (C)	N=11 (0,1/2,3,2,4)				
		5.00 - 6.00	B		5.00	11.11		Stiff, brown, CLAY.
		5.00	SPT (C)	N=16 (5,4/6,5,3,2)				
		6.00	SPT (C)	34 (7,8/34 for 110mm)				
					6.30	9.81		End of Borehole at 6.300m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
6.30	200	200

Equipment Dando 2000.

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks

Cable percussion borehole terminated at 6.30m bgl, refusal on gravelly CLAY.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	08/08/2024 08:00	0.00	Start of shift.
	08/08/2024 18:00	5.00	End of shift.
	09/08/2024 08:00	5.00	Start of shift.
	09/08/2024 18:00	6.30	End of borehole.

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Drilled By	Borehole No.
KC	**BH03A**
Logged By	Sheet 1 of 1
MH	

Project Name	Carriganarra LRD - Site Investigation	**Project No.** P24077	**Co-ords**	560198.00E - 56746.06N	**Hole Type** CP
Location	Ballincollig, Co. Cork		**Level**	15.76 m OD	**Scale** 1:50
Client	Murnane O'Shea Ltd.		**Date**	26/07/2024 - 06/08/2024	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					(TOPSOIL) Soft to firm, brown, CLAY with rootlets.
		0.00	SPT (C)	N=8 (2,2/1,2,3,2)				
		0.50	SPT (C)	N=6 (2,1/1,1,2,2)				
		1.00 - 2.00	B		1.00	14.76		Firm, brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular.
		1.00	SPT (C)	N=13 (2,2/3,3,4,3)				
		1.50	SPT (C)	N=8 (3,2/1,2,3,2)				
		2.00 - 3.00	B		2.00	13.76		Stiff, purplish dark brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine, angular to sub-angular.
		2.00	SPT (C)	N=24 (4,3/4,7,7,6)				
		3.00	SPT (C)	N=28 (6,8/9,7,6,6)				
		3.80	SPT (C)	50 (19,22/50 for 0mm)	3.80	11.96		End of Borehole at 3.800m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
3.80	200	200

Equipment Dando 2000.

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.60	2.70	00:45	Chisel.
3.70	3.80	01:00	Chisel.

Remarks

Cable percussion borehole terminated at 3.80m bgl, refusal on angular gravel.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	26/07/2024 08:00	0.00	Start of shift.
Dry	26/07/2024 18:00	2.80	End of shift.
Dry	06/08/2024 08:00	2.80	Start of shift.
Dry	06/08/2024 18:00	3.80	End of borehole.

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Drilled By	Borehole No.
KC	**BH03B**
Logged By	Sheet 1 of 1
MH	

Project Name	Carriganarra LRD - Site Investigation	**Project No.** P24077	**Co-ords**	560203.42E - 569686.98N	**Hole Type** CP
Location	Ballincollig, Co. Cork		**Level**	16.11 m OD	**Scale** 1:50
Client	Murnane O'Shea Ltd.		**Date**	07/08/2024 - 07/08/2024	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown, slightly sandy slightly gravelly SILT with rootlets. Sand is fine to coarse. Gravel is coarse, angular with Limestone lithology.
		0.00	SPT (C)	N=5 (1,0/0,1,2,2)				
		0.50	SPT (C)	N=5 (1,1/0,2,2,1)				
		1.00 - 2.00	B		1.00	15.11		Soft, brown, slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular.
		1.00	SPT (C)	N=3 (1,1/0,1,1,1)				
		1.50	SPT (C)	N=2 (0,0/0,0,1,1)				
		2.00 - 3.00	B		2.00	14.11		Firm to stiff, greyish brown, slightly sandy CLAY. Sand is fine to coarse.
		2.00	SPT (C)	N=9 (1,1/1,1,2,5)				
		3.00 - 4.00	B					
		3.00	SPT (C)	N=14 (1,2/1,2,4,7)				
		4.00 - 5.00	B					
		4.00	SPT (C)	N=20 (6,6/6,5,5,4)				
		5.00 - 6.00	B					
		5.00	SPT (C)	N=13 (3,2/1,4,3,5)				
		6.00 - 7.00	B					
		6.00	SPT (C)	N=8 (1,1/2,2,2,2)				
		7.00 - 8.00	B		7.00	9.11		Loose to dense, blueish grey, slightly clayey sandy GRAVEL with high cobble content. Sand is coarse. Gravel is fine to coarse, angular to sub-angular. Cobbles are angular with Limestone lithology and between 63-150mm in diameter.
		7.00	SPT (C)	N=8 (2,6/3,1,2,2)				
		8.00	SPT (C)	N=35 (2,2/3,12,11,9)				
		8.50	SPT (C)	50 (25 for 0mm/50 for 0mm)	8.50	7.61		End of Borehole at 8.500m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
8.50	200	200

Equipment Dando 2000

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
8.40	8.50	01:00	Chisel.

Remarks

Cable percussion borehole terminated at 8.50m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	07/08/2024 08:00	0.00	Start of shift.
Dry	07/08/2024 18:00	8.50	End of borehole.

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Drilled By	KC	Borehole No.	**BH04B**
Logged By	MH		Sheet 1 of 1

Project Name	Carriganarra LRD - Site Investigation	**Project No.**	P24077	**Co-ords**	560235.00E - 569738.00N
Location	Ballincollig, Co. Cork			**Level**	15.71 m OD
Client	Murnane O'Shea Ltd.			**Date**	06/08/2024 - 06/08/2024

Hole Type: CP
Scale: 1:50

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown, CLAY with rootlets.
		1.00 - 2.00 1.00	B SPT (C)	N=9 (1,2/2,2,2,3)	1.00	14.71		Firm to stiff, brown, slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular.
		2.00 - 3.00 2.00	B SPT (C)	N=12 (3,2/2,3,3,4)	2.00	13.71		Firm, brown, slightly sandy CLAY. Sand is fine to coarse.
		3.00	SPT (C)	50 (43 for 75mm/50 for 0mm)	3.00	12.71		End of Borehole at 3.000m

Groundwater

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
3.00	200	200

Equipment: Dando 2000.

Chiselling Details

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.95	3.00	01:00	Chisel.

Remarks

Cable percussion borehole terminated at 3.00m bgl, refusal.

Shift Data

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	06/08/2024 08:00	0.00	Start of shift.
Dry	06/08/2024 18:00	3.00	End of borehole.

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Drilled By	AK & DmG	**Location**	**RC-BH02A**
Logged By	MH		Sheet 1 of 1

Project Name	Carriganarra LRD - Site Investigation	**Project No.**	P24077	**Co-ords**	560122.25E - 569721.00N
Location	Ballincollig, Co. Cork			**Level**	16.04 m OD
Client	Murnane O'Shea Ltd.			**Date**	25/02/2025 - 26/02/2025

Hole Type: RC
Scale: 1:50

Backfill	Water Strike (m bgl)	Sampling and In-Situ Testing: Depth (m bgl)	Type	Results	Coring %: TCR	SCR	RQD	Fl/ Run	Spacing (mm)	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
													Open hole drilling; driller describes silty gravelly CLAY.
										5.50	10.54		Open hole drilling; driller describes weathered bedrock. Lithology presumed to be the same as below.
		6.00 - 7.55			100	68	17	17	30mm min 450mm max 170mm avg	6.00	10.04		Lithology; Medium strong, blue, LIMESTONE. Weathering; Lightly to moderately weathered. Oxidation discolouration present on fracture surfaces. Clay accretion present on fracture surfaces. Evidence of limestone dissolution present. Fracture Sets; 2 sets observed. Set 1 is dipping 70-80 degrees with planar, smooth fracture surfaces and moderate spacing. Set 2 is dipping 60 degrees with undulating, smooth fracture surfaces and wide spacing.
		7.55 - 9.10			90	43	32	8	20mm min 160mm max 100mm avg				
					TCR	SCR	RQD			9.10	6.94		End of Borehole at 9.100m

Shift Data

Date & Time	Depth (m bgl)	Water (m bgl)	Remarks
25/02/2025 08:00	0.00		Start of shift.
25/02/2025 18:00	6.00	0	End of shift.
26/02/2025 08:00	6.00	0	Start of shift.
26/02/2025 18:00	9.10	0.5	End of borehole.

Chiselling Details

Top (m bgl)	Base (m bgl)	Duration (hh:mm)	Tool

Plant: Soilmec PSM
Method: Compressed air mist

Hole Details: Depth (m)	Hole Details: Diameter (mm)	Casing Details: Depth (m)	Casing Details: Diameter (mm)
6.00	131	6.00	131
9.10	76		

Remarks

Rotary borehole terminated at 9.10m bgl. Reached required depth. 50mm standpipe installed. Response zone from 6.00m to 9.00m bgl.

Groundwater Details

Strike (m bgl)	Rose (m bgl)	After (Mins)	Remarks
			See shift data.

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Project Name	Carriganarra LRD - Site Investigation	Project No.	Co-ords	Hole Type
		P24077	560047.67E - 569952.00N	RC
Location	Ballincollig, Co. Cork	**Level**	21.65 m OD	**Scale** 1:50
Client	Murnane O'Shea Ltd.	**Date**	19/02/2025 - 19/02/2025	

Backfill	Water Strike (m bgl)	Sampling and In-Situ Testing: Depth (m bgl)	Type	Results	Coring %: TCR	SCR	RQD	Fl/ Run	Spacing (mm)	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
													Open hole drilling; driller describes CLAY with boulder content.
		1.50	SPT(C)	50 (10,18/50 for 80mm)									
		1.90 - 3.40			100	69	55	12	70mm min 370mm max 240mm avg	1.90	19.75		Lithology; Very strong, blue, LIMESTONE. Weathering; Moderately to heavily weathered. Oxidation discolouration present on fracture surfaces. Clay accretion present on fracture surfaces. Evidence of limestone dissolution present around fractures. Fracture Sets; 3 sets observed. Set 1 is dipping 90 degrees with planar, smooth fracture surfaces and moderate spacing. Set 2 is dipping 70-80 degrees with planar, rough fracture surfaces with moderate spacing. Set 3 is dipping 0 degrees with planar, smooth fracture surfaces and moderate spacing. *Rock is weak.*
		3.40 - 3.80			100	0	0						
		3.80 - 4.90			100	36	12	15	50mm min 200mm max 100mm avg				
		4.90 - 6.40			100	47	28	16	80mm min 300mm max 150mm avg	6.40	15.25		End of Borehole at 6.400m
					TCR	SCR	RQD						

Shift Data				Chiselling Details				Plant	Soilmec PSM
Date & Time	Depth (m bgl)	Water (m bgl)	Remarks	Top (m bgl)	Base (m bgl)	Duration (hh:mm)	Tool	Method	Compressed air mist
19/02/2025 08:00	0.00		Start of shift.					Hole Details	Casing Details
19/02/2025 18:00	6.40	5.2	End of borehole.					Depth (m) / Diameter (mm)	Depth (m) / Diameter (mm)
								1.90 / 131	1.90 / 131
								6.40 / 76	

Remarks	Groundwater Details			
	Strike (m bgl)	Rose (m bgl)	After (Mins)	Remarks
Rotary borehole terminated at 6.40m bgl. Reached required depth. 50mm standpipe installed. Response zone from 3.40m to 6.40m bgl.				See shift data.

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Project Name	Carriganarra LRD - Site Investigation	Project No.	Co-ords	Hole Type
		P24077	559907.04E - 569871.00N	RC
Location	Ballincollig, Co. Cork	**Level**	18.77 m OD	**Scale** 1:50
Client	Murnane O'Shea Ltd.	**Date**	20/02/2025 - 20/02/2025	

Backfill	Water Strike (m bgl)	Sampling and In-Situ Testing: Depth (m bgl)	Type	Results	Coring %: TCR	SCR	RQD	Fl/ Run	Spacing (mm)	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
													Open hole drilling; driller describes CLAY with boulder content.
		2.00											
		2.00 - 3.10	SPT(C)	50 (25 for 75mm/50 for 0mm)	100	36	16	14	30mm min 200mm max 100mm avg	2.00	16.77		Lithology; Medium strong, blue, LIMESTONE. Weathering; Lightly weathered. Slight oxidation discolouration present on fracture surfaces. Fracture Sets; 2 sets observed. Set 1 is dipping 70 degrees with planar, stepped fracture surfaces and moderate spacing. Set 2 is dipping 90 degrees with planar, smooth fracture surfaces and moderate spacing. *Calcite veining present throughout core.*
		3.10 - 4.60			100	90	50	11	30mm min 400mm max 180mm avg				
		4.60 - 5.70			100	84	63	10	50mm min 270mm max 250mm avg	5.70	13.07		End of Borehole at 5.700m
					TCR	SCR	RQD						

Shift Data				Chiselling Details				Plant	Soilmec PSM
Date & Time	Depth (m bgl)	Water (m bgl)	Remarks	Top (m bgl)	Base (m bgl)	Duration (hh:mm)	Tool	Method	Compressed air mist
20/02/2025 08:00	0.00		Start of shift.					Hole Details	Casing Details
20/02/2025 18:00	5.70	2.5	End of borehole.					Depth (m) / Diameter (mm)	Depth (m) / Diameter (mm)
								2.00 / 131	2.00 / 131
								5.70 / 76	

Remarks	Groundwater Details			
	Strike (m bgl)	Rose (m bgl)	After (Mins)	Remarks
Rotary borehole terminated at 5.70m bgl. Reached required depth. 50mm standpipe installed. Response zone from 2.70m to 5.70m bgl.				See shift data.

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Drilled By	Location
AK & DmG	**RC-BH07**
Logged By	Sheet 1 of 1
MH	

Project Name	Carriganarra LRD - Site Investigation	**Project No.** P24077	**Co-ords**	560268.84E - 569825.82N	**Hole Type** RC
Location	Ballincollig, Co. Cork		**Level**	16.14 m OD	**Scale** 1:50
Client	Murnane O'Shea Ltd.		**Date**	24/02/2025 - 24/02/2025	

Backfill	Water Strike (m bgl)	Sampling and In-Situ Testing: Depth (m bgl)	Type	Results	Coring %: TCR	SCR	RQD	Fl/ Run	Spacing (mm)	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		1.50	SPT(C)	N=23 (4,5/5,6,6,6)						1.50	14.64		Open hole drilling; driller describes TOPSOIL.
		2.80 2.80 - 4.30	SPT(C)	50 (7,10/50 for 225mm)						2.80	13.34		Open hole drilling; driller describes extremely weathered bedrock. Lithology presumed to be the same as below.
		4.30 - 5.80			77	30	15	19	20mm min 148mm max 130mm avg				Lithology; Strong, light blue, LIMESTONE. Weathering; Moderately weathered. Oxidation discolouration present on fracture surfaces. Evidence of limestone dissolution around fracture surfaces. Fracture Sets; 2 sets observed. Set 1 is dipping 90 degrees with undulating, rough fracture surfaces and moderate spacing. Set 2 is dipping 60-70 degrees with planar, smooth fracture surfaces and moderate spacing.
		5.80 - 6.90			53	7	0	8	50mm min 110mm max 100mm avg				
					91	0	0			6.90	9.24		End of Borehole at 6.900m
					TCR	SCR	RQD						

Shift Data

Date & Time	Depth (m bgl)	Water (m bgl)	Remarks
24/02/2025 08:00	0.00		Start of shift.
24/02/2025 18:00	6.90	Dry	End of borehole.

Chiselling Details

Top (m bgl)	Base (m bgl)	Duration (hh:mm)	Tool

Plant	Soilmec PSM
Method	Compressed air mist

Hole Details		Casing Details	
Depth (m)	Diameter (mm)	Depth (m)	Diameter (mm)
2.80	131	2.80	131
6.90	76		

Remarks

Rotary borehole terminated at 6.90m bgl. Reached required depth. 50mm standpipe installed. Response zone from 2.50m to 5.50m bgl.

Groundwater Details

Strike (m bgl)	Rose (m bgl)	After (Mins)	Remarks
			Dry

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Drilled By	Location
AK & DmG	**RC-BH09**
Logged By	Sheet 1 of 1
MH	

Project Name	Carriganarra LRD - Site Investigation	**Project No.** P24077	**Co-ords**	559928.83E - 569990.94N	**Hole Type** RC
Location	Ballincollig, Co. Cork		**Level**	21.65 m OD	**Scale** 1:50
Client	Murnane O'Shea Ltd.		**Date**	21/02/2025 - 21/02/2025	

Backfill	Water Strike (m bgl)	Sampling and In-Situ Testing: Depth (m bgl)	Type	Results	Coring %: TCR	SCR	RQD	Fl/ Run	Spacing (mm)	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
													Open hole drilling; driller describes CLAY with boulder content.
		1.50 1.50 - 2.10	SPT(C)	50 (25 for 50mm/50 for 25mm)	50	0	0			1.50	20.15		Lithology; Strong, blue, LIMESTONE. Weathering; Moderately weathered. Core is brecciated intermittently. Evidence of limestone dissolution present on fracture surfaces. Fracture Sets; 3 sets observed. Set 1 is dipping 50 degrees with planar, undulating fracture surfaces and wide spacing. Set 2 is dipping 90 degrees with planar, smooth fracture surfaces and wide spacing. Set 3 is dipping 70-80 degrees with stepped, rough fracture surfaces and wide spacing.
		2.10 - 2.90			63	6	0						
		2.90 - 3.30			100	0	0						
		3.30 - 3.90			100	45	18	7	40mm min 160mm max 110mm avg				
		3.90 - 4.80			89	0	0						
		4.80 - 5.60			100	50	16	9	70mm min 220mm max 210mm avg	5.60	16.05		End of Borehole at 5.600m
					TCR	SCR	RQD						

Shift Data

Date & Time	Depth (m bgl)	Water (m bgl)	Remarks
21/02/2025 08:00	0.00		Start of shift.
21/02/2025 18:00	5.60	Dry	End of shift.

Chiselling Details

Top (m bgl)	Base (m bgl)	Duration (hh:mm)	Tool

Plant	Soilmec PSM
Method	Compressed air mist

Hole Details		Casing Details	
Depth (m)	Diameter (mm)	Depth (m)	Diameter (mm)
1.50	131	1.50	131
5.60	76		

Remarks

Rotary borehole terminated at 5.60m bgl. Reached required depth.

Groundwater Details

Strike (m bgl)	Rose (m bgl)	After (Mins)	Remarks
			Dry

KEY TO SYMBOLS ON LAB RESULTS

U	Undisturbed Sample
P	Piston Sample
TWS	Thin Wall Sample
B	Bulk Sample - Disturbed
D	Jar Sample - Disturbed
W	Water Sample
pH	Acidity/Alkalinity Index
SO_3	% - Total Sulphate Content (acid soluble)
SO_3	g/ltr - Water Soluble Sulphate (Water or 2:1 Aqueous Soil Extract)
+	Calcareous Reaction
Cl	Chloride Content
PI	Plasticity Index
<425	% of material in sample passing 425 micron sieve
LL	Liquid Limit
PL	Plastic Limit
MC	Water Content
NP	Non Plastic
Yb	Bulk Density
Yd	Dry Density
Ps	Particle Density
U/D	Undrained/Drained Triaxial
U/C	Unconsolidated/Consolidated Triaxial
T/M	Single Stage/Multistage Triaxial
100/38	Sample Diameter (mm)
REM	Remoulded Triaxial Test Specimen
TST	Triaxial Suction Test
V	Vane Test
DSB	Drained Shear Box
RSB	Residual Shear Box
RS	Ring Shear σ_3 Cell Pressure
σ_1-σ_3	Deviator Stress
c	Cohesion
c_	Effective Cohesion Intercept ϕ
ϕ_	Effective Angle of Shearing Resistance εf
p_o	Effective Overburden Pressure m_v Coefficient of Volume
c_v	Coefficient of Consolidation
Std	Standard Compaction - 2.5kg Rammer
Hvy	Heavy Compaction - 4.5kg Rammer
Vib	Vibratory Compaction
CBR	California Bearing Ratio
MCV	Moisture Condition Value

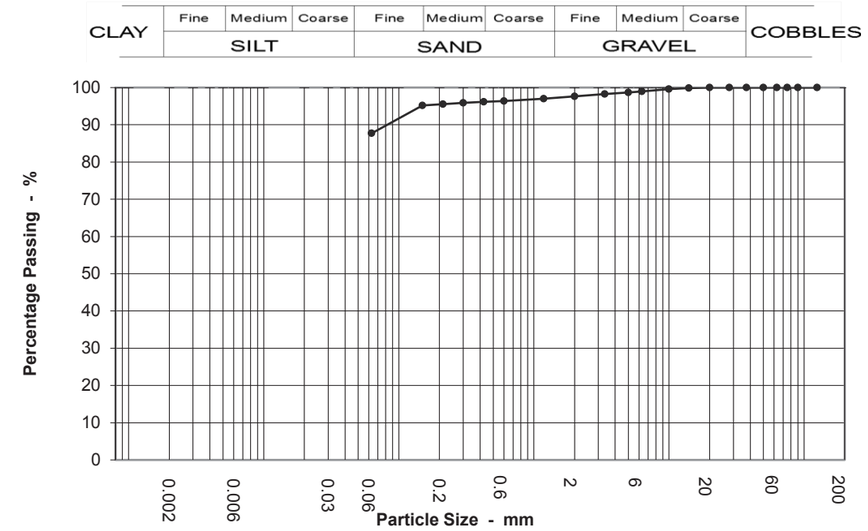
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PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P24077**
		Borehole / Pit No	BH01A
Location	**Carriganarra LRD**	Sample No	3
		Depth	2.00 m
Soil Description	Slightly gravelly slightly sandy CLAY	Sample type	B



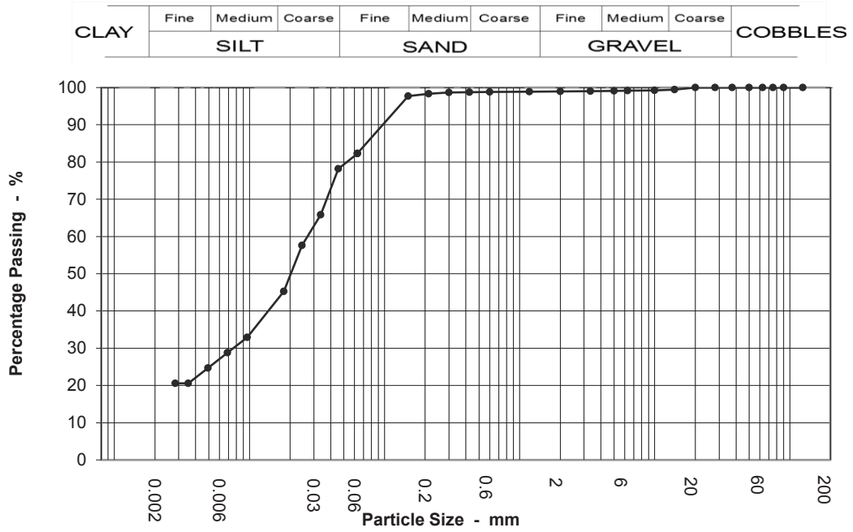
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	98		
2	98		
1.18	97		
0.6	96		
0.425	96		
0.3	96		
0.212	96		
0.15	95		
0.063	88		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	2.0
Sand	10.0
Silt & Clay	88.0

Grading Analysis	
D100	20.00
D60	
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH01B
Location	Carriganarra LRD	Sample No	3
		Depth	2.00 m
Soil Description	Slightly gravelly slightly sandy CLAY	Sample type	B



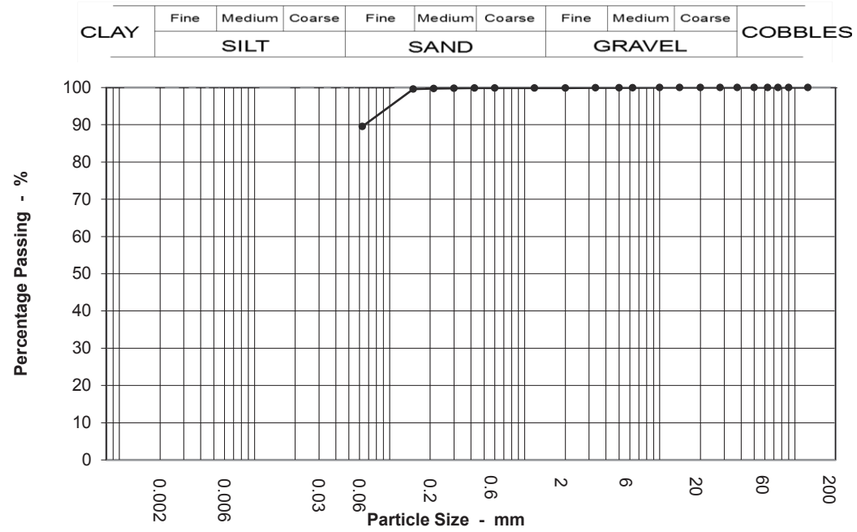
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
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90	100	0.045	78
75	100	0.034	66
63	100	0.024	58
50	100	0.018	45
37.5	100	0.010	33
28	100	0.007	29
20	100	0.005	25
14	99	0.004	21
10	99	0.003	21
6.3	99	0.002	16
5	99		
3.35	99		
2	99		
1.18	99		
0.6	99		
0.425	99		
0.3	99		
0.212	98		
0.15	98		
0.063	82		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	1.0
Sand	17.0
Silt	64.0
Clay	18.0

Grading Analysis	
D100	20.00
D60	0.03
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH01B
Location	Carriganarra LRD	Sample No	4
		Depth	3.00 m
Soil Description	Slightly sandy CLAY	Sample type	B



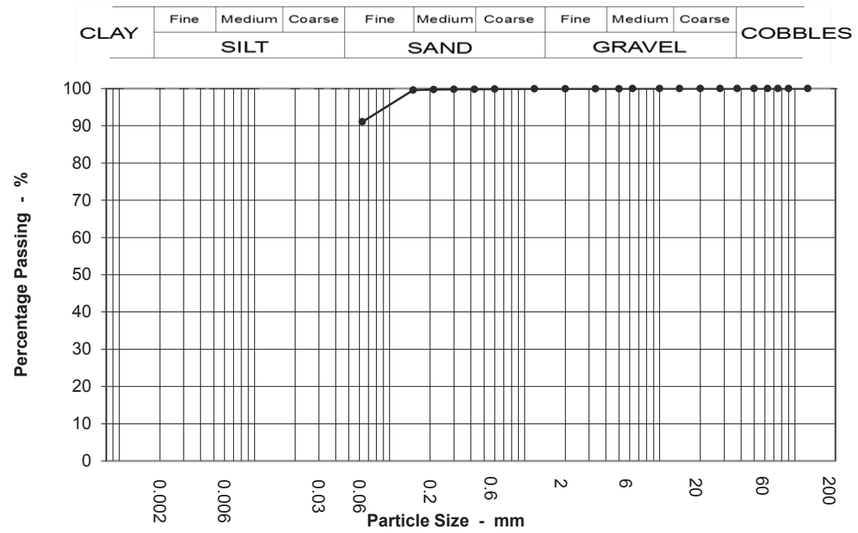
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	100		
0.063	90		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	10.0
Silt & Clay	90.0

Grading Analysis	
D100	10.00
D60	
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P24077**
		Borehole / Pit No	BH01B
Location	**Carriganarra LRD**	Sample No	5
		Depth	4.00 m
Soil Description	Slightly sandy CLAY	Sample type	B



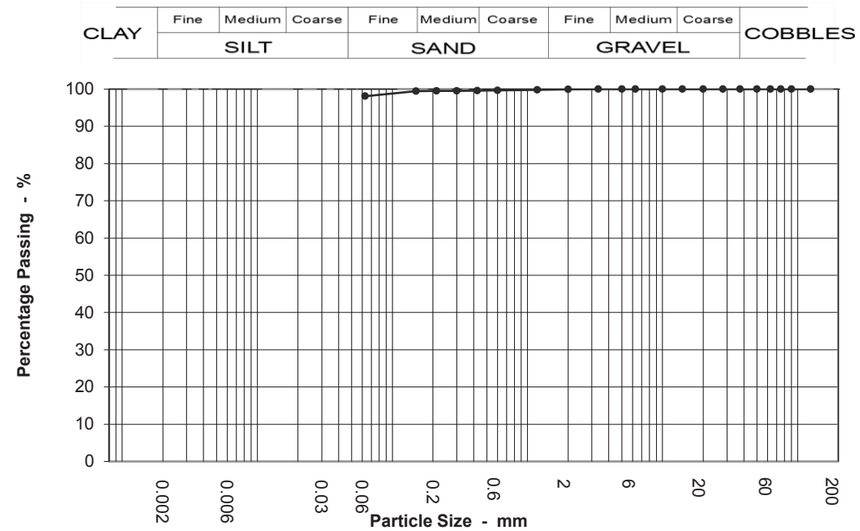
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	100		
0.063	91		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	9.0
Silt & Clay	91.0

Grading Analysis	
D100	10.00
D60	
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P24077**
		Borehole / Pit No	BH01B
Location	**Carriganarra LRD**	Sample No	6
		Depth	5.00 m
Soil Description	Slightly sandy CLAY	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	99		
0.15	99		
0.063	98		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

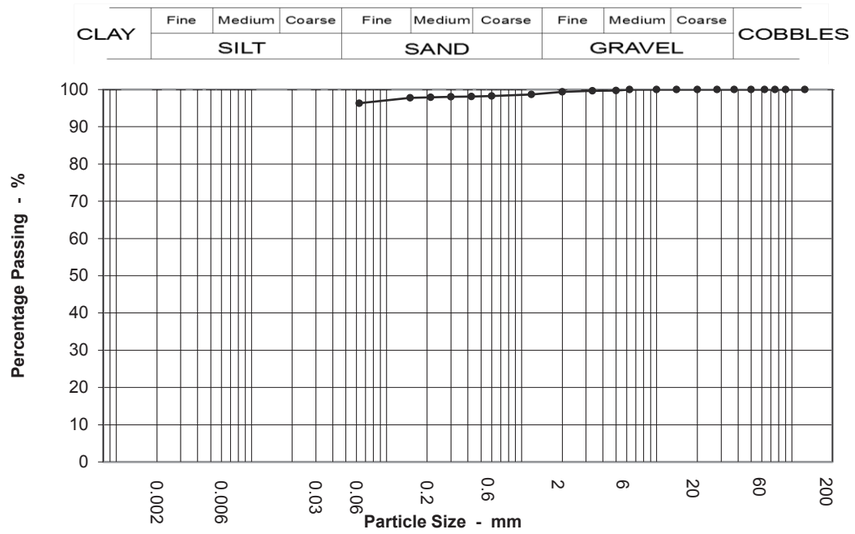
Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	2.0
Silt & Clay	98.0

Grading Analysis	
D100	5.00
D60	
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P24077**
		Borehole / Pit No	BH01B
Location	**Carriganarra LRD**	Sample No	7
		Depth	6.00 m
Soil Description	Slightly gravelly slightly sandy CLAY	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	98		
0.425	98		
0.3	98		
0.212	98		
0.15	98		
0.063	96		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

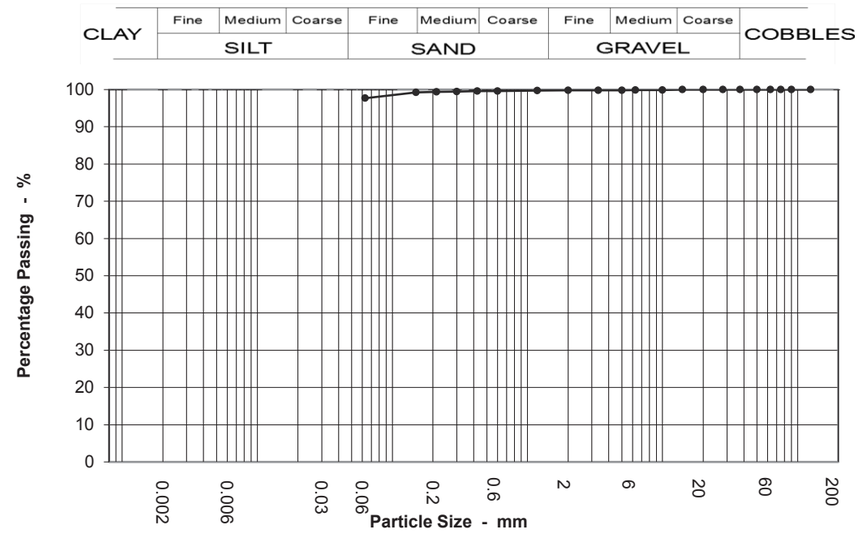
Sample Proportions	
Cobbles	0.0
Gravel	1.0
Sand	3.0
Silt & Clay	96.0

Grading Analysis	
D100	6.30
D60	
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P24077**
		Borehole / Pit No	BH01B
Location	**Carriganarra LRD**	Sample No	8
		Depth	7.00 m
Soil Description	Slightly sandy CLAY	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	99		
0.15	99		
0.063	98		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

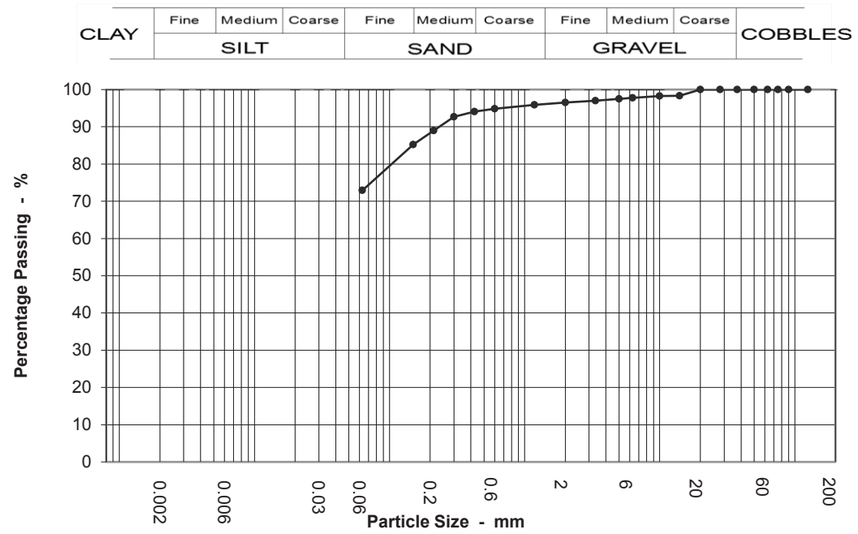
Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	2.0
Silt & Clay	98.0

Grading Analysis	
D100	14.00
D60	
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P24077**
		Borehole / Pit No	BH02A
Location	**Carriganarra LRD**	Sample No	1
		Depth	0.00 m
Soil Description	Slighly gravelly slightly sandy CLAY	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	98		
10	98		
6.3	98		
5	98		
3.35	97		
2	97		
1.18	96		
0.6	95		
0.425	94		
0.3	93		
0.212	89		
0.15	85		
0.063	73		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

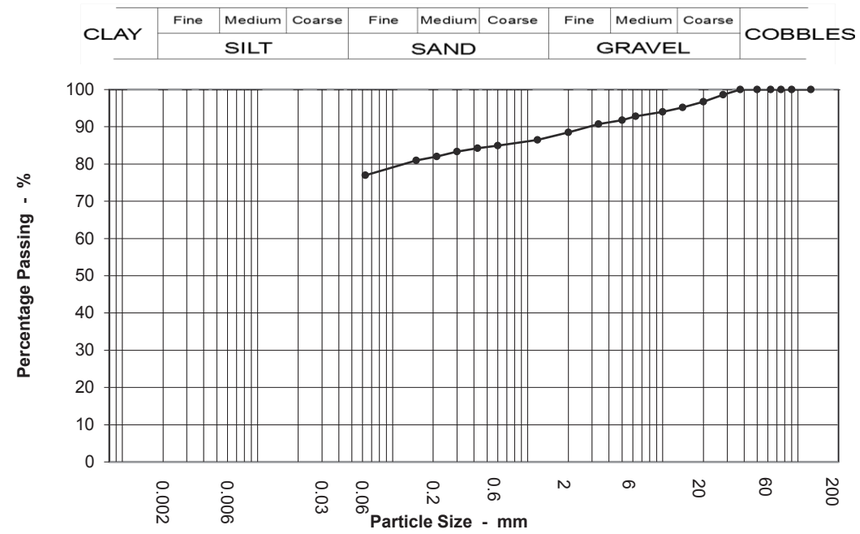
Sample Proportions	
Cobbles	0.0
Gravel	3.0
Sand	24.0
Silt & Clay	73.0

Grading Analysis	
D100	20.00
D60	
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P24077**
		Borehole / Pit No	BH02A
Location	**Carriganarra LRD**	Sample No	2
		Depth	1.00 m
Soil Description	Slightly sandy slightly gravelly CLAY	Sample type	B



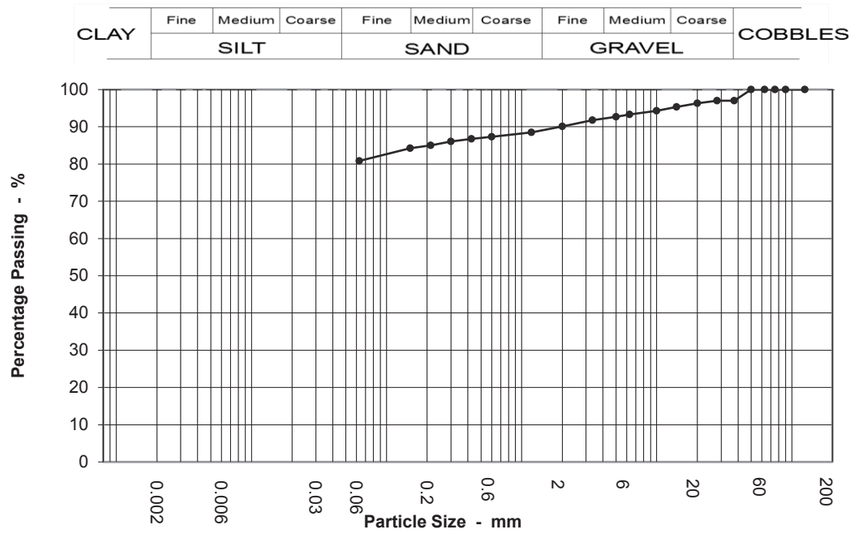
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	99		
20	97		
14	95		
10	94		
6.3	93		
5	92		
3.35	91		
2	88		
1.18	86		
0.6	85		
0.425	84		
0.3	83		
0.212	82		
0.15	81		
0.063	77		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	12.0
Sand	12.0
Silt & Clay	77.0

Grading Analysis	
D100	37.50
D60	
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH02A
Location	**Carriganarra LRD**	Sample No	3
		Depth	2.00 m
Soil Description	Slightly sandy sightly gravelly CLAY	Sample type	B



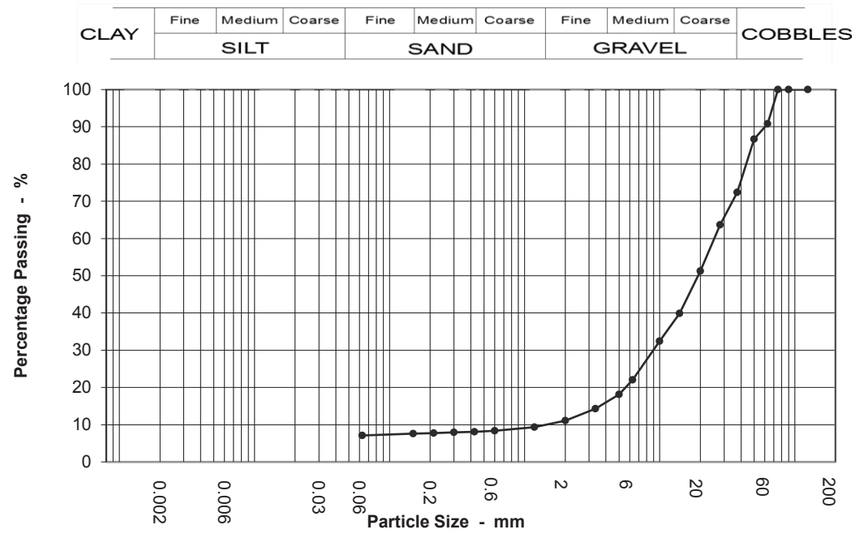
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	97		
20	96		
14	95		
10	94		
6.3	93		
5	93		
3.35	92		
2	90		
1.18	89		
0.6	87		
0.425	87		
0.3	86		
0.212	85		
0.15	84		
0.063	81		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	10.0
Sand	9.0
Silt & Clay	81.0

Grading Analysis	
D100	50.00
D60	
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH02A
Location	**Carriganarra LRD**	Sample No	4
		Depth	3.00 m
Soil Description	Slightly sandy slightly clayey GRAVEL with low cobble conttent	Sample type	B



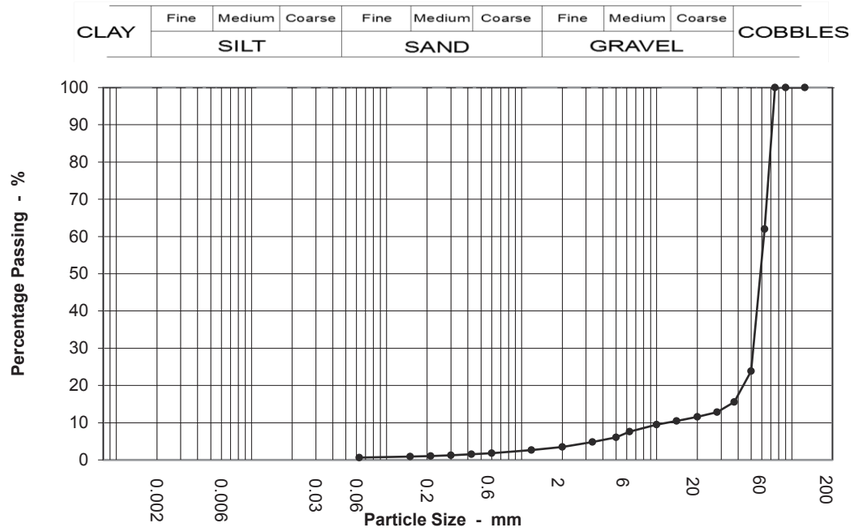
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	91		
50	87		
37.5	72		
28	64		
20	51		
14	40		
10	32		
6.3	22		
5	18		
3.35	14		
2	11		
1.18	9		
0.6	8		
0.425	8		
0.3	8		
0.212	8		
0.15	8		
0.063	7		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	9.0
Gravel	80.0
Sand	4.0
Silt & Clay	7.0

Grading Analysis	
D100	75.00
D60	25.40
D10	1.43
Uniformity Coefficient	18.00

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH02A
Location	**Carriganarra LRD**	Sample No	5
		Depth	4.00 m
Soil Description	Slightly clayey slightly sandy GRAVEL with high cobble content	Sample type	B



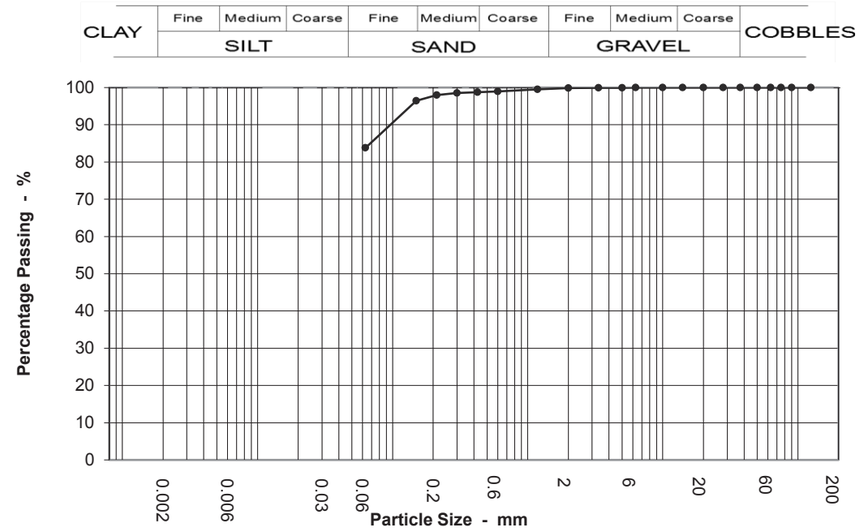
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	62		
50	24		
37.5	16		
28	13		
20	12		
14	10		
10	9		
6.3	8		
5	6		
3.35	5		
2	4		
1.18	3		
0.6	2		
0.425	2		
0.3	1		
0.212	1		
0.15	1		
0.063	1		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	38.0
Gravel	59.0
Sand	3.0
Silt & Clay	1.0

Grading Analysis	
D100	75.00
D60	62.20
D10	12.00
Uniformity Coefficient	5.20

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH03.5
Location	**Carriganarra LRD**	Sample No	2
		Depth	1.00 m
Soil Description	Slightly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	99		
0.3	99		
0.212	98		
0.15	96		
0.063	84		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

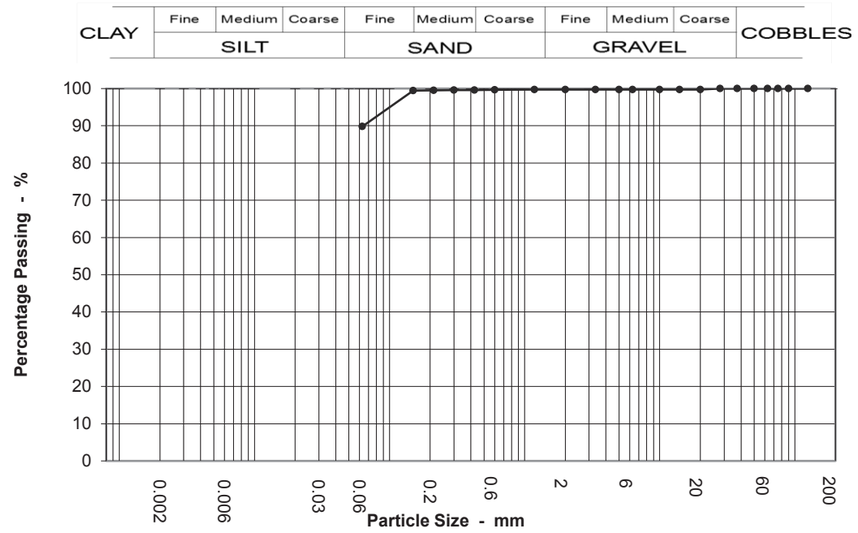
Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	16.0
Silt & Clay	84.0

Grading Analysis	
D100	6.30
D60	
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P24077**
		Borehole / Pit No	BH03.5
Location	**Carriganarra LRD**	Sample No	3
		Depth	2.00 m
Soil Description	Slightly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	99		
0.063	90		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

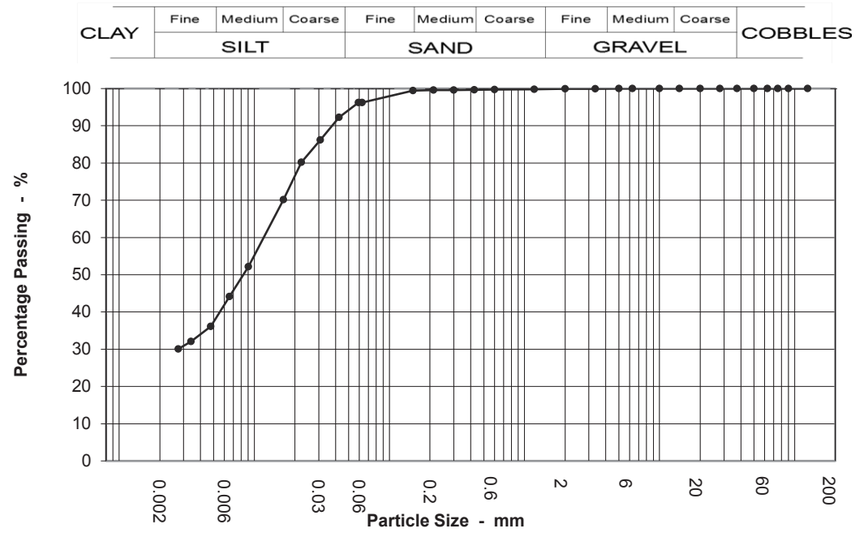
Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	10.0
Silt & Clay	90.0

Grading Analysis	
D100	28.00
D60	
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P24077**
		Borehole / Pit No	BH03.5
Location	**Carriganarra LRD**	Sample No	4
		Depth	3.00 m
Soil Description	Slightly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	96
90	100	0.042	92
75	100	0.031	86
63	100	0.022	80
50	100	0.016	70
37.5	100	0.009	52
28	100	0.007	44
20	100	0.005	36
14	100	0.003	32
10	100	0.003	30
6.3	100	0.001	22
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	99		
0.063	96		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

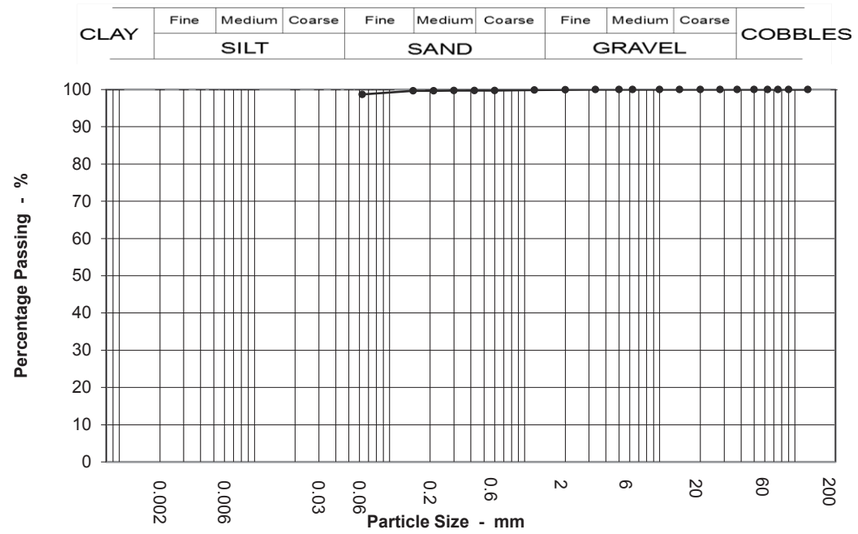
Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	4.0
Silt	70.0
Clay	26.0

Grading Analysis	
D100	5.00
D60	0.01
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P24077**
		Borehole / Pit No	BH03.5
Location	**Carriganarra LRD**	Sample No	5
		Depth	4.00 m
Soil Description	Slightly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	100		
0.063	99		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

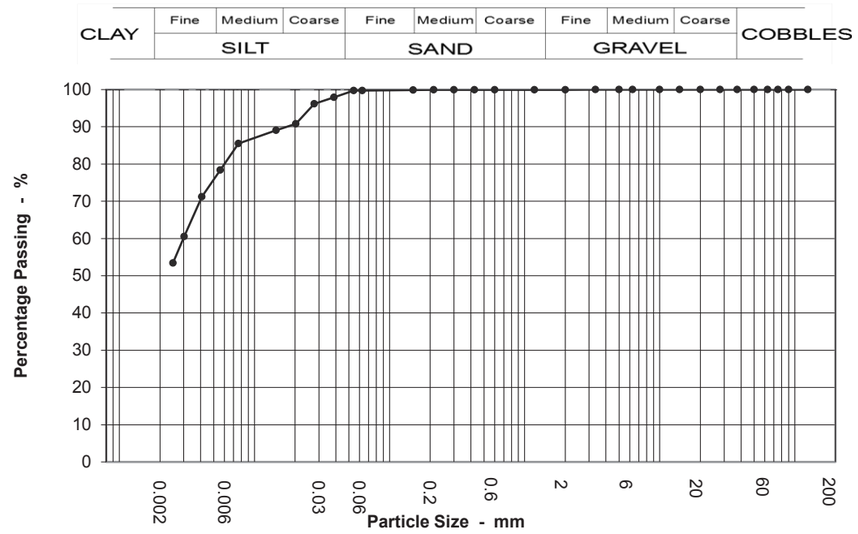
Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	1.0
Silt & Clay	99.0

Grading Analysis	
D100	5.00
D60	
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P24077**
		Borehole / Pit No	BH03.5
Location	**Carriganarra LRD**	Sample No	6
		Depth	5.00 m
Soil Description	CLAY	Sample type	B



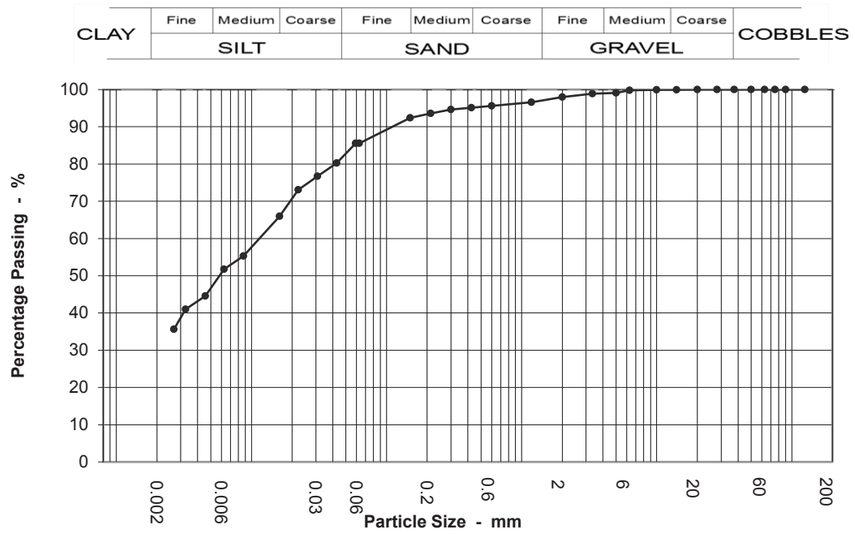
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.054	100
90	100	0.039	98
75	100	0.028	96
63	100	0.020	91
50	100	0.014	89
37.5	100	0.008	85
28	100	0.006	78
20	100	0.004	71
14	100	0.003	61
10	100	0.002	53
6.3	100	0.001	36
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	100		
0.063	100		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	0.0
Silt	53.0
Clay	46.0

Grading Analysis	
D100	5.00
D60	0.00
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH03A
Location	**Carriganarra LRD**	Sample No	2
		Depth	1.00 m
Soil Description	Slightly gravelly slightly sandy CLAY	Sample type	B



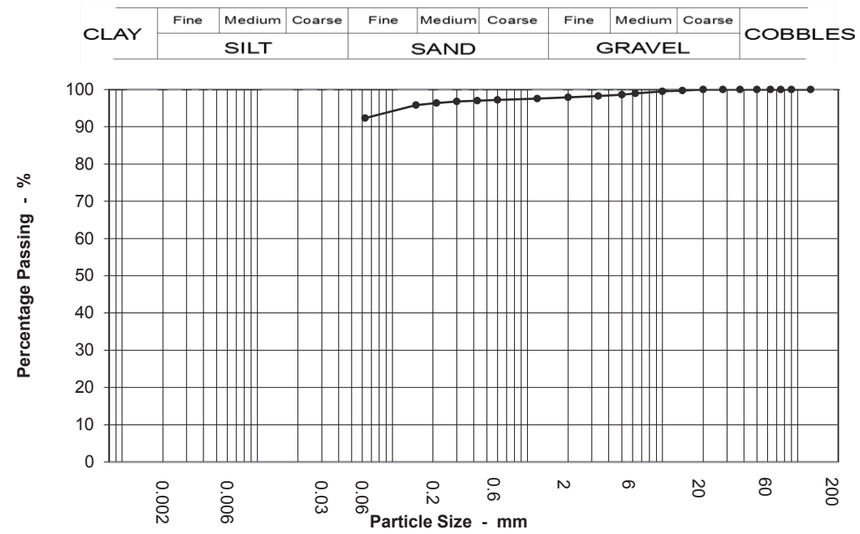
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	86
90	100	0.043	80
75	100	0.031	77
63	100	0.022	73
50	100	0.016	66
37.5	100	0.009	55
28	100	0.006	52
20	100	0.005	45
14	100	0.003	41
10	100	0.003	36
6.3	100	0.001	27
5	99		
3.35	99		
2	98		
1.18	97		
0.6	96		
0.425	95		
0.3	95		
0.212	94		
0.15	92		
0.063	86		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	2.0
Sand	12.0
Silt	54.0
Clay	31.0

Grading Analysis	
D100	20.00
D60	0.01
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH03A
Location	**Carriganarra LRD**	Sample No	3
		Depth	2.00 m
Soil Description	Slightly gravelly slightly sandy CLAY	Sample type	B



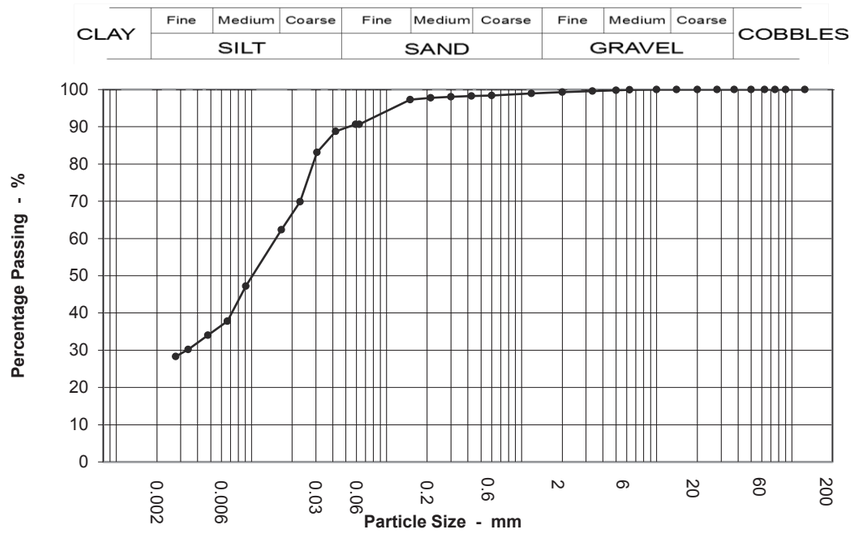
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	99		
6.3	99		
5	99		
3.35	98		
2	98		
1.18	98		
0.6	97		
0.425	97		
0.3	97		
0.212	96		
0.15	96		
0.063	92		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	2.0
Sand	6.0
Silt & Clay	92.0

Grading Analysis	
D100	20.00
D60	
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH03B
Location	**Carriganarra LRD**	Sample No	2
		Depth	1.00 m
Soil Description	Slightly gravelly slightly sandy CLAY	Sample type	B



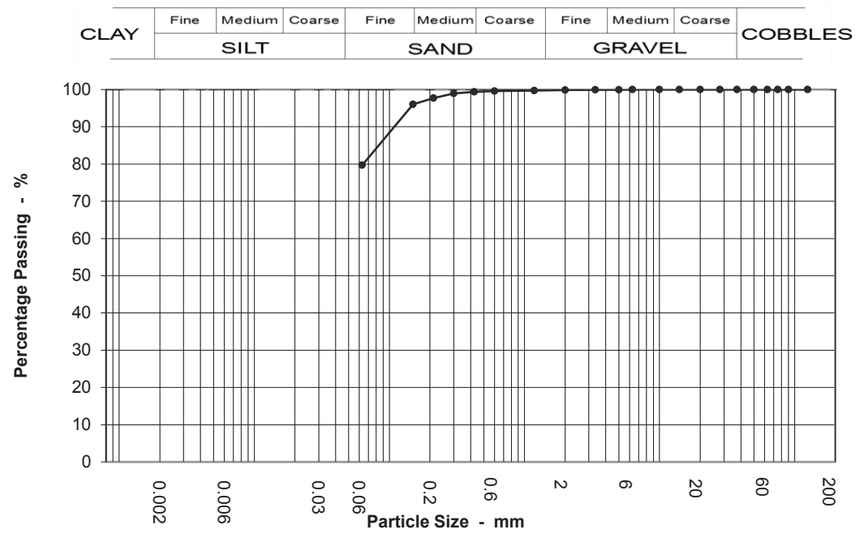
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	91
90	100	0.042	89
75	100	0.031	83
63	100	0.023	70
50	100	0.017	62
37.5	100	0.009	47
28	100	0.007	38
20	100	0.005	34
14	100	0.003	30
10	100	0.003	28
6.3	100	0.001	25
5	100		
3.35	100		
2	99		
1.18	99		
0.6	98		
0.425	98		
0.3	98		
0.212	98		
0.15	97		
0.063	91		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	1.0
Sand	9.0
Silt	64.0
Clay	26.0

Grading Analysis	
D100	10.00
D60	0.02
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH03B
Location	**Carriganarra LRD**	Sample No	3
		Depth	2.00 m
Soil Description	Slightly sandy CLAY	Sample type	B



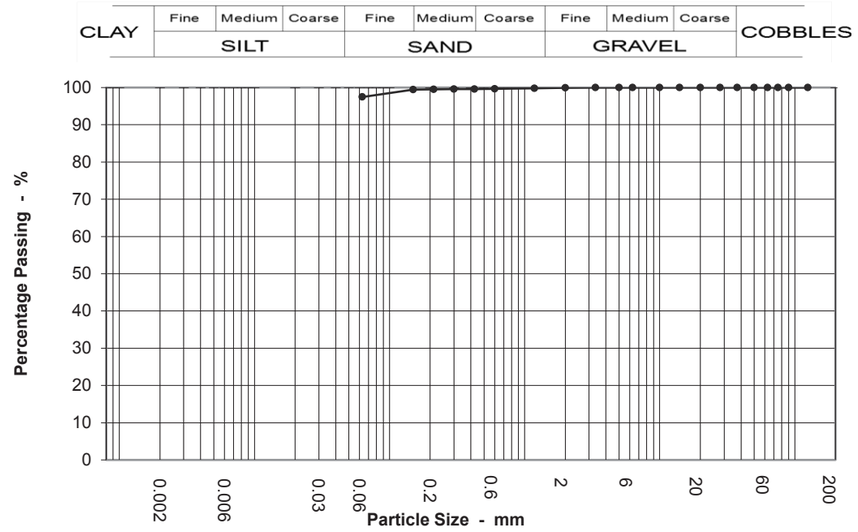
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	99		
0.212	98		
0.15	96		
0.063	80		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	20.0
Silt & Clay	80.0

Grading Analysis	
D100	10.00
D60	
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH03B
Location	Carriganarra LRD	Sample No	5
		Depth	4.00 m
Soil Description	Slightly sandy CLAY	Sample type	B



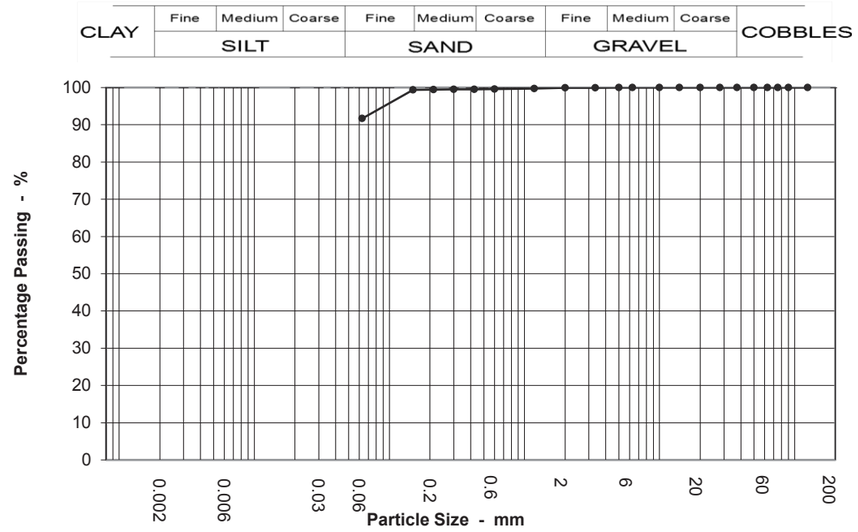
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	99		
0.063	97		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	2.0
Silt & Clay	97.0

Grading Analysis	
D100	5.00
D60	
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH03B
Location	Carriganarra LRD	Sample No	6
		Depth	5.00 m
Soil Description	Slightly sandy CLAY	Sample type	B



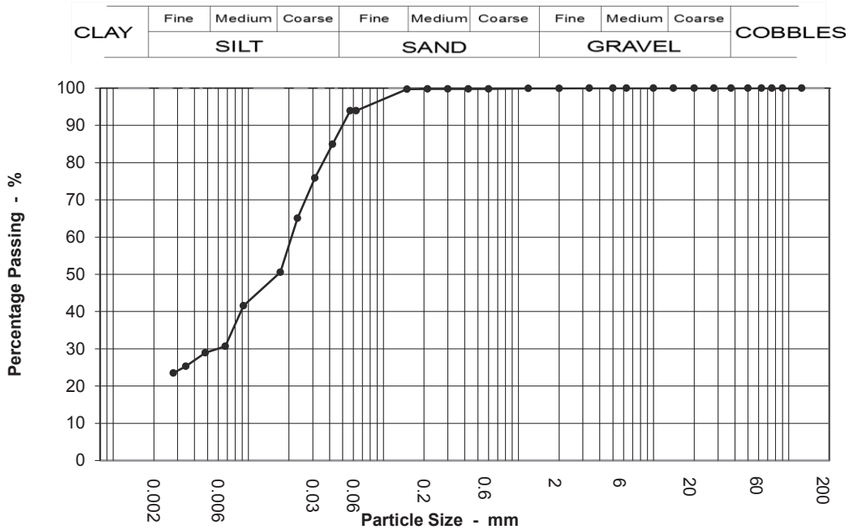
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	99		
0.15	99		
0.063	92		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	8.0
Silt & Clay	92.0

Grading Analysis	
D100	6.30
D60	
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH03B
Location	**Carriganarra LRD**	Sample No	7
		Depth	6.00 m
Soil Description	Slightly sandy CLAY	Sample type	B



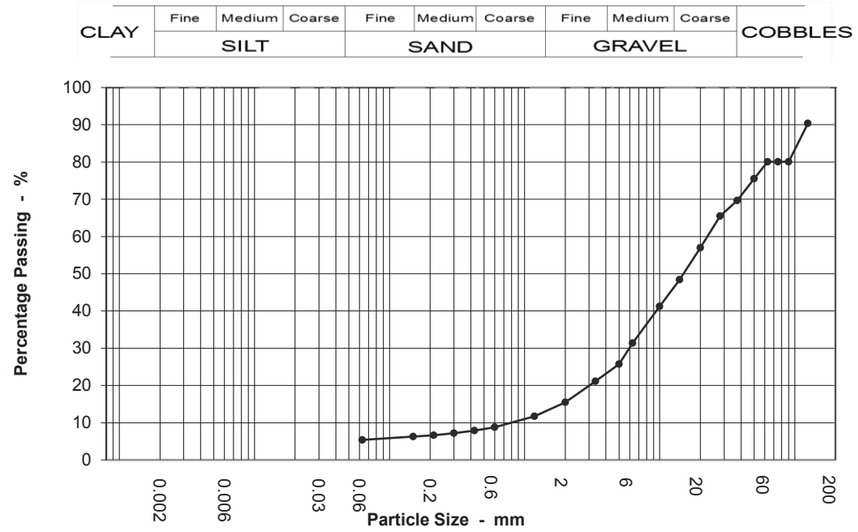
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.057	94
90	100	0.042	85
75	100	0.031	76
63	100	0.023	65
50	100	0.017	51
37.5	100	0.009	42
28	100	0.007	31
20	100	0.005	29
14	100	0.003	25
10	100	0.003	23
6.3	100	0.002	16
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	100		
0.063	94		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	6.0
Silt	74.0
Clay	20.0

Grading Analysis	
D100	3.35
D60	0.02
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH03B
Location	**Carriganarra LRD**	Sample No	8
		Depth	7.00 m
Soil Description	Slightly clayey sandy GRAVEL with high cobble content	Sample type	B



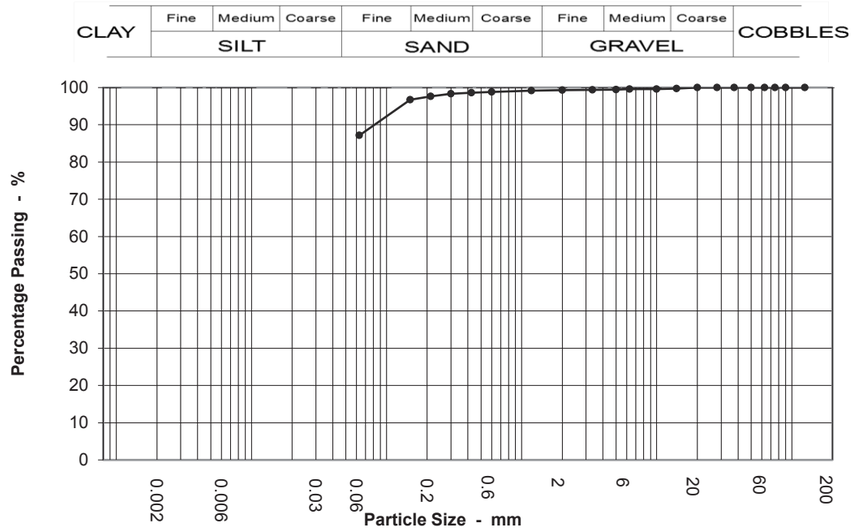
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	90		
90	80		
75	80		
63	80		
50	76		
37.5	70		
28	66		
20	57		
14	48		
10	41		
6.3	31		
5	26		
3.35	21		
2	15		
1.18	12		
0.6	9		
0.425	8		
0.3	7		
0.212	7		
0.15	6		
0.063	5		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	20.0
Gravel	65.0
Sand	10.0
Silt & Clay	5.0

Grading Analysis	
D100	
D60	22.50
D10	0.80
Uniformity Coefficient	28.00

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH04B
Location	**Carriganarra LRD**	Sample No	2
		Depth	1.00 m
Soil Description	Slightly gravelly slightly sandy CLAY	Sample type	B



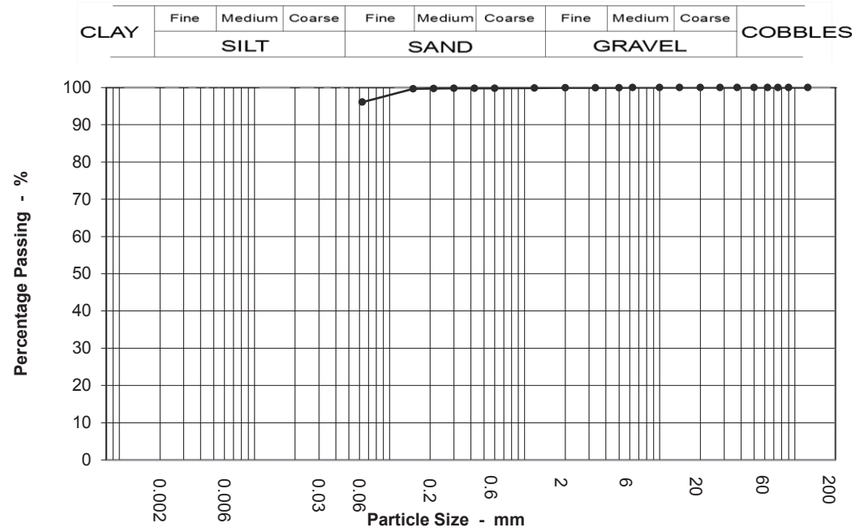
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	99		
2	99		
1.18	99		
0.6	99		
0.425	99		
0.3	98		
0.212	98		
0.15	97		
0.063	87		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	1.0
Sand	12.0
Silt & Clay	87.0

Grading Analysis	
D100	20.00
D60	
D10	
Uniformity Coefficient	

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	P24077
		Borehole / Pit No	BH04B
Location	**Carriganarra LRD**	Sample No	3
		Depth	2.00 m
Soil Description	Slightly sandy CLAY	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	100		
0.063	96		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	4.0
Silt & Clay	96.0

Grading Analysis	
D100	6.30
D60	
D10	
Uniformity Coefficient	

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.: 25-05685-1

Initial Date of Issue: 25-Feb-2025

Re-Issue Details:

Client Priority Geotechnical Ltd

Client Address: Unit 12
Owenacurra Business Park
Midleton
County Cork
Ireland

Contact(s): Colette Kelly

Project P24077 Carriganarra LRD

Quotation No.:

Date Received: 18-Feb-2025

Order No.: 16729

Date Instructed: 18-Feb-2025

No. of Samples: 3

Turnaround (Wkdays): 5

Results Due: 24-Feb-2025

Date Approved: 25-Feb-2025

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: P24077 Carriganarra LRD

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**		25-05685	25-05685	25-05685
Quotation No.:				**Chemtest Sample ID.:**		1934692	1934693	1934694
				Sample Location:		BH01B	BH01B	BH01B
				Sample Type:		SOIL	SOIL	SOIL
				Top Depth (m):		5.00	6.00	7.00
				Date Sampled:		10-Feb-2025	10-Feb-2025	10-Feb-2025
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Moisture		N	2030	%	0.020	11	11	11
Soil Colour		N	2040		N/A	Brown	Brown	Brown
Other Material		N	2040		N/A	None	Stones	None
Soil Texture		N	2040		N/A	Clay	Clay	Clay
Organic Matter		M	2625	%	0.40	< 0.40	0.41	< 0.40

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
Uncertainty of measurement for the determinands tested are available upon request .
None of the results in this report have been recovery corrected.
All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.
All Asbestos testing is performed at the indicated laboratory .
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - The required amount of sample for analysis was not received
H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.
All water samples will be retained for 14 days from the date of receipt.
Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

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 - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

TRIAL PIT LOG

Project:	Carriganarra LRD	Trial Pit No.	TP-01 (Ch300)
Location:	Carriganarra, Carrigrohane Ballincollig Cork	Logged by:	Dan Keohane
Date:	12 July 2024	Keohane Geological & Environmental Consultancy	
Co-ords:	560063 / 569707; GL Elev: 15.79mOD		

Depth	Description	Samples	Comments
0.0 m	Light brown / greyish soft to firm sandy CLAY.		0.0 to 0.1m
	Topsoil		0.1 to 1.2m
	Light grey / brownish with orange mottling and purple hue stiff sandy silty CLAY.		Trial pit walls are slick from
0.5 m	Crumbly texture.		bucket.
			Un-drained shear strength:
			84kPa @ 0.18m
			104 kPa @ 0.55m
			Moist @ 0.7m.
1.0 m			
	Purple stiff silty clayey FINE SAND.		1.2 to 1.6m,
1.5 m			Un-drained shear strength:
			48kPa @ 1.4m
	Total Depth = 1.6m.		
			Side walls stable
			No GW ingress.
2.0 m			No samples.
2.5 m			
3.0m			
3.5 m			
4.0m			
4.5m			
5.0m			
5.5 m			

Description of Trial Pit Location:

Excavated with a Case CX210B 20-tonne track-mounted excavator with 1.2m-wide bucket.
Located on alignment on proposed sustainable access corridor - chainage 300m.
Trial pit backfilled immediately after logging.

TRIAL PIT TP-01 (Ch300) - PHOTOGRAPHS









TRIAL PIT LOG

Project:	Carriganarra LRD	Trial Pit No.	TP-02 (Ch320)
Location:	Carriganarra, Carrigrohane Ballincollig Cork	Logged by:	Dan Keohane
Date:	12 July 2024	Keohane Geological & Environmental Consultancy	
Co-ords:	560117 / 569609 GL Elev: 16.03mOD		

Depth	Description	Samples	Comments
0.0 m	Light brown firm fine sandy SILT.		0.0 to 0.1m
	Topsoil		0.1 to 0.5m
	Mottled light brown - orange firm fine sandy clayey SILT.		Un-drained shear strength: 65kPa @ 0.45m
0.5 m			
	Mottled purple-grey firm silty clayey FINE SAND.		0.5 to 0.7m. Un-drained shear strength: 68kPa @ 0.65m
	Mottled orange - purple firm to stiff silty clayey FINE SAND.		GW ingress @ 14.93mOD.
1.0 m	Purple loose silty clayey sandy FINE GRAVEL.		0.7 to 0.9m. Un-drained shear strength: 104kPa @ 0.8m
			0.9 to 1.5m. GW ingress at 0.9m.
1.5 m			
	Purple dense silty clayey FINE SAND.		1.5 to 2.0m. Un-drained shear strength: >150kPa @ 1.8m
2.0 m			Side walls unstable
	Total Depth = 2.0m.		GW ingress. No samples.
2.5 m			
3.0m			
3.5 m			
4.0m			
4.5m			
5.0m			
5.5 m			

Description of Trial Pit Location:

Excavated with a Case CX210B 20-tonne track-mounted excavator with 1.2m-wide bucket.
Located on alignment on proposed sustainable access corridor - chainage 320m.
Trial pit backfilled immediately after logging.

TRIAL PIT TP-02 (Ch320)- PHOTOGRAPHS









CHAPTER SEVEN

WATER (HYDROLOGY & HYDROGEOLOGY)

APPENDIX 7-1 Surface Water Sampling Locations
APPENDIX 7-2 Surface Water Result Certificates
APPENDIX 7-3 Site Specific Flood Risk Assessment – Malachy Walsh & Partners
APPENDIX 7-4 Drainage Impact Assessment – DOSA Consulting Engineers
APPENDIX 7-5 Water Framework Directive Assessment - Keohane Geological & Environmental Consultancy

APPENDIX 7-1 Surface Water Sampling Locations

Carriganarra Development
Surface Water Sampling Locations

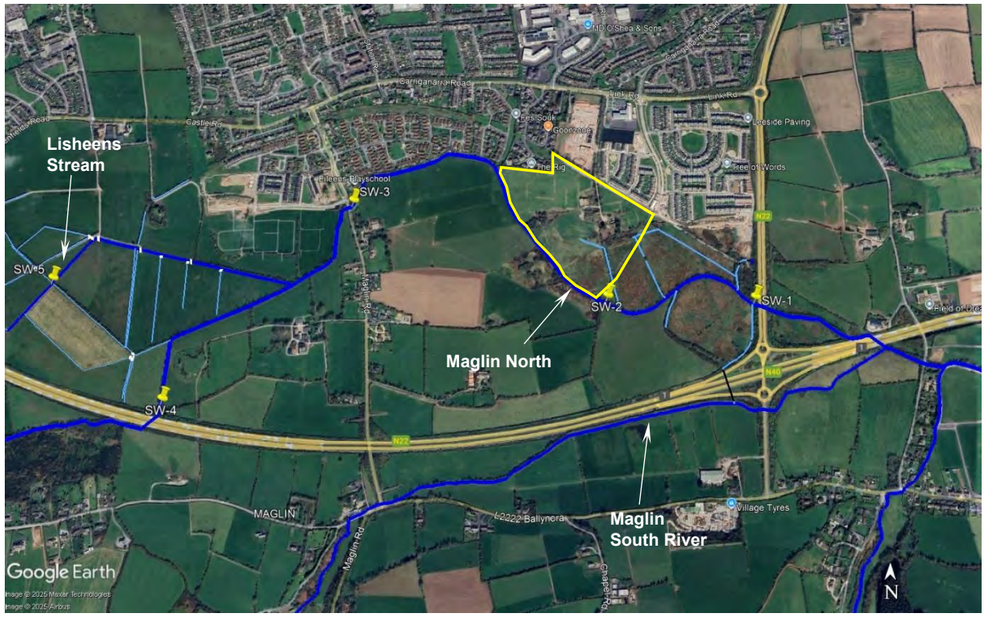


Figure A7.1-1: SW Monitoring Locations



Plate 1: Sampling Location SW1 – Maglin North at N22 Bridge



Plate 2: Sampling Location SW2 – Maglin North at Former Confluence with Maglin South



Plate 3: Sampling Location SW3 – Maglin North at Maglin Road Bridge



Plate 4: **Sampling Location SW4 – Maglin North D/S of By-Pass Culvert**



Plate 5: **Sampling Location SW5 – Lisheens Stream**

APPENDIX 7-2 Surface Water Result Certificates

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Environmental Research Institute

Environmental Research Institute,
Lee Road, University College Cork

e. eri@ucc.ie
t. +353 (0)21 4901931
@eriucc | eri.ucc.ie

Analysis Certificate (Ballincollig)

	Sampling Date	14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024
	Arrival Date	15/02/2024	15/02/2024	15/02/2024	15/02/2024	15/02/2024
EPA approved	**Sample**	**SW1**	**SW2**	**SW3**	**SW4**	**SW5**
Yes	**Total Alkalinity (mg $CaCO_3$/l)**	144	145	131	112	275
Yes	**Total Nitrogen (mg N/l)**	4.950	5.120	5.150	5.580	4.560
Yes	**Nitrate (mg N/l)**	3.987	4.155	4.309	4.750	3.899
N/A	**Nitrite (mg N/l)**	0.031	0.029	0.023	0.020	0.008
Yes	**Total Ammonia (mg N/l)**	0.097	0.090	0.078	0.077	0.033
N/A	**Unionised Ammonia (mg N/l)**	0.004	0.003	0.003	0.002	0.001
Yes	**Ortho-P (mg P/l)**	0.055	0.054	0.050	0.054	0.020
Yes	**Total-P (mg P/l)**	0.139	0.127	0.118	0.106	0.042
Yes	**BOD (mg O_2/l)**	1.7	1.3	1.0	1.2	0.3
Yes	**COD (mg O_2/l)**	24.4	21.8	22.2	19.2	15.3
Yes	**Chloride (mg Cl/l)**	20.0	20.2	20.5	21.1	26.5
Yes	**Suspended Solids (mg/l)**	13.3	11.8	11.5	9.8	3.8
Yes	**Conductivity @25°C (µS/cm)**	394	397	377.0	364	656
N/A	**Turbidity (NTU)**	14.83	13.63	13.19	9.93	3.89

Arrial Date: 15-02-24
Report Date: 20-02-24

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Environmental Research Institute

Environmental Research Institute,
Lee Road, University College Cork

e. eri@ucc.ie
t. +353 (0)21 4901931
@eriucc | eri.ucc.ie

Analysis Certificate (M&OS-Ballincollig)

	Sampling Date	07/05/2025	07/05/2025	07/05/2025	07/05/2025	07/05/2025
	Arrival Date	07/05/2025	07/05/2025	07/05/2025	07/05/2025	07/05/2025
EPA approved	**Sample**	**SW1**	**SW2**	**SW3**	**SW4**	**SW5**
Yes	**Total Alkalinity (mg $CaCO_3$/l)**	145	135	123	103	235
Yes	**Total Nitrogen (mg N/l)**	5.964	6.479	6.193	6.221	6.539
Yes	**Nitrate (mg N/l)**	5.429	5.674	5.639	5.863	6.110
N/A	**Nitrite (mg N/l)**	0.013	0.012	0.009	0.006	0.008
Yes	**Total Ammonia (mg N/l)**	0.038	0.020	0.027	0.021	0.034
N/A	**Unionised Ammonia (mg N/l)**	<0.001	<0.001	<0.001	<0.001	0.001
Yes	**Ortho-P (mg P/l)**	0.034	0.032	0.033	0.040	0.014
Yes	**Total-P (mg P/l)**	0.055	0.055	0.045	0.049	0.023
Yes	**BOD (mg O_2/l)**	0.8	0.8	0.6	0.8	1.2
Yes	**COD (mg O_2/l)**	9.2	11.8	9.2	7.9	8.8
Yes	**Chloride (mg Cl/l)**	20.7	21.0	21.0	20.2	24.7
Yes	**Suspended Solids (mg/l)**	6.0	8.0	2.5	2.8	12.3
Yes	**Conductivity @25°C (µS/cm)**	415	395	378	342	587
N/A	**Turbidity (NTU)**	6.67	7.99	3.82	2.79	7.82

Arrival Date: 07-05-25
Report Date: 19-05-25

Institiúid na hInbhuanaitheachta
Sustainability Institute

Analysis Certificate (M&OS-Ballincollig)						
	Sampling Date	09/09/2025	09/09/2025	09/09/2025	09/09/2025	09/09/2025
	Arrival Date	09/09/2025	09/09/2025	09/09/2025	09/09/2025	09/09/2025
EPA approved	**Sample**	**SW1**	**SW2**	**SW3**	**SW4**	**SW5**
Yes	**Total Alkalinity (mg $CaCO_3$/l)**	63	62	92	90	226
Yes	**Total Nitrogen (mg N/l)**	1.014	1.544	3.222	3.777	4.566
Yes	**Nitrate (mg N/l)**	0.557	1.083	2.530	3.058	3.892
N/A	**Nitrite (mg N/l)**	0.007	0.012	0.017	0.010	0.202
Yes	**Total Ammonia (mg N/l)**	0.030	0.035	0.096	0.040	0.045
N/A	**Unionised Ammonia (mg N/l)**	0.001	0.001	0.003	0.002	0.001
Yes	**Ortho-P (mg P/l)**	0.043	0.064	0.142	0.104	0.026
Yes	**Total-P (mg P/l)**	0.074	0.099	0.189	0.153	0.063
Yes	**BOD (mg O_2/l)**	1.7	1.8	3.2	2.4	3.4
Yes	**COD (mg O_2/l)**	13.6	19.2	28.3	30.9	16.6
Yes	**Chloride (mg Cl/l)**	7.8	12.1	22.1	24.4	26.1
Yes	**Suspended Solids (mg/l)**	3.2	4.0	4.5	5.0	16.8
Yes	**Conductivity @25°C (µS/cm)**	166	185	301	318	566
N/A	**Turbidity (NTU)**	6.44	6.80	8.29	9.14	17.06

Sample Arrival Date: 09-09-25 / Report Date:18-09-25

APPENDIX 7-3 Site Specific Flood Risk Assessment – Malachy Walsh & Partners

Flood Risk Assessment

Carriganarra LRD, Ballincollig, Cork

Murnane & 'O' Shea Ltd

April 2026

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Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Status
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1. General

1.1 Introduction & Context

Malachy Walsh and Partners (MWP) Consulting Engineers have been commissioned by Murnane O' Shea Ltd to carry out a Flood Risk Assessment for a proposed residential development at Carriganarra, Ballincollig, Cork.

1.2 Overview of Existing Site

The subject site is located within the Maglin Urban Expansion Area (MUEA). The existing land is a greenfield site. The subject land is bounded by pastures to the southeast, Limeworth residential area to the north and the Maglin North River to the southwest. The total area of the subject land is c.13.5ha.

The site slopes from northeast to southwest. Elevations of c.22mOD were surveyed along the northeastern boundary of the site. Elevations of c.15.7mOD were surveyed along the southwestern boundary of the site.

The site location is highlighted in Figure 1.1.



Figure 1.1: Site Location Map

1.3 Overview of Proposed Development

The development will consist of the demolition of existing agricultural building and the construction of a residential development of 300 no. residential units consisting of 128 no. dwellings houses, 172 no. apartment/duplex units, a two storey creche facility and all ancillary site development works. The proposed 128 no. dwelling houses will include 42 no. bedroom detached/semi-detached dwelling houses and 84 no. 3 bedroom semi-detached/townhouse dwelling houses. The proposed development also provides for the restoration of an existing vernacular farm building on site which will accommodate 2 no. 2 bedroom semi-detached units.

The proposed 172 no. apartment/duplex units will include 18 no. 3 bedroom units, 109 no. 2 bedroom units and 45 no. 1 bedroom units, to be provided in 20 no. apartment/duplex buildings ranging in height from 3-4 storeys over basement level.

Vehicular access to the proposed development will be provided via the existing junction from the Killumney road serving the Heathfield residential development and existing sections of the Maglin Sustainable Access Corridor to the north. The proposed development provides for the extension of Maglin Sustainable Access Corridor and the provision of 4 no. pedestrian/cycle connections to the Heathfield residential development to the north which is under construction.

The delivery of a further section of the MUE Sustainable Access Corridor (SAC) in tandem with the delivery of housing has been a critical component of the proposed development since its inception. The exact route of the SAC has been the subject of detailed discussions with the Planning Authority. Having regard to existing ground conditions and for urban design reasons it was initially proposed to deliver a portion of the SAC further north on a different alignment than the route initially identified by Cork City Council and infill the area between the proposed residential development and the proposed SAC. While Cork City Council had no objection to the principle of the proposed realignment from a planning policy or flood risk management perspective, in response to the Council's request in the LRD Opinion it has been decided to revert to the route of the SAC based upon the design originally defined by Cork City Council. Reverting to the original SAC Route has increased the area between the SAC and the residential development and which forms part of the *ZO 15 Public Open Space* zoning objective in this area and which is identified as being at risk of flooding.

The provision of the SAC and the access road to the site will require the raising of levels in these areas which will leave an area of low lying land between these roads and the development effectively cutting off this area from lands to the South. Consistent with the previously proposed approach, it is proposed to fill the remaining areas between the proposed residential development and the proposed SAC. As highlighted in Section 6.3 of the EIAR this will be done using inert soil and stone engineering fill.

The filling of this will have no adverse impacts on adjoining lands not within the control of the applicants in terms of flood risk as demonstrated in this Flood Risk Assessment. The proposed filling of this area has significant engineering benefits in that it allows for a more efficient manner of dealing with surface water in this area, which when the area is filled can be drained to the existing watercourse to the west of the site. Without the filling of this area surface water would continue to flow in its current manner to the south and which will require the construction of culverts under the proposed SAC. The proposed construction of culverts under the SAC will complicate the construction of the SAC and increases the risk of clashes with Uisce Eireann and other utilities which will be constructed within the proposed new SAC. Therefore, it is considered that the original strategy of filling the remaining land between the proposed residential development and the SAC continues to be the most appropriate strategy and one that will ensure the efficient delivery of the SAC.

Ancillary site works include the raising of existing ground levels on site, the provision of bicycle parking and bin storage facilities serving the proposed apartment/duplex and creche buildings, the delivery of active travel

infrastructure, landscaping and servicing proposals including a temporary pumping station, and the undergrounding/diversion of an existing 38KV overhead ESB line which traverses the site.

The proposed site layout is illustrated in Figure 1.2 below.



Figure 1.2: Proposed Site Layout

1.4 Objectives

The purpose of the report is to establish the flood risk associated with the proposed development of the subject lands and, if appropriate, to recommend mitigation measures to prevent any increase in flood risk within the site or externally in the wider area.

The report has been prepared in the context of *The Planning System and Flood Risk Management – Guidelines for Planning Authorities, November 2009*, published by the Office of Public Works and the Department of Environment, Heritage and Local Government. Flood Risk Assessments are carried out at different scales by different organisations. The hierarchy of assessment types are Regional Flood Risk Assessment (RFRA), Strategic Flood Risk Assessment (SFRA) and Site-specific Flood Risk Assessment (FRA). This report is site-specific.

1.5 Methodology

The Flood Risk Management Guidelines document outlines three stages in the assessment of flood risk as follows:

Stage 1 Flood risk identification – to identify whether there may be any flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation;

Stage 2 Initial flood risk assessment – to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to determine what surveys and modelling approach is appropriate to match the spatial resolution required and complexity of the flood risk issues. The extent of the risk of flooding should be assessed which may involve preparing indicative flood zone maps. Where existing river or coastal models exist, these should be used broadly to assess the extent of the risk of flooding and potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures; and

Stage 3 Detailed risk assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This will typically involve use of an existing or construction of a hydraulic model or a river or coastal cell across a wide enough area to appreciate the catchment wide impacts and hydrological processes involved.

This report has been prepared generally in accordance with these stages.

1.6 Flood Risk & Zones

In the Planning System and Flood Risk Management Guidelines document, the likelihood of a flood occurring is established through the identification of Flood Zones which indicate a high, moderate or low risk of flooding from fluvial or tidal sources. Table 1.1 below includes the definition of Flood Zones as well as the implications for planning.

The flood zone type is determined based on current water surface levels without allowance for climate change and without the benefit of any flood defences.

It is important to note that the Flood Zones do not take into account other sources of flooding, such as groundwater or pluvial, so an assessment of risk arising from such sources should also be made, where appropriate.

Flood Zone	Description & Summary of Planning Implications
Zone A High probability of flooding	More than 1% probability (1 in 100) for river flooding and more than 0.5% probability (1 in 200) for coastal flooding. Most types of development would be considered inappropriate in this zone.
Zone B Moderate probability of flooding	0.1% to 1% probability (between 1 in 100 and 1 in 1,000) for river flooding and 0.1% to 0.5% probability (between 1 in 200 and 1 in 1,000) for coastal flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone.
Zone C Low probability of flooding	This zone defines areas with a low risk of flooding from rivers and the coast (i.e. less than 0.1% probability or less than 1 in 1,000). Development in this zone is appropriate from a flooding perspective (subject to assessment of flood hazard from sources other than rivers and the coast).

Table 1.1: Definitions of Flood Zones

The Guidelines have outlined three Vulnerability Classifications for developments based on the proposed land use and type of development. These classifications and particular examples of development types which would be included in each classification are summarised as follows;

- **Highly Vulnerable Development:** This would include emergency services, hospitals, schools, residential institutions, dwelling houses, essential infrastructure, water & sewage treatment etc.
- **Less Vulnerable Development:** Retail, leisure, commercial, industrial buildings, local transport infrastructure.
- **Water-compatible development:** Docks, marinas and wharves. Amenity and open space, outdoor sports and recreation and essential facilities such as changing rooms.

The Guidelines include a matrix that determines the appropriateness of different types of development based on their vulnerability classification and the Flood Zones in which they are located. The matrix is reproduced in Table 1.2 below.

Where the matrix indicates that a development is not appropriate it may still be justified based on a procedure described as a Justification Test.

Vulnerability Classification	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable Development (Including essential Infrastructure)	Justification Test	Justification Test	Appropriate
Less Vulnerable Development	Justification Test	Appropriate	Appropriate
Water-compatible Development	Appropriate	Appropriate	Appropriate

Table 1.2: Vulnerability Matrix

2. Flood Risk Identification (Stage 1)

Possible sources of flood risk were identified by;

- Geology & Soil Maps
- EPA Watercourse Maps
- Flood History - Examination of available information on the OPW website (www.floodinfo.ie)
- South Ballincollig Drainage Study - Strategic Flood Risk Assessment
- Lee Catchment Flood Risk and Management Study (CFRAMS)
- OPW Arterial Drainage Scheme & Drainage Districts
- GSI Winter 2015/2016 Surface Water Flooding
- GSI Predictive & Historic Groundwater Flood Mapping
- Internet Searches
- Site Walkover & Anecdotal Information

2.1 Geology & Soil Mapping

The GSI bedrock geology map is presented in Figure 2.1. Bedrock is the solid rock at or below the land surface. Over much of Ireland, the bedrock is covered by materials such as soil and gravel. The Bedrock map shows what the land surface of Ireland would be made up of if these materials were removed. As the bedrock is commonly covered, bedrock maps are an interpretation of the available data. The bedrock geology at the subject lands location comprises of the *Little Island Formation* and *Waulsortian Limestones*. Little Island Formation (CDLITT) is described as Carboniferous massive calcilutite limestones (mudbank facies) and crinoidal calcilutites. The formation is a uniform succession of crinoidal biomicrite limestones (wackestones) and massive unbedded calcilutite limestones of mudbank facies. The top of the formation is highly crinoidal and passes up to poorly bedded wackestones. The formation is estimated to be up to 500m thick. Waulsortian Limestones (CDWAUL) is described as Carboniferous massive, unbedded limes mudstones. Sometimes informally called "reef" limestones, although inaccurate. Dominantly pale grey, crudely bedded or massive limestone. Known to be moderately to intensely karstified. Typically, 300m - 500m thick.

The Quaternary sediments map is presented in Figure 2.2. The map shows the sediments mapped within 1 metre of the surface which were laid down during the Quaternary, bedrock at or close to the surface, water bodies or made ground. The Quaternary sediments underlaying the site is primarily "*TDSs – Till derived from Devonian Sandstones"*.

The National Soils Map is presented in Figure 2.3. The site is primarily composed of *"AminDW - Deep well drained mineral (Mainly acidic)"* sourced from Devonian Sandstone till.

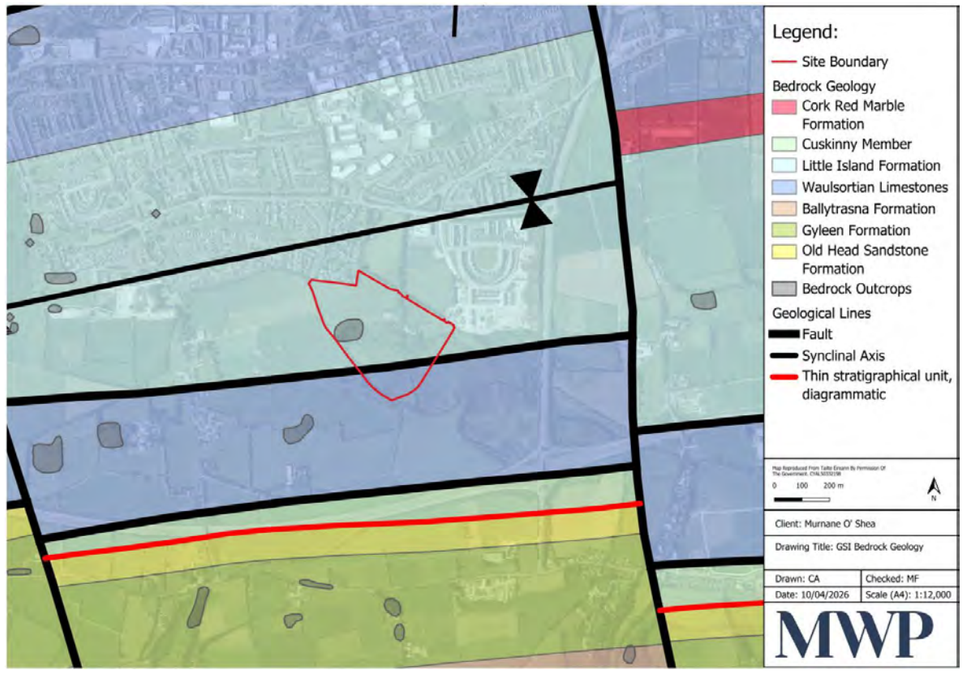


Figure 2.1: GSI Bedrock Geology 100k Map

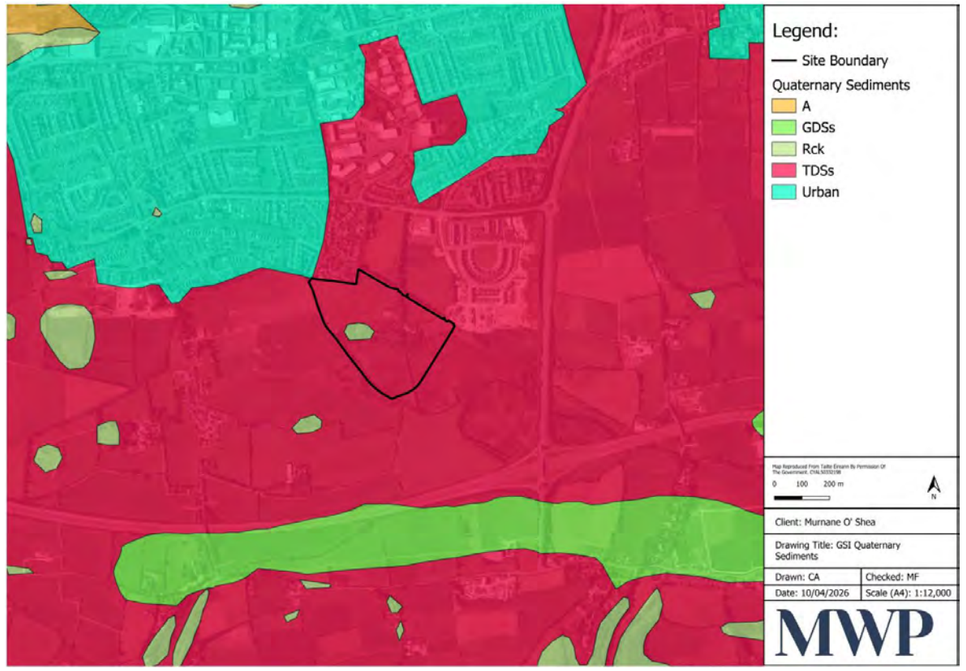


Figure 2.2: GSI Quaternary Sediments

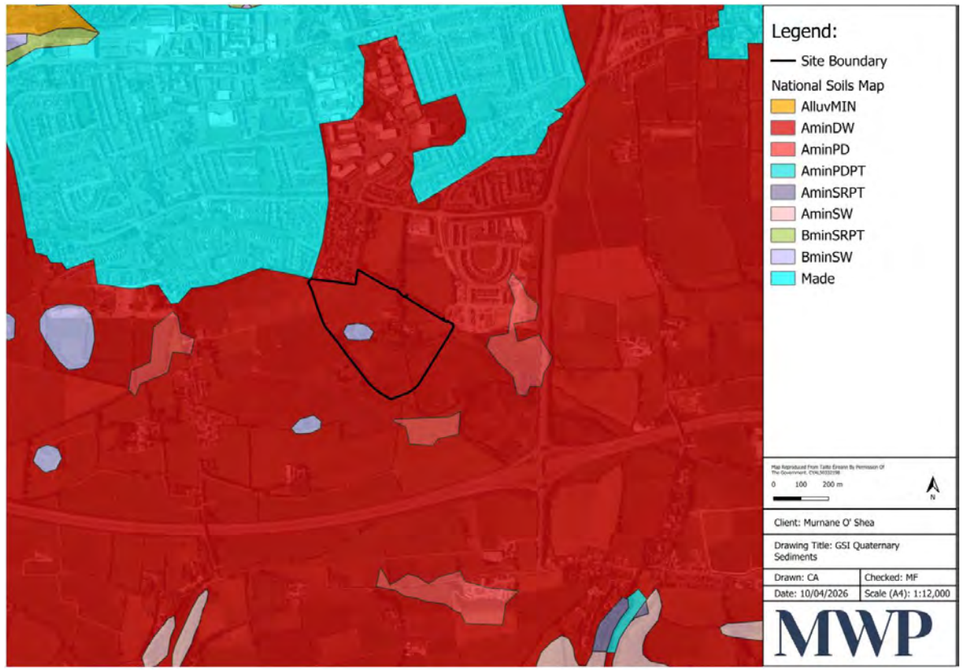


Figure 2.3: National Soils Map

2.2 Watercourse Mapping

The EPA River Network database was reviewed to identify any watercourses located within or in close proximity of the subject land. One watercourse was identified in close proximity of the site, the Maglin North River flowing from west to east through the Maglin area along the southwestern boundary of the proposed development boundary. The watercourse identified above is illustrated in Figure 2.4.

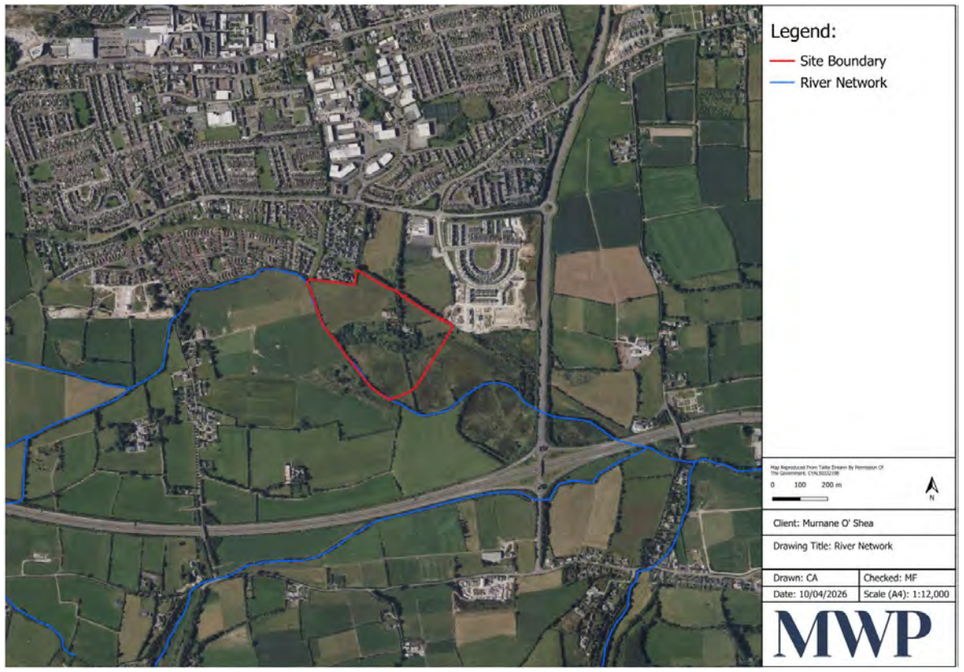


Figure 2.4: Watercourse Mapping

2.3 Flood History – OPW Local Area Summary Report

The Past Flood Event Local Area Summary Report which was obtained from the Office of Public Works (OPW) floodinfo.ie website summarises all recorded past flood events within 2.5km of the subject lands. There are 14 flood events which have been reported below which are largely located within 2.5km of the subject lands. There is no recorded flood event within proposed development boundary.

Past Flood Event Local Area Summary Report

OPW Oifig na nOibreacha Poiblí Office of Public Works

Report Produced: **6/11/2025 17:56**

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "**Website**"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

14 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Curraheen Bishopstown recurring (ID-5271)	n/a	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
2.	Army Barracks Ballincollig Co. Cork undated (ID-3864)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
3.	Lee Inniscarra to Cork City Aug 1986 (ID-492)	04/08/1986	Area
	Additional Information: Reports (8) Press Archive (3)		
4.	Flooding at Lee Road, Iniscarra Road, Cloughroe Road on 22/02/2021 (ID-14040)	22/02/2021	Approximate Point
	Additional Information: Reports (0) Press Archive (0)		
5.	River Lee Leemount Co. Cork recurring (ID-3862)	n/a	Approximate Point
	Additional Information: Reports (6) Press Archive (3)		
6.	Manorhill Area Ballincollig Co Cork recurring (ID-3863)	n/a	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
7.	Curraheen River Clash road Recurring (ID-3859)	n/a	Approximate Point
	Additional Information: Reports (3) Press Archive (1)		
8.	Curraheen,Ballincollig,Co.Cork. Dec.2009 and Jan.2010 (ID-11422)	n/a	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
9.	Lee Leemount Bridge area Nov 2000 (ID-1351)	28/11/2000	Approximate Point
	Additional Information: Reports (4) Press Archive (0)		
10.	Inchigoggin,Carrigrohane,Co.Cork. 19th.Nov.09 (ID-10904)	19/11/2009	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
11.	Clash Road Ballincollig Co.Cork 19th.Nov.09 (ID-10940)	19/11/2009	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
12.	Curraheen,Ballincollig,Co.Cork.Flooding 19th.Nov.2009 (ID-10941)	19/11/2009	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
13.	Bannow Br.Lee Rd.,Ballincollig Co.Cork Flooding 19/11/2009 (ID-10981)	19/11/2009	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
14.	Curraheen, Co.Cork. 28th June 2012 (ID-11671)	27/06/2012	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		

Figure 2.5: OPW Local Area Summary Report

2.4 South Ballincollig Drainage Study - Strategic Flood Risk Assessment

Malachy Walsh and Partners (MWP) Consulting Engineers were commissioned by Cork City Council (CCC) to carry out a Strategic Flood Risk Assessment (SFRA) in relation to the development of lands in Maglin, Ballincollig, Cork. This was completed in October 2021. A detailed hydrological analysis was carried out to estimate the flood flows throughout the study area and the surrounding areas. The results of this analysis were used as input parameters to the hydraulic modelling.

Detailed hydraulic analysis was also carried out which included modelling of approximately 3.2km of the Maglin North River, 2.1km of Maglin South River, circa 1km of the Curraheen River as well as Lisheens Stream[1] running through the western portion of the lands. In order to ensure the model was performing to an acceptable level of accuracy, the model was calibrated using surveyed and estimated flood levels from the February 2021 event.

The results of this hydraulic analysis were used to identify the Flood Zones for the study area. Cork City Council reviewed the flood zones identified during the SFRA preparation and applied the sequential approach when making decisions on land zoning in the South Ballincollig Plan Area. The baseline hydraulic model was adjusted for the post-development situation which includes for the proposed new Sustainable Access Corridor alignment which will cross the river and floodplain at a number of locations. It was assumed for the purpose of this SFRA that no other alterations will be made to the river or floodplains. An indicative road alignment and footprint was agreed with Cork City Council to enable the SFRA to be completed. A number of mitigation measures were recommended from a SFRA perspective to ensure that the flood risk to developments within the South Ballincollig

[1] Lisheens Stream is referred to as the Artificial Drain in South Ballincollig Drainage Study (Will be referred to as Lisheens Stream hereafter).

Plan Area is acceptable and to prevent an adverse impact upstream or downstream of the proposed development boundary.

The baseline predicted flood extents from the SFRA are presented in Figure 2.6.

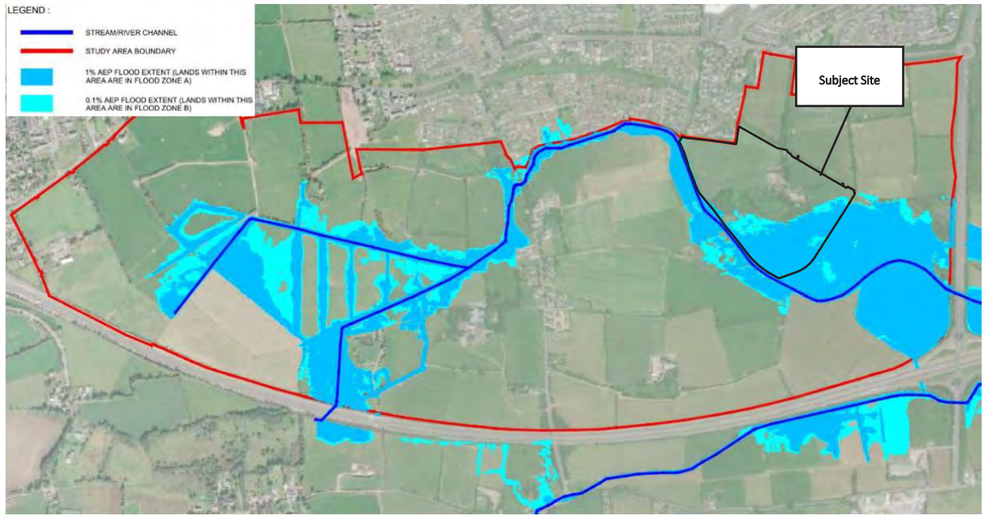


Figure 2.6: 1% AEP & 0.1% AEP Baseline SFRA Flood Extents

2.5 Lee Catchment Flood Risk and Management Study (CFRAMS)

The Lee CFRAMS involved detailed hydraulic modelling of rivers and their tributaries along with coastal flooding. Flood extents have been generated for the Maglin North River which flows through the Maglin area. An extract of the flood extent map for the present-day scenario is shown in Figure 2.7. Flooding is indicated within proposed development boundary in the southern area of these lands.

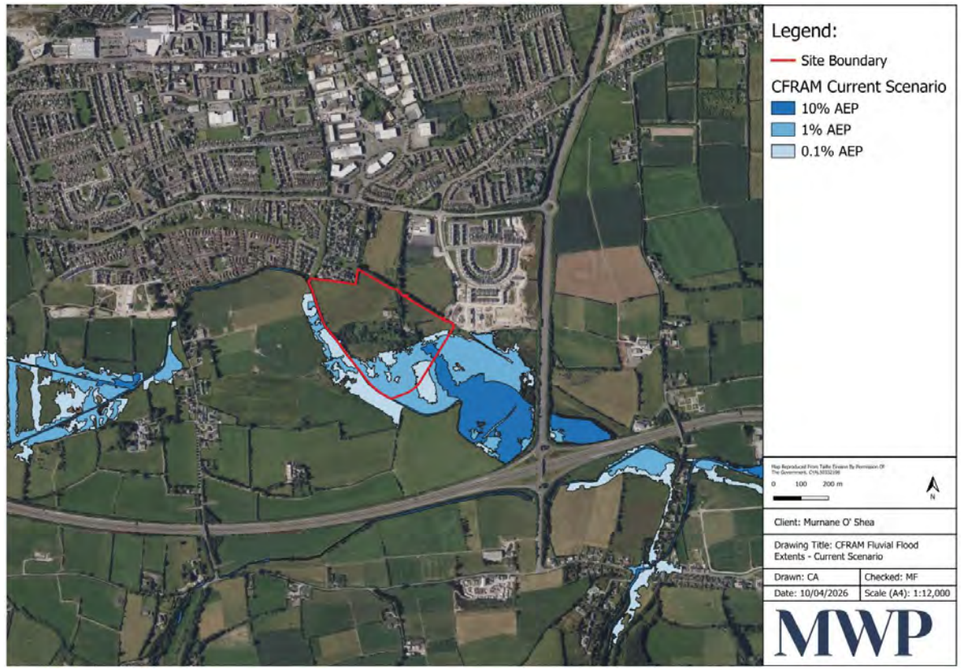


Figure 2.7: CFRAMS Fluvial Flood Mapping

2.6 OPW Arterial Drainage Scheme & Drainage Districts

Arterial Drainage Schemes were carried out under the Arterial Drainage Act, 1945 to improve land for agriculture and to mitigate flooding. Rivers, lakes, weirs and bridges were modified to enhance conveyance, embankments were built to control the movement of flood water and various other work was carried out under Part II of the Arterial Drainage Act, 1945. The purpose of the schemes was to improve land for agriculture, to ensure that the 3 – year flood was retained in bank. This was achieved by lowering water levels during the growing season to reduce waterlogging on the land beside watercourses known as callows. Flood protection in the benefiting lands was increased as a result of the Arterial Drainage Schemes.

The watercourses forming part of the arterial drainage scheme are indicated in Figure 2.8. The Benefited land layer identifies land that was drained as part of the scheme and is also indicated in Figure 2.8.

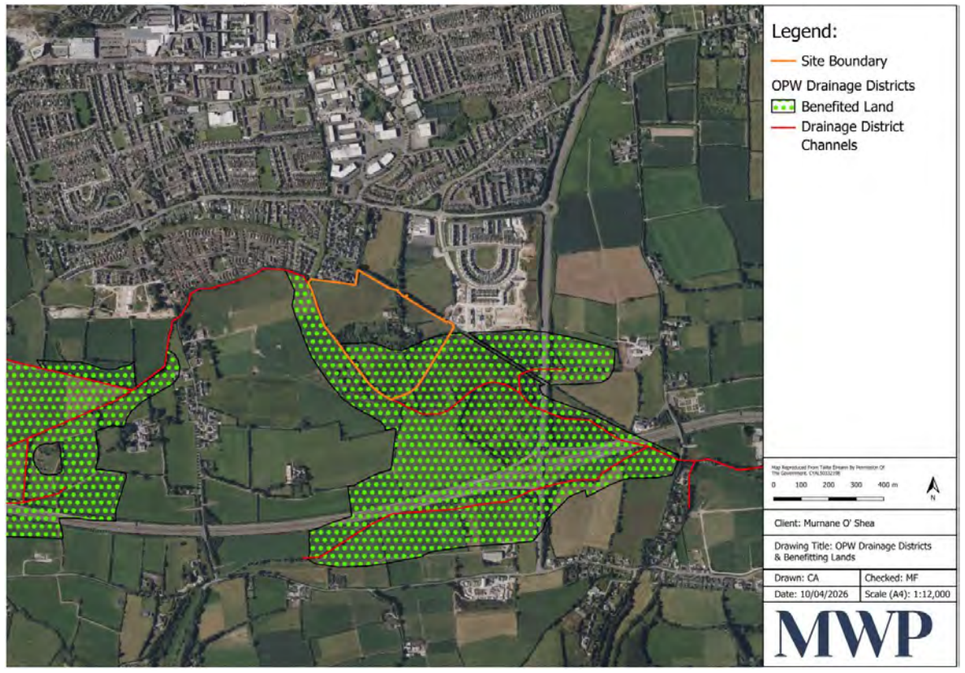


Figure 2.8: OPW Arterial Drainage Scheme Features

2.7 GSI Winter 2015/2016 Surface Water Flooding

The Winter 2015/2016 Surface Water Flooding map shows fluvial (rivers) and pluvial (rain) floods, excluding urban areas, during the winter 2015/2016 flood event. There is no flooding indicated within proposed development boundary during this flood event.

2.8 GSI Predictive Groundwater Flood Mapping

The GSI Groundwater Probability Mapping shows the probabilistic flood extent of groundwater flooding in limestone regions. There is no flooding indicated within the proposed development boundary.

2.9 Internet Searches

An internet search was conducted on 12/12/2025 to gather information about whether the subject land was affected by flooding previously. There were no reports of flooding within the proposed development boundary

2.10 Summary of Stage 1 FRA

The Stage 1 FRA has identified a flood risk at this subject site which is confined to the southern area of the proposed development boundary. A Stage 2 FRA will be carried out to provide a more comprehensive assessment of the flood risk.

3. Initial Flood Risk Assessment (Stage 2)

The purpose of Initial Flood Risk Assessment is primarily to ensure that the relevant flood risk sources are identified so that they can be addressed appropriately in the Detailed Flood Risk Assessment, where relevant.

3.1 Flooding Sources

The potential sources of flooding and their relevance to the flood risk to the proposed development are outlined in the following sub-sections.

3.1.1 Fluvial Flooding

Fluvial flooding occurs when the capacity of a river channel is exceeded and water flows onto the adjacent land or floodplain. The main watercourse in the proximity of the subject lands is the Maglin North River which flows from northwest to southeast along the western boundary of the proposed development boundary.

As previously indicated, the South Ballincollig Drainage Study SFRA has included detailed modelling of Lisheens Stream, Maglin North River, Curraheen River and Maglin South River in this area. The flood maps from the SFRA demonstrate that the subject lands are at risk of flooding for the 1% AEP and 0.1% AEP fluvial flood events.

As part of the proposed development, there is proposed infilling of the subject lands and a proposed Sustainable Access Corridor that will be located within Flood Zones A & B. The proposed infilling of the subject lands and construction of the Sustainable Access Corridor could potentially change the floodplain flow mechanisms associated with fluvial flooding from the Maglin North River. Therefore, an updated hydraulic model will be required. In conjunction with this update, the hydraulic model utilised for the SFRA will be adopted and updated for this FRA. The updated hydraulic model will include additional topographic survey data for the proposed development area and surrounds. The impacts of incorporating this topographic survey data are discussed in more detail in the Hydraulic Analysis Report included in Appendix 2.

It will be necessary to complete a Stage 3 -Detailed Flood Risk Assessment for this site. The Stage 3 assessment will determine the required finished Floor Level (FFL) of proposed buildings and will deliver updated flood extent maps, water surface elevations(mOD) and assess the impacts of the development on flood risk elsewhere.

3.1.2 Pluvial Flooding

Overland flow or pluvial flooding occurs when rainfall intensity exceeds the infiltration capacity of the ground. The excess water flows overland to the nearest watercourse or piped drainage system. Intense rainfall events can result in ponding in low areas or upstream of physical obstructions. Overland flow is most likely to occur following periods of sustained and intense rainfall when the ground surface becomes saturated.

Flood risk from pluvial sources exists in all areas. The subject lands is predominantly a greenfield site. Increase in hardstanding area will increase the risk of pluvial flooding. There is no history of pluvial or surface water flooding on the site and as discussed previously, the general topography of the site falls gently from north to south. There are no low points within the site which overland flows could pond.

The design of adequate storm water drainage systems will minimise pluvial flood risk to an acceptable level. The design of this drainage system should be confirmed at detailed design stage.

Pluvial flooding does not require further consideration in this report.

3.1.3 Tidal Flooding

Estuarial or tidal flooding is caused by higher-than-normal sea levels which occur primarily due to extreme high tides, storm surges, wave action or due to high river flows combining with high tides. This risk is not relevant to this site due to its location inland and its elevation. The tidal influence of the River Lee reaches inland as far as the Mardyke area of Cork City which is located approximately 5km east of the subject lands. Therefore, this does not require further consideration in this report.

3.1.4 Groundwater Flooding

Groundwater flooding occurs when the water table rises to the level of the ground surface due to rainfall and flows out over the surface. Groundwater flooding occurs relatively slowly and generally poses a low hazard to people. There is also no known history of such an occurrence in the vicinity of the subject lands and for these reasons this source of flooding will not be considered further in this report.

3.2 Summary of Identified Flood Risk (Stage 2)

The Stage 2 FRA indicates that there is a potential fluvial flood risk within the southern area of the proposed development boundary, and a Stage 3 Flood Risk Assessment is required.

3.3 Requirements for Detailed Flood Risk Assessment (Stage 3)

A Stage 3 detailed flood risk assessment will be carried out in Section 4 of this report in order to provide a quantitative appraisal of potential flood risk to the site and to examine the potential impact of the development on flood risk elsewhere. This will require the construction of a hydraulic model of the Maglin North River and the completion of a hydrological assessment of the catchment. Any relevant mitigation measures will be reviewed, and residual risks will be assessed.

4. Detailed Flood Risk Assessment (Stage 3)

4.1 Introduction

The purpose of this Stage 3 FRA is to assess flood risk issues in sufficient detail to provide a quantitative appraisal of potential flood risk to the proposed development, of the potential impact of the development on flood risk elsewhere and to establish what mitigation measures, if any, may be required. The Stage 3 FRA will therefore require carrying out a detailed review of the Maglin North River and Lisheens Stream catchment hydrology to establish appropriate flood flows for various scenarios. A hydraulic model of the river reach will then be created to determine key flood risk parameters such as flood levels and flood extents.

4.2 Hydrology & Flow Estimation

4.2.1 Overview

A detailed hydrological analysis was carried out to estimate the flood flows throughout the site and the surrounding Maglin area for the South Ballincollig Drainage Study SFRA. The hydrology and flow estimation methods adopted for the South Ballincollig Drainage Study SFRA was reviewed and deemed suitable for reuse for the purpose of this hydraulic analysis to ensure consistency with the SFRA. A summary of the hydrological analysis performed for the South Ballincollig Drainage Study SFRA is provided below. The South Ballincollig Drainage Study SFRA can be consulted for a detailed overview of the hydrological analysis.

4.2.2 Catchment & River Reach Description

The Maglin North River flows through the Maglin area where it joins the Curraheen River approximately 1km east of the subject site. Due to the construction of the N22 road system, local changes have been made to the Maglin South River alignment and catchment area of both the Maglin North River and the Maglin South River. In particular, the confluence of these two watercourses has shifted further downstream. A hydraulic connection, following the original channel of the Maglin South River, still exists between the two rivers. This takes the form of a twin culvert system under the N22 road which allows flows to pass between the tributaries via the floodplain a short distance upstream of Hydrological Estimation Point (HEP) MN02. For this reason it is necessary to include Maglin South River in the hydrological analysis and hydraulic modelling.

The Maglin South River discharges into the Maglin North River which then discharges to the Curraheen River approximately 1km east of the subject site. In order to ensure that the downstream boundary conditions are suitably accounted for in the hydraulic analysis, the model has been extended a distance downstream of the confluence of the Curraheen and Maglin North rivers. Therefore, it is necessary to include the Curraheen River in the hydrological analysis.

Maglin North River has a catchment area of approximately 5.6km^2 and 9.8km^2 at MN06 and MN02 respectively. The upstream catchment is characterised by relatively steep reaches, whilst the gradient reduces significantly on the northern downstream portion of the catchment.

The soil classification for the catchment is Soil Class 2 according to the Flood Studies Report 1975 (FSR) soil maps. This is consistent with MWP's local knowledge of the area and the EPA soil mapping.

The catchment of Maglin North River is also influenced by urban development in Ballincollig and the N22 road, primarily via inflows within or adjacent to the Maglin area. Estimation of the urban area contributing to the catchments was influenced by the available storm and foul network drawings which are available for Ballincollig.

On the lower reaches, parts of the Maglin North River and Curraheen River catchments are located within a drainage district. These lands were drained by the Commissioners of Public Works under various acts between 1842 and the 1930's. The purpose of the schemes were to improve land for agriculture by lowering water levels. Typical works included channel and lake widening / deepening, embankment construction, weir removal and bridge replacement / modification. For Section 50 applications the OPW typically requires that design flows in drained catchments be increased by a factor of 1.6 to account for increased rate of runoff, and therefore peak flows, from the artificially drained areas. It is entirely possible that Local Authorities have not maintained the drainage districts in the recent past therefore any such increased flows may not be realised. In any case, this has been accounted for in the Flood Studies Update (FSU) methodology with the ARTDRAIN2 PCD.

The Standard Average Annual Rainfall (SAAR) for the Maglin North River catchment is approximately 1080mm according to the FSU database. It is slightly higher at circa 1100mm for the Curraheen catchment.

The sub-catchment delineation of the key catchments included in this study is shown on Figure 4.1 below.

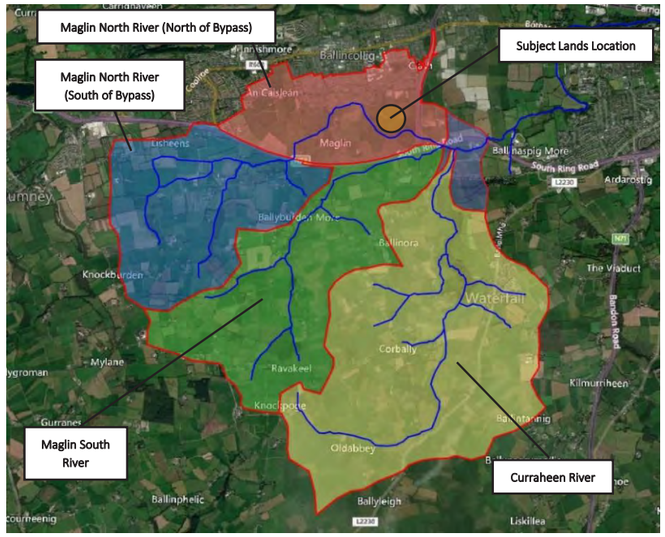


Figure 4.1: Sub Catchment Delineation

4.2.3 Hydrological Estimation Points

In order to gain a suitable understanding of the flood sources and mechanisms and to build a representative hydraulic model of the system, it is necessary to estimate the relevant flows at suitable locations along the reach. Hydrological Estimation Points (HEP) were selected at relevant locations along the length of the rivers, typically at the location of significant changes to the catchment area or flow regime. The location of all HEP's selected for this study are summarised on Table 4-1 and Figure 4.2 below.

Flows at MN02 are not presented in the following sections because the initial flood estimation indicated that the difference in peak flow between upstream and downstream HEP is not significant.

HEP	River	Description
CU01	Curraheen	Near downstream end of model
CU02	Curraheen	N40 crossing
CU03	Curraheen	N40 crossing
MA01	Maglin North River	Downstream of Confluence
MS01	Maglin	Upstream of Confluence
MN01	Maglin North River	Upstream of Confluence
MN02	Maglin North River	Upstream of N22 Culvert
MN03	Maglin North River	Open Channel, downstream of urban inflows
MN04	Maglin North River	Downstream of Lisheens Stream confluence
MN05	Maglin North River	Upstream of Lisheens Stream confluence
MN06	Maglin North River	Downstream of N22 Culvert
AD01	Lisheens Stream	Open Channel
AD02	Lisheens Stream	Upstream end of model

Table 4-1: Hydrological Estimation Points

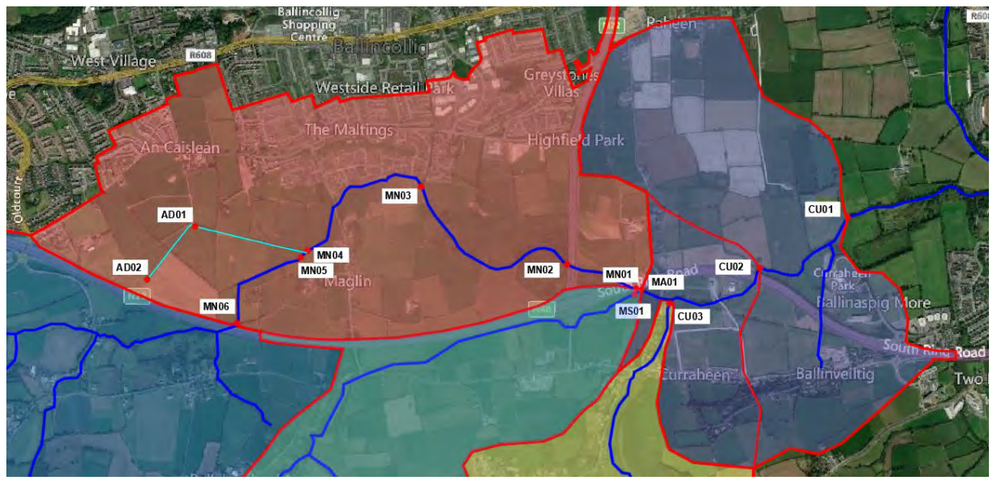


Figure 4.2: Hydrological Estimation Points

4.2.4 Flow Estimation Summary

The Flood Studies Update (FSU) programme was undertaken by the OPW in order to provide improved extreme rainfall and flood estimation methods for Ireland. It is the most recent major study of its kind to be carried out in Ireland and is broadly recognised as the best practice method for estimating peak flood flows.

One of the key outputs from the FSU was the 7 variable regression equation for estimating the Index Flood (i.e. QMED) based on Physical Catchment Descriptors (PCD's). The Index Flood is the flow that can statistically be expected to be equalled or exceeded once in a 2 year period. Ideally the application of this equation would be limited to catchments greater than 25km^2, although it has been shown to perform reasonably well for smaller catchments, albeit with a seemingly higher Factorial Standard Error (FSE) of 1.879 rather than 1.37 (Gebre et al., 2012). An alternative regression equation which was developed as part of FSU WP 4.2 for small and urbanised catchments was shown to perform slightly better than the 7 variable equation with a FSE of 1.674. However, it was concluded that the dataset on which the small catchment equation was based is very small and the FSU 7 variable equation is still the preferred method for catchments greater than 5km^2.

It is for these reasons, and others outlined below, that the flows estimated using the FSU 7 variable regression equation have been compared to the flows calculated using the following methods;

1. FSU WP4.2 Small Catchment Equation, modified by Gebre et. al. 2012;
2. Flood Studies Report (FSR) 1975 Rainfall Runoff (RR) Method;
3. Institute of Hydrology (IH) 124 3-variable Equation;
4. Poots & Cochrane, 1979

Since it is the flows associated with the northern tributary of the Maglin North River that are of most interest to this study, design flows were initially estimated at MN01 and MN06 using the methods outlined above. The selected method was then applied to the other HEP's in the study area.

The peak flows estimated at MN01 using the techniques outlined above are summarised on Table 4-2 below for various AEP's. The peak flows estimated at MN06 are similarly presented on Table 4-3. The IH124 is a clear outlier and is not considered further. It is encouraging that the estimated flows up to around 1% are broadly similar, with a maximum difference of around 10%. The difference increases to around 15% for the 0.1% AEP event. Poots & Cochrane method mainly differs for rarer events due to the difference in the adopted growth curves. When this method is eliminated, the maximum difference between the three remaining methods is less than 10% for all events.

The analysis carried out indicates that the FSU 7-variable equation with pivotal site adjustment is suitable for estimating Q_{MED} at all HEP's. The flows for various AEP's will be derived using the growth curves derived from the FSU pooling group.

MN01 - Peak Flow Summary						
Return Period, T	AEP (%)	FSU 7-Variable	FSU Small Catchment Eqn.	FSR RR	IH124	Poots & Cochrane
2	0.50	3.86	3.54	3.36	2.54	3.60
5	0.20	4.86	4.46		3.21	4.55
10	0.10	5.56	5.09		3.66	5.19
20	0.05	6.25	5.73		4.14	5.87
30	0.033	6.71	6.16		4.42	6.27
50	0.02	7.25	6.65		4.73	6.71
100	0.01	8.10	7.43	8.27	5.24	7.43
200	0.005	8.99	8.24		5.72	8.11
1000	0.001	11.42	10.47		6.95	9.85

Table 4-2: MN01 - Summary of Peak Flows

MN06 - Peak Flow Summary						
Return Period, T	AEP (%)	FSU 7-Variable	FSU Small Catchment Eqn.	FSR RR	IH124	Poots & Cochrane
2	0.50	2.34	2.43	2.16	1.33	2.33
5	0.20	2.95	3.06		1.67	2.94
10	0.10	3.37	3.50		1.91	3.36
20	0.05	3.79	3.94		2.16	3.80
30	0.033	4.07	4.23		2.31	4.06
50	0.02	4.40	4.57		2.47	4.34
100	0.01	4.91	5.11	5.36	2.73	4.81
200	0.005	5.45	5.66		2.99	5.25
1000	0.001	6.92	7.20		3.63	6.38

Table 4-3: MN06 - Summary of Peak Flows

4.3 Baseline Hydraulic Modelling

4.3.1 General

As previously discussed, additional topographic surveying was made available to MWP in November 2023. The details of this more reliable topographical survey information are summarised in the Hydraulic Analysis Report included in Appendix 2. This has resulted in a review and update of the South Ballincollig Drainage Study SFRA baseline hydraulic model. The result of this update is outlined in the Hydraulic Analysis Report included in Appendix 2. This update has resulted in minor changes to flood levels and extents in the Maglin area.

4.3.2 Hydraulic Model Overview

The hydraulic analysis was carried out using the Hydraulic Engineering Centre River Analysis System software which was developed by the US Army Corps of Engineers.

The initial model was developed as a combined 1D-2D hydraulic model using HEC-RAS Version 5.0.7. The model was updated following the release of HEC-RAS Version 6.1 in June 2021 and it was determined through various sensitivity checking that the results from a full 2D model were similar to the initial model and moreover the 2D model was found to provide better stability and robustness with less uncertainty associated with the efficiency of flow transfer between the 1D and 2D domains. The model has subsequently been updated using HEC RAS 6.4.1 for the purpose of this study.

The final model includes approximately a 3.2km reach of the Maglin North River, 2.1km of Maglin South River and circa 1km of the Curraheen River as well as the Lisheens Stream west of the subject site.

The river channel was created using the 1-dimensional (1D) cross sections obtained from the OPW Lee CFRAMS survey data with a small number of supplementary cross sections surveyed by HD surveys for the South Ballincollig Drainage Study SFRA. These 1D cross sections were used to create a digital terrain model DTM of the river channel to enable in-bank flows to be modelled using the hydrographic survey data since LIDAR data would not be suitable. The river channel remains unchanged for the hydraulic analysis completed as part of this study.

The remainder of the 2D model was developed using a DTM from LIDAR data. This has a total area of approximately 360 hectares and includes the lands within the Maglin area, to the south of the N22 road as well as an extensive area downstream of the Maglin North River confluence with the Curraheen River. The DTM based on the 1D cross sections was then enforced onto the LIDAR DTM to provide a single terrain model for the entire area. As previously discussed, the 2D area in the Maglin area has been updated where applicable using the additional topographical survey information obtained in 2023. The result of this update is discussed in the Hydraulic Analysis Report in Appendix 2.

The model also includes 18no. existing bridge/culvert structures. The hydraulic model extents and schematic is included in Figure 4.3 below.

An unsteady flow analysis was performed using flow hydrographs which were derived during the hydrological analysis outlined previously and in the South Ballincollig Drainage Study SFRA. The downstream boundary condition was set to match the water surface gradient at the downstream end of the reach.

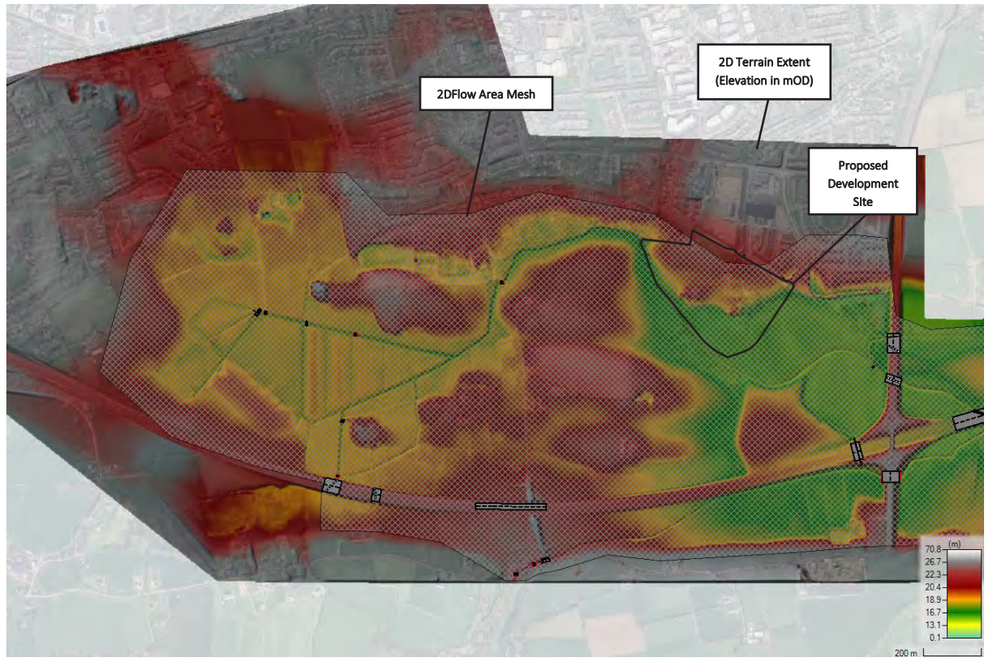


Figure 4.3: Hydraulic Model Schematic

4.4 Flood Zone Mapping & Baseline Flood Levels

The Planning System and Flood Risk Management Guidelines for Planning Authorities (2009) defines three flood zone types as follows:

- *Flood Zone A* – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);
- *Flood Zone B* – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and
- *Flood Zone C* – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

The hydraulic model was used to establish the baseline (existing situation at time of writing i.e. no development, no Sustainable Access Corridor) flood levels at the site for the 1% AEP and 0.1% AEP events and these were used to produce a flood zone map for the site. The Flood Zone map, which indicates the extent of Flood Zones A and B, is shown on Figure 4.4 and Figure 4.5 below. The baseline flood levels are presented in Table 4.5 to Table 4.7. It is demonstrated that the flood extents for the baseline SFRA hydraulic model and the updated baseline hydraulic model are relatively similar. For the purpose of this study, the updated baseline model results will be adopted as the updated terrain surface used in the baseline hydraulic model is based on more reliable topographic survey data.

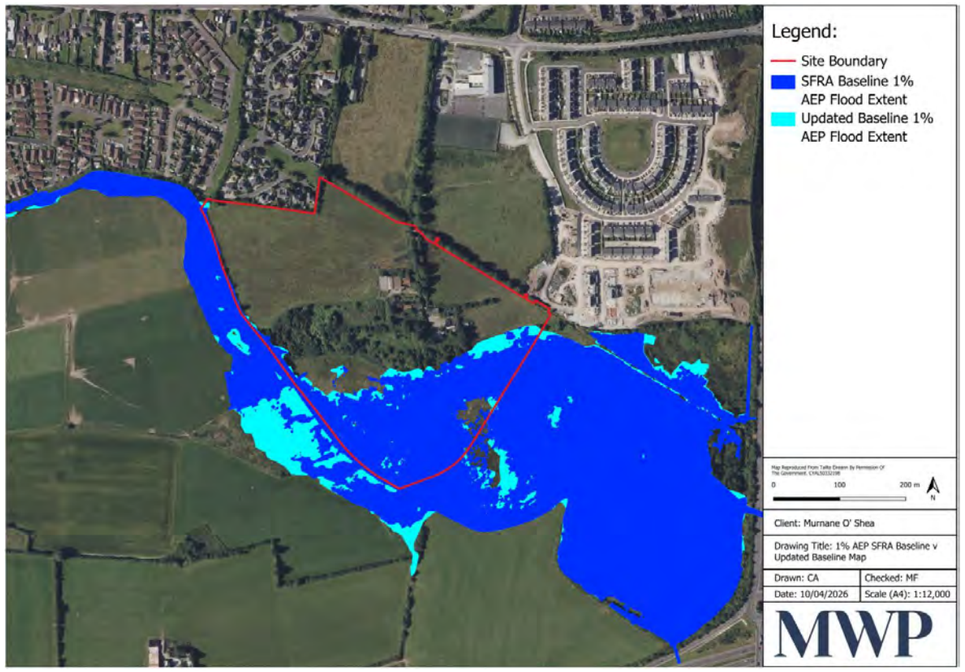


Figure 4.4: Baseline Flood Extents - SFRA v Updated Baseline - 1% AEP

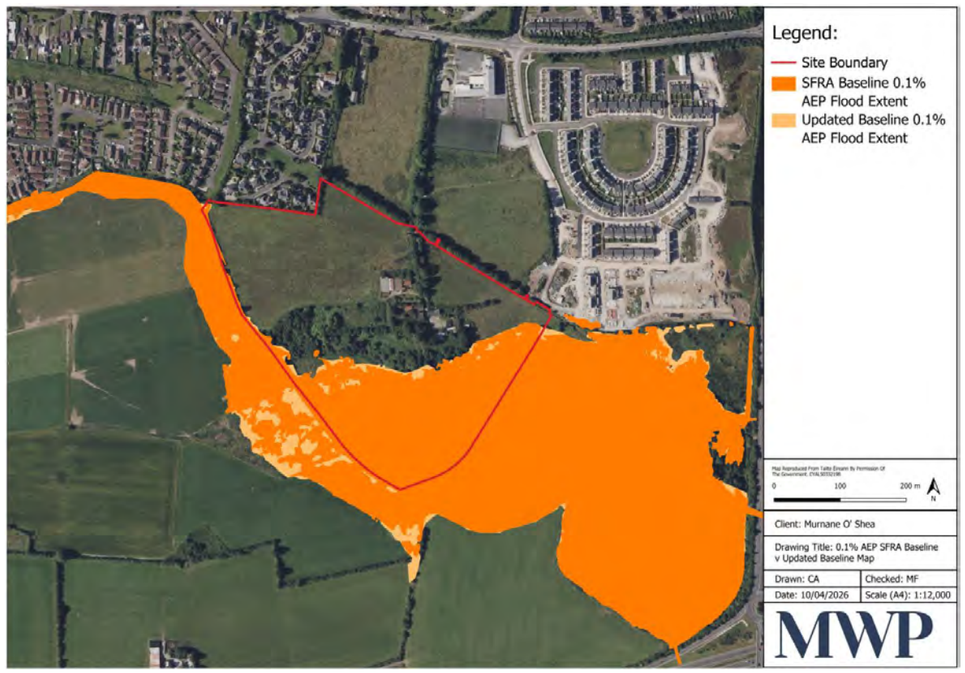


Figure 4.5: Baseline Flood Extents - SFRA v Updated Baseline – 0.1% AEP

4.5 Vulnerability of Proposed Development

The Guidelines have outlined three Vulnerability Classifications for developments based on the proposed land use and type of development. These classifications and particular examples of development types which would be included in each classification are summarised as follows;

- **Highly Vulnerable Development:** This would include emergency services, hospitals, schools, residential institutions, dwelling houses, essential infrastructure, water & sewage treatment etc.
- **Less Vulnerable Development:** Retail, leisure, commercial, industrial buildings, local transport infrastructure.
- **Water-compatible development:** Docks, marinas and wharves. Amenity and open space, outdoor sports and recreation and essential facilities such as changing rooms.

The Guidelines include a matrix that determines the appropriateness of different types of development based on their vulnerability classification and the Flood Zones in which they are located. The matrix is reproduced in Table 4-4 below.

Where the matrix indicates that a development is not appropriate it may still be justified based on a procedure described as a Justification Test.

Vulnerability Classification	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable Development (Including essential Infrastructure)	Justification Test	Justification Test	Appropriate
Less Vulnerable Development	Justification Test	Appropriate	Appropriate
Water-compatible Development	Appropriate	Appropriate	Appropriate

Table 4-4: Vulnerability Matrix

The following is noted:

1. The proposed residential development is considered to be a Highly Vulnerable Development in accordance with the PSFRM Guidelines. The proposed residential development is largely within Flood Zone C and these areas are therefore appropriate for development without completing a Justification Test. A minor area of the proposed residential development encroaches into Flood Zone A & B, a Justification Test is required for this area.
2. The proposed Ballincollig Sustainable Access Corridor will be developed along the southeastern site boundary as indicated in the site layout drawing. Local transport infrastructure is considered as less vulnerable infrastructure. As this proposed Sustainable Access Corridor is located within Flood Zone A & B, a Justification Test is required.

4.6 Post Development Hydraulic Modelling

4.6.1 General

The proposed development includes the provision of a Sustainable Access Corridor through the Maglin Valley as requested by the Local Authority. The proposed development of the subject lands will include constructing the proposed Sustainable Access Corridor along the southeastern boundary of the subject lands as indicated in Figure 1.2. It is necessary to model the impacts of the post development scenario to ensure the proposed development of the subject lands will not increase flood risk to lands upstream or downstream of the subject lands or to those occupying the proposed development of these subject lands.

The adjustments made to the hydraulic model to represent the post development situation are summarized as follows.

1. The proposed Sustainable Access Corridor adjacent to the proposed residential development was added to the baseline terrain file used for hydraulic model computations. The modelled road was raised to prevent flooding for the purpose of this hydraulic analysis.
2. The infilling associated with the proposed residential development was also added to the baseline terrain file used for hydraulic model computations. This includes the area between the proposed residential development and the proposed Sustainable Access Corridor.

The model schematic is shown on Figure 4.6.

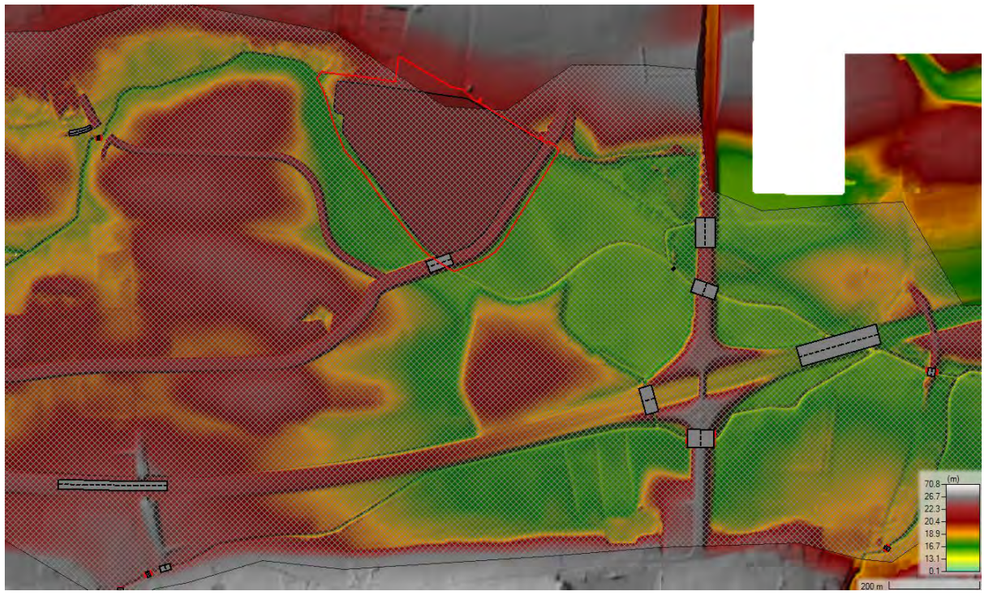


Figure 4.6: Post Development Hydraulic Model Schematic

4.6.2 Post Development Hydraulic Modelling Results

This scenario presents the results of the post development hydraulic modelling. This assumes the proposed development boundary has been infilled in conjunction with the construction of the residential and Sustainable Access Corridor development.

As previously discussed, hydraulic analysis of this scenario has been completed to establish the impact the updated Sustainable Access Corridor alignment combined with the infilling of the proposed development site. This scenario has been modelled and the flood extents for both the pre and post development situations are presented on Figure 4.9 to Figure 4.11 for the 1% AEP & 0.1% AEP Current MRFS Scenarios respectively. The flood level differences at the node points given in these figures are tabulated on Table 4.5 to Table 4.7 below. It should be noted that these differences relate to the total difference in flood levels pre and post development and do not reflect the difference between the original SFRA flood levels and the flood levels due to the revised Sustainable Access Corridor alignment and infilling of the subject lands. This is discussed in Section 4.6.3.

The original SFRA envisaged an increase in flood risk upstream of the Sustainable Access Corridor, along with minor increases downstream of the Sustainable Access Corridor, and the results of the subject analysis are consistent with this. For the subject analysis, the maximum flood level increase upstream of the Sustainable Access Corridor is approximately 360mm. Any notable increase upstream of the road is relatively localised and extends a maximum c. 350m upstream of the proposed Sustainable Access Corridor. It does not impact flood risk to any existing buildings and only involves a minor increase in flood extents to lands for which the adjacent landowner has no objection and consented to (Refer to Appendix 3). The minor increase in flood level downstream is less than 50mm and extends downstream of the proposed Sustainable Access Corridor for which the adjacent landowner has no objection and consented to.

There is no impact on flood levels at Node 7 (adjacent to existing residential properties) and Node 11 (adjacent to N22). The flood level node locations are presented in Figure 4.7 below.



Figure 4.7: Flood Level Node Locations

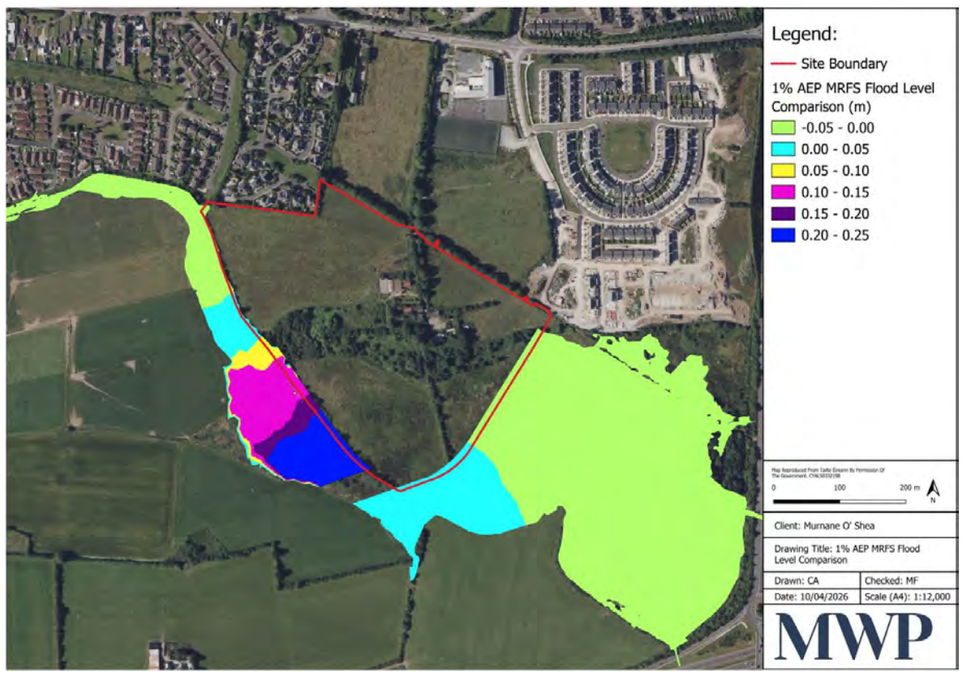


Figure 4.8: Flood Level Difference Map - 1% AEP MRFS – Impact of Infilling Combined with Modified Sustainable Access Corridor Layout



Figure 4.9: Flood Extent Comparison - Baseline (Blue) v Post Development (Orange) – 1% AEP



Figure 4.10: Flood Extent Comparison - Baseline (Blue) v Post Development (Orange) – 0.1% AEP



Figure 4.11: Flood Extent Comparison - Baseline (Blue) v Post Development (Orange) – 1% AEP MRFS

Flood Levels at Node Points (Baseline v Proposed Development) – 1% AEP Current			
Node ID	1% AEP Current (Baseline) (mOD)	1% AEP Current (Proposed) (mOD)	Difference (m)
7	17.30	17.30	0
8	16.53	16.56	0.03
9	16.11	16.34	0.23
10	16.04	16.07	0.03
11	15.93	15.93	0
18	15.95	15.95	0
19	15.95	15.95	0
20	16.00	-	-

Table 4.5: Predicted Flood Levels at Node Points – 1% AEP Current

Flood Levels at Node Points (Baseline v Proposed Development) – 0.1% AEP Current			
Node ID	0.1% AEP Current (Baseline) (mOD)	0.1% AEP Current (Proposed) (mOD)	Difference (m)
7	17.40	17.40	0
8	16.59	16.73	0.14
9	16.30	16.66	0.36
10	16.28	16.30	0.02
11	16.25	16.25	0
18	16.26	16.26	0
19	16.26	16.26	0
20	16.27	-	-

Table 4.6: Predicted Flood Levels at Node Points – 0.1% AEP Current

Flood Levels at Node Points (Baseline v Proposed Development) - 1% AEP MRFS			
Node ID	1% AEP MRFS (Baseline) (mOD)	1% AEP MRFS (Proposed) (mOD)	Difference (m)
7	17.35	17.35	0
8	16.56	16.61	0.05
9	16.18	16.49	0.31
10	16.14	16.17	0.03
11	16.09	16.09	0
18	16.10	16.10	0
19	16.10	16.10	0
20	16.12	-	-

Table 4.7: Predicted Flood Levels at Node Points – 1% AEP MRFS

Scenario	Upstream End of Site (mOD)	Downstream End of Site (mOD)
1% AEP Current	17.06	16.34
0.1% AEP Current	17.12	16.70
1% AEP MRFS	17.09	16.50

Figure 4.12: Post Development Flood Levels

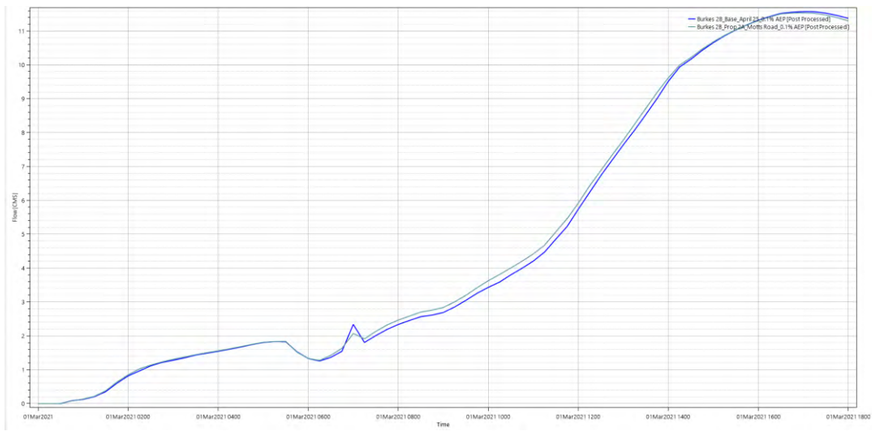


Figure 4.13: Downstream Peak Flow Hydrograph - 0.1% AEP Current

4.6.3 Comparison of Flood Risk Impacts with South Ballincollig Drainage Study SFRA

The South Ballincollig Drainage Study SFRA prepared in October 2021 envisaged limited increases to flood risk both upstream and downstream of the Sustainable Access Corridor. Such increases were considered acceptable once this was allowed for in the development of the zoned lands.

The flood level comparison map from the South Ballincollig SFRA is presented in Figure 4.14 below. This was based on the use of LiDAR data in the floodplains. More reliable topographic data was received by MWP in November 2023. This was used to update the hydraulic model and create a new flood level comparison map (with all other aspects, including the Sustainable Access Corridor alignment, being identical to the SFRA) which is shown on Figure 4.15.

In terms of the post-development situation, the difference in flood level between the SFRA and this assessment is shown on Table 4.8 below. This indicates that:

1. The flood levels upstream of the Sustainable Access Corridor are higher than the SFRA. This is due to the inclusion of a flow control structure (details to be confirmed during detailed design taking cognisance of Section 50 requirements) under the Sustainable Access Corridor for the purpose of this development to control the amount of flow passed downstream of the Sustainable Access Corridor. As stated in the previous sub-section, this does not impact flood risk to any existing buildings or unpermitted 3rd party lands and it serves to benefit flood risk downstream of the road.
2. As indicate on the table, there is no notable difference in flood level downstream of the Sustainable Access Corridor when compared to the SFRA.

It is concluded that the flood level impact as a result of facilitating the residential development is consistent with the intent of the South Ballincollig Drainage Study SFRA.

Flood Levels at Node Points (Updated SFRA Levels v Proposed Development Levels) - 1% AEP MRFS			
Node ID	1% AEP MRFS (Updated SFRA) (mOD)	1% AEP MRFS (Proposed) (mOD)	Difference (m)
7	17.35	17.35	0
8	16.56	16.61	0.05
9	16.28	16.49	0.21
10	16.17	16.17	0
11	16.09	16.09	0
18	16.10	16.10	0
19	16.10	16.10	0

Table 4.8: Comparison of Post-Development Flood Levels – Updated SFRA v Proposed Development



Figure 4.14: Extract from South Ballincollig SFRA - Flood Level Increase Upstream of Sustainable Access Corridor

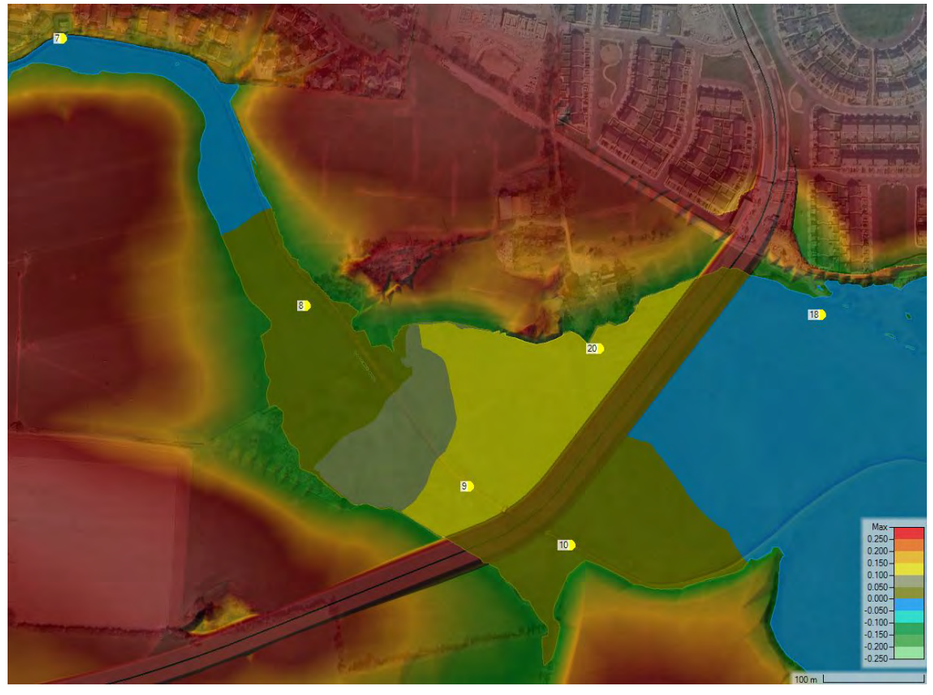


Figure 4.15: SFRA Flood Level Impacts (Using Updated Topographic Data)

4.7 Mitigation Measures

The mitigation measures relating to the proposed development of the subject lands and Sustainable Access Corridor realignment should be as per the South Ballincollig Drainage Study SFRA. It is proposed that a flow control structure be provided where the Maglin passes under the Sustainable Access Corridor to control the amount of flow being conveyed downstream of the Sustainable Access Corridor.

For context, the following is an extract from the South Ballincollig Drainage Study SFRA:

"The post-development situation includes for the proposed new spine road which will cross the river and floodplain at a number of locations. It is assumed for the purpose of this SFRA that no other alterations will be made to the river or floodplains. The design of the spine road is yet to be completed therefore the analysis was carried out based on an indicative alignment which is expected to be broadly consistent with the final position. This approach is acceptable in the context of a SFRA for development plan zoning however at design stage, the possible implications of any deviations from the assumed alignment should be checked.

An indicative road alignment and footprint was agreed with Cork City Council to enable the SFRA to be completed. The hydraulic model was then adjusted to include the new road alignment." This analysis for the SFRA involved adjusting the DTM to include a 40m wide embankment along the line of the road and the provision of crossing structures at all locations where the road crosses the river channel. The dimensions of the structures were adjusted iteratively until an acceptable solution was achieved, taking cognisance of anticipated OPW Section 50 requirements."

The mitigation strategy includes the construction of (flow control structure) to convey the Maglin North River under the proposed Sustainable Access Corridor. The initial flow control structure dimensions were selected to facilitate throttling of the flow upstream of the Sustainable Access Corridor to mitigate downstream impacts while ensuring impacts are consistent with the SFRA intent. This approach is consistent with the SFRA intent. Section 50 consent will be required from the OPW in relation to this flow control structure.

The proposed minimum finished floor level of all buildings typically ranges from 17.60mOD – 22.50mOD. This is above the predicted design flood level (16.50mOD – 17.09mOD) for the 1% AEP MRFS. There is 2no. apartment blocks with proposed basement levels of 17.25mOD. This is still above the adjacent design flood level of 16.58mOD therefore the risk to occupants of the residential units is considered low. The proposed ground levels will be raised to a minimum level of 17.00mOD. The proposed Sustainable Access Corridor will be raised to a level ranging from c. 17.0mOD at the southwestern end of the road to c20.00mOD at the northeastern end of the road.

4.8 Assessment of Risk to Occupants

The proposed ground levels within the proposed development boundary and finished floor level of any proposed buildings will be above the predicted design flood level therefore the risk to occupants of the proposed residential units is low. The proposed Sustainable Access Corridor is elevated above the flood level therefore safe access and egress is available to the site during flood events.

Notwithstanding this, it is recommended that users of the site are made aware of the potential for flooding in this area and that warning signs and life-saving equipment are provided at accessible locations. The exact details of these should be established by an operational risk assessment of the site.

4.9 Impact of Development on Flooding Elsewhere

Generally, potential impacts outside the site can occur due to loss of water storage where part of a floodplain is filled to accommodate development.

The mitigation measures outlined in this report have been formulated to ensure that the proposed development will not adversely impact flood risk elsewhere, except where this is consistent with the intent of the South Ballincollig Drainage Study SFRA.

The impact of the proposed development is discussed in Section 4.6.2 and the comparison to the South Ballincollig Drainage Study SFRA is discussed in Section 4.6.3. It is therefore concluded that the proposed development will not adversely affect flood risk when compared to the SFRA.

4.10 Residual Risks

The following residual risks have been identified;

1. Climate change effects larger than currently estimated
2. Flood Flows Larger than estimated
3. Blockage of the proposed Sustainable Access Corridor Flow Control Structure

4.10.1 Climate Change Effects & Larger Flood Flows

During the sensitivity analysis an assessment was carried out to determine the impact a 1% AEP flood event for the HEFS (i.e. 30% increase in flows to allow for climate change). The predicted flood level for the 1% AEP HEFS flood event is 17.12mOD and 16.60mOD at the upstream and downstream end of the site respectively and the flood level impacts elsewhere are consistent with the impacts identified above.

Based on this the proposed development of this site is deemed to not create an unacceptable flood risk elsewhere and the proposed development is not at risk during the 1%AEP HEFS.

4.10.2 Sustainable Access Corridor Flow Control Structure Blockage

During the sensitivity analysis an assessment was carried out to determine the impact a 20% blockage of the proposed structure beneath the proposed Sustainable Access Corridor. The scenario was run using the 1% AEP MRFS flood event. There is an approximate 150mm increase in flood levels as a result of this blockage at the downstream end of the site with negligible effect on flood levels at the upstream end of the site. Based on this the site is deemed not to be at risk due to the residual risk of a structure blockage.

4.11 Justification Test

The PSFRM Guidelines outlines two types of Justification Test, namely Plan-making Justification Tests and Development Management Justification Tests. The latter is appropriate at the planning application stage for developments in moderate or high risk flood areas.

The PSFRM Guidelines state that when applying the Justification Test to developments which may be vulnerable to flooding a number of criteria should be satisfied. These are listed and commented on below.

Criterion 1: "The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines".

The Cork City Development Plan 2022-2028 was adopted on 27th June 2022 and requires proposals for development in Ballincollig to comply with objectives 10.56 – 10.62 of the Cork City Development Plan 2022 -

2028 and with the provisions of the Planning System and Flood Risk Management Guidelines. This Flood Risk Assessment has been carried out in accordance with these Objectives and Guidelines. The following objectives have been extracted from the Cork City Development Plan 2022-2028.

Objective 10.57 South Ballincollig (Maglin) Expansion Area: To support the compact growth and development of South Ballincollig Expansion Area as a strategic City consolidation and expansion area, as identified in the Core Strategy. All development shall be designed, planned and delivered in a co-ordinated and phased manner, using a layout and mix of uses that form part of an emerging neighbourhood integrated with the wider area.

Objective 10.60 Ballincollig Framework Plan for the Link Road/Leo Murphy Road Area: During the lifetime of this Plan Cork City Council in collaboration with relevant stakeholders including the National Transport Authority, Transport Infrastructure Ireland and landowners will prepare a Framework plan for the Link Road / Leo Murphy Road Area through a multidisciplinary master planning approach for the comprehensive and coordinated redevelopment of these lands.

The Northern portion of the site has been zoned ZO 01 – Sustainable Residential Neighbourhoods under the Cork City Development Plan 2022 – 2028. The provision of the Sustainable Access Corridor has included a portion of Z015 – Public Open Space zoned lands which will now be severed from the remainder of the flood zone. As set out in this report the raising of this portion of the lands out of the flood zone has no impact on the lands downstream and allows these lands to be rezoned in the future to allow a more coherent overall development to the North of the new Sustainable Access Corridor.

Ballincollig experienced significant economic growth in recent times. Future housing and population growth in Ballincollig will be concentrated in the Maglin Area to the south of the town and other zoned lands to the west and on infill and brownfield lands within the existing built-up area of the town. The construction of a Sustainable Access Corridor through the Maglin Area is essential to facilitate the sustainable development of these lands and thereby provide for the targeted expansion of the town. The objectives

This demonstrates that the proposed development is in compliance with the relevant zoning objectives for the site.

Criterion 1 of the justification test is therefore considered to be satisfied.

Criterion 2: Table 4.9 outlines the justification for Criterion 2 of the Justification Test.

Justification Test Criterion 2	
Justification Criteria	**Justification**
The proposal has been subject to an appropriate flood risk assessment that demonstrates: i. The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk ii. The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible iii. The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access iv. The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.	These criteria are addressed in the previous sub-sections and have been fulfilled by carrying out appropriate risk assessments, the implementation of mitigation measures and by adequately assessing all associated risks as summarised below: i. As outlined in Section 4.6.3, there is no unacceptable increase in flood levels due to the proposed development that and the proposed development will not increase flood risk elsewhere. ii. As outlined in the site-specific FRA, the provision of mitigation measures such as ensuring F.F.L have appropriate freeboard above flood levels, the provision of a suitably designed storm drainage system to control surface runoff, the provision of 1no. flow control structure under the proposed Sustainable Access Corridor, will minimise flood risk to people, property the economy and the environment as far as reasonably possible. iii. As outlined in Section 4.10, there are uncertainties with regard to climate change impacts on peak flows. The best approach is to be flexible with regard to management of flood risk. The proposed minimum basement F.F.L of the residential development units is 17.25mOD. This provides freeboard above the 1% AEP HEFS flood event. The HEFS is deemed an appropriate uplift in flood levels due to climate change for residual risk assessment. The development proposed therefore includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access. iv. As outlined throughout the FRA, the development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

Table 4.9: Justification Test Criterion 2

5. Summary & Conclusions

A summary of the main findings of this FRA is as follows;

1. This report has been prepared in the context of The Planning System and Flood Risk Management – Guidelines for Planning Authorities, November 2009 (PSFRM), published by the Office of Public Works and the Department of Environment, Heritage and Local Government.
2. The development will consist of the demolition of existing agricultural building and the construction of a residential development of 300 no. residential units consisting of 128 no. dwellings houses, 172 no. apartment/duplex units, a two storey creche facility and all ancillary site development works. The Stage 1 and 2 flood risk assessments indicated that there is potential for fluvial flooding at this site. The potential source of flooding was identified as the Maglin North River located south of the site.
3. A Stage 3 Detailed Flood Risk Assessment (FRA) was carried out to assess flood risk issues in sufficient detail to provide a quantitative appraisal of potential flood risk to the site.
4. A hydraulic model was created to predict the flood zones and flood levels at the site. This demonstrated that the majority of the proposed residential development of the site is located in Flood Zone C and therefore has a low probability of flooding. The southern area of the site which includes a small portion of the proposed residential area and the proposed Sustainable Access Corridor is located in Flood Zone A/B and therefore has a high/moderate probability of flooding.
5. A Justification Test is required for the proposed residential development as it encroaches into Flood Zone A and B and the proposed Sustainable Access Corridor. A Justification Test was carried out which demonstrates that the proposed development of the Sustainable Access Corridor is compliant with PSFRM Guidelines and the Objectives of Cork City Development Plan 2022 - 2028.
6. To ensure that there is no unacceptable flood risk, the following mitigation measures are recommended:
    a. The finished floor level (FFL) of all buildings should be set above the 1% AEP flood level for the MRFS plus 500mm freeboard. This recommendation is in line with the requirements of Criterion 3 of the Greater Dublin Strategic Drainage Study (GDSDS), 2005. On this basis, the design flood level ranges from 16.50 mOD to 17.09mOD at the downstream and upstream end of the site respectively. The proposed minimum F.F.L of the residential units ranges from 17.25mOD to 22.50mOD and any proposed F.F.L is over 500mm above the adjacent design flood level.
    b. The land within the site will be raised above the design flood level.
    c. The proposed Sustainable Access Corridor will be raised to a level ranging from c. 17.0mOD at the southwestern end of the road to c20.00mOD at the northeastern end of the road which places it above the design flood level.
7. It was also concluded that, once these mitigation measures are implemented, the proposed development would not have an adverse impact on flooding on third party lands downstream of the Sustainable Access Corridor when compared to the South Ballincollig Drainage Study SFRA.
8. It was demonstrated that the risk to occupants of the site would be low.
9. Residual risks associated with the development were also assessed and are considered to be acceptable.

Appendix 1

Site Layout Plan

DO NOT SCALE. WORK TO FIGURED DIMENSIONS ONLY.
ALL EXISTING DIMENSIONS TO BE CHECKED ON SITE.
DRAWN ON AUTOCAD R2004 AT DEADY GAHAN ARCHITECTS LTD
LAYERS ON THIS DRAWING COMPLY WITH BS 1192: PART 5

AREAS SCHEDULE	
SITE AREA	13.5 Ha
DEV. AREA	6.67 Ha
NO.UNITS	300
OPEN SPACE	15% Usable
DENSITY	45 Unit/Ha

Character Area 1 - Crescent Park

Character Area 2 - Hamlet Square

Character Area 3 - Maglin View

PEDESTRIAN CONNECTION TO NORTHERN DEVELOPMENT

PERMITTED DEVELOPMENT UNDER CONSTRUCTION BY APPLICANT PLANNING REF: 22/41644

LOCATION OF SITE NOTICE

PROVISION FOR FUTURE EXTENSION TO ACTIVE TRAVEL ROUTE TO WEST

PROPOSED ACTIVE TRAVEL ROUTE

PERMITTED ACTIVE TRAVEL ROUTE

PROPOSED EXTENSION TO PERMITTED ACTIVE TRAVEL ROUTE

PROPOSED PEDESTRIAN CONNECTION NORTH

COMPLETED HEATHFIELD DEVELOPMENT CONSTRUCTED BY APPLICANT PLANNING REF: 19/38923

EXISTING ESB LINES TO BE UNDERGROUNDED/ DIVERTED

PROPOSED PEDESTRIAN CONNECTION NORTH

ARCHAEOLOGICAL FEATURE TO BE RETAINED

ARCHAEOLOGICAL FEATURE TO BE RETAINED

OPEN SPACE

OPEN SPACE

OPEN SPACE

PROPOSED UNCONTROLLED RAISED CROSSING

EXISTING WAYLEAVE

PROVISION FOR FUTURE PEDESTRIAN CONNECTIVITY TO WEST

PROPOSED LOCATION OF SITE MAST

SITE ENTRANCE

AGRICULTURAL LAND

PROPOSED EXTENSION TO SUSTAINABLE ACCESS CORRIDOR

MAGLIN NORTH STREAM

PROPOSED TEMPORARY PUMPING STATION

AGRICULTURAL LAND

SITE ENTRANCE

PROPOSED UNCONTROLLED RAISED CROSSING

PROVISION FOR FUTURE EXTENSION TO SUSTAINABLE ACCESS CORRIDOR TO WEST

FOR LOCATION OF SITE NOTICES - REFER TO LOCATION MAPS - DWG NO. 22148/P/001A & 22148/P/001B

PLEASE REFER TO SRLA LANDSCAPE DRAWINGS FOR DETAILS OF BOUNDARY AND SURFACE TREATMENTS

PLEASE REFER TO ENGINEERS DRAWINGS FOR ROAD DETAILS

Denotes area of land subject to planning application

Denotes area of land under applicants ownership

NORTH

date	rev	name	chk	note
11.02.26	P1	GN	EJG	ISSUE FOR PLANNING

DEADY GAHAN ARCHITECTS

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Project
PROPOSED RESIDENTIAL DEVELOPMENT
CARRIGANARRA, BALLINCOLLIG,
CO. CORK

Drawing title
PROPOSED SITE LAYOUT
MASTERPLAN

Scale	Drawn	Checked	Date
1:1000 @ A1	GN	EJG	23.05.2025

Project No.	Drg. No.	Revision
22148	22148/P/003	P1

☐ Information \ Comments — Tender ☐
☐ Planning — Construction ☐

PROPOSED SITE PLAN - MASTERPLAN

SCALE 1:1000 @ A1

Appendix 2

Baseline Model Update – Hydraulic Analysis Report

MWP

Hydraulic Analysis Report

Maglin Area Baseline Hydraulic Model Update

Murnane O' Shea

January 2025

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Appendices

Appendix A – Topographic Survey

Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Status
24363	MWP-ZZ-ZZ-RP-Z-6001	P01	31/01/2025	CA	MF	MF	S3

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1. General

1.1 Introduction

Malachy Walsh and Partners (MWP) has been commissioned by Murnane O'Shea to carry out the hydraulic analysis in relation to a proposed residential development located in Maglin, Ballincollig, Cork.

This report has been commissioned to establish the hydraulic implications of additional topographical survey information of the Maglin area and the further design development of the Ballincollig Distributor Road since the South Ballincollig Drainage Study SFRA was undertaken in 2021.

1.2 Summary of South Ballincollig Drainage Study SFRA

Malachy Walsh and Partners (MWP) Consulting Engineers were commissioned by Cork City Council (CCC) to carry out a Strategic Flood Risk Assessment (SFRA) in relation to the development of lands in Maglin, Ballincollig, Cork. This was completed in October 2021. A detailed hydrological analysis was carried out to estimate the flood flows throughout the study area and the surrounding areas. The results of this analysis were used as input parameters to the hydraulic modelling.

Detailed hydraulic analysis was also carried out which included modelling of approximately 3.2km of the Maglin North River, 2.1km of Maglin South River, circa 1km of the Curraheen River as well as the artificial drainage channel running through the western portion of the lands. In order to ensure the model was performing to an acceptable level of accuracy, the model was calibrated using surveyed and estimated flood levels from the February 2021 event.

The results of this hydraulic analysis were used to identify the Flood Zones for the study area. Cork City Council reviewed the flood zones identified during the SFRA preparation and applied the sequential approach when making decisions on land zoning in the Plan Area.

The baseline hydraulic model was adjusted for the post-development situation which includes for the proposed new spine road which will cross the river and floodplain at a number of locations. It was assumed for the purpose of this SFRA that no other alterations will be made to the river or floodplains. An indicative road alignment and footprint was agreed with Cork City Council to enable the SFRA to be completed. A number of mitigation measures were recommended from a SFRA perspective to ensure that the flood risk to developments within the Plan Area is acceptable and to prevent an adverse impact upstream or downstream of the site.

2. Data Acquisition & Review

2.1 Additional Topographic Survey Information

2.1.1 Overview

As previously discussed, additional topographic surveying has been completed in the Maglin area and made available to MWP in November 2023. This topographical survey information relates to the floodplain areas in the Maglin area as indicated in Figure 2.1. This has resulted in a review and update of the South Ballincollig Drainage Study SFRA baseline hydraulic model based on the most up to date survey information for the purpose of the hydraulic analysis completed for this proposed development. It should be noted that this additional information only affects the 2D terrain surface utilised in South Ballincollig Drainage Study SFRA hydraulic modelling. The hydrographic survey data used to create the 1D cross sectional model of the river channels remains unchanged.

A summary of the location of the additional topographic survey information is provided below.

- The lands located in the western area of the Ballincollig lands (highlighted in orange in Figure 2.1) have a point spacing ranging from 30m – 60m with elevations ranging from approximately 30mAOD in the west to approximately 18mAOD in the east of this section of the surveyed area.
- The lands located in the north east area of the Ballincollig lands (highlighted in red in Figure 2.1) have a point spacing ranging from 10m – 15m with elevations ranging from approximately 23mAOD in the south west to approximately 15mAOD in the south east of this section of the surveyed area.
- The lands located in the south eats area of the Ballincollig lands (highlighted in purple in Figure 2.1have a point spacing ranging from 30m – 60m with elevations ranging from approximately 23mAOD in the west to approximately 15mAOD in the east of this section of the surveyed area.

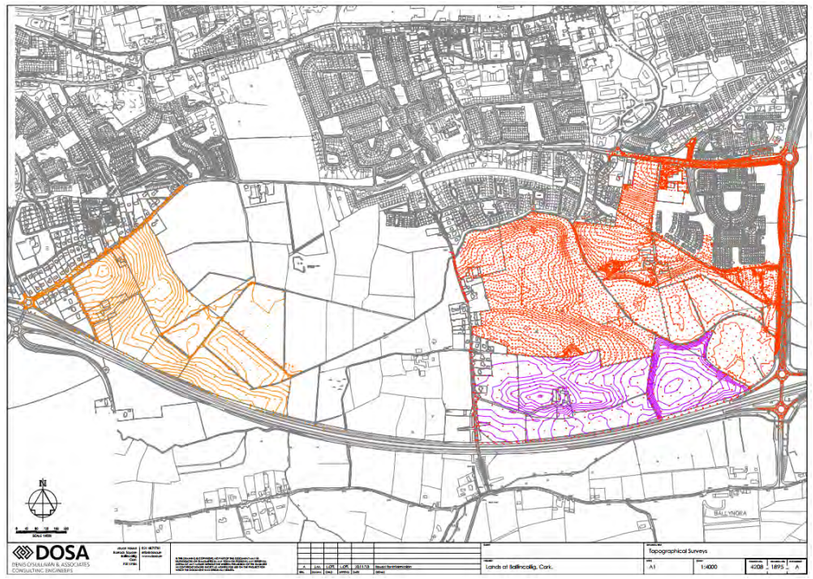


Figure 2.1: Location of Topographic Survey Areas

2.1.2 Comparison of LiDAR & Topographical Survey Information

The majority of the 2D terrain surface utilised for the South Ballincollig Drainage Study SFRA hydraulic analysis was created using 2.0m LIDAR data which was obtained from National Map Services in March 2021.

Presented below are screenshots of profile lines which compare the new topographical survey levels with the LIDAR surface from the South Ballincollig Drainage Study SFRA hydraulic model. This indicates the topographical survey is typically lower than the LIDAR by approximately 100mm-150mm. This is likely to have an impact on flood extents and levels within this area as these areas are located within the floodplain.

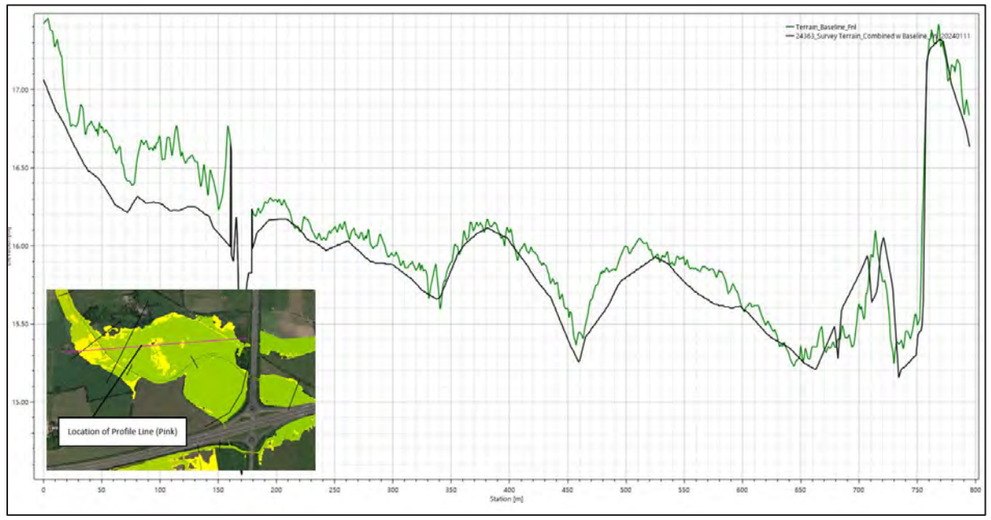


Figure 2.2: Comparison of Elevations - Topographic Survey 2023 (Black) LIDAR (Green)

3. Hydraulic Modelling

3.1 Overview of Hydraulic Modelling Approach

The hydraulic analysis was carried out using the Hydraulic Engineering Centre River Analysis System software which was developed by the US Army Corps of Engineers.

The initial model was developed as a combined 1D-2D hydraulic model using HEC-RAS Version 5.0.7. The model was updated following the release of HEC-RAS Version 6.1 in June 2021 and it was determined through various sensitivity checking that the results from a full 2D model were similar to the initial model and moreover the 2D model was found to provide better stability and robustness with less uncertainty associated with the efficiency of flow transfer between the 1D and 2D domains. The model has subsequently been updated using HEC RAS 6.4.1 for the purpose of this study.

The final model includes approximately a 3.2km reach of the Maglin North River, 2.1km of Maglin South River and circa 1km of the Curraheen River as well as the artificial drainage channel running through the western portion of the lands.

As discussed in the South Ballincollig Drainage Study SFRA, the river channel was created using the 1-dimensional (1D) cross sections obtained from the OPW Lee CFRAMS survey data with a small number of supplementary cross sections surveyed by HD surveys for this SFRA. These 1D cross sections were used to create a digital terrain model DTM of the river channel to enable in-bank flows to be modelled using the hydrographic survey data since LIDAR data would not be suitable. The river channel remains unchanged for the hydraulic analysis completed as part of this study.

The remainder of the 2D model was developed using a DTM from LIDAR data. This has a total area of approximately 360 hectares and includes the lands within the study area, to the south of the N25 road as well as an extensive area downstream of the Maglin confluence with the Curraheen River. The DTM based on the 1D cross sections was then enforced onto the LIDAR DTM to provide a single terrain model for the entire area. As previously discussed, the 2D area in the Maglin area has been updated where applicable using the additional topographical survey information obtained in 2023. The result of this update is discussed in the following sub sections.

The model also includes 18no. existing bridge/culvert structures. The hydraulic model extents and schematic is included in Figure 3.1 below.

As indicated previously, the Ballincollig Distributor Road layout has also been modified since the completion of the South Ballincollig Drainage Study SFRA and this modification has been captured in the hydraulic analysis completed during this study and the result of this modification will be discussed in the following sub sections.

An unsteady flow analysis was performed using flow hydrographs which were derived during the hydrological analysis outlined previously and in the South Ballincollig Drainage Study SFRA. The downstream boundary condition was set to match the water surface gradient at the downstream end of the reach.

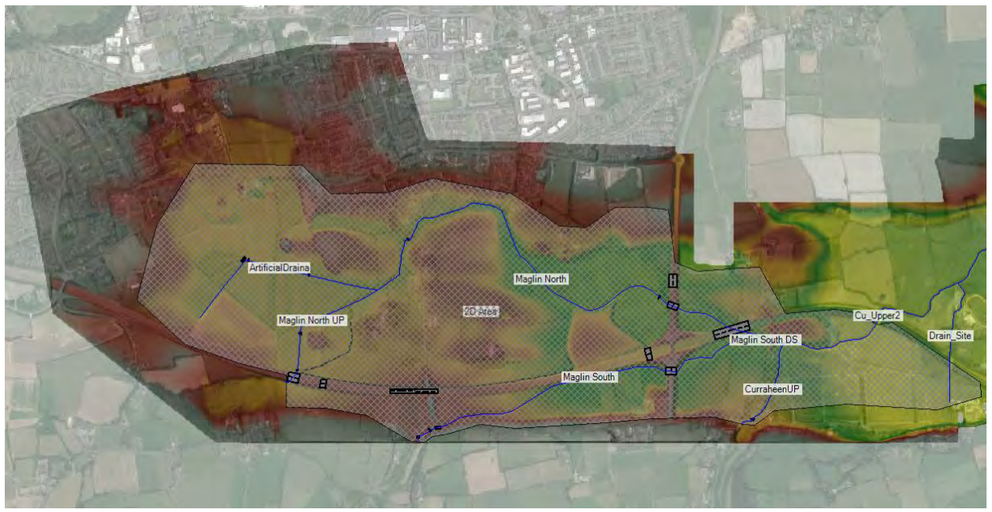


Figure 3.1: Hydraulic Model Schematic

3.2 Baseline Hydraulic Model Update

3.2.1 Overview

As previously discussed, additional topographic surveying was made available to MWP in November 2023. The details of this additional topographical survey information are summarised in Section 2.1. This has resulted in a review and update of the South Ballincollig Drainage Study SFRA baseline hydraulic model. The result of this update is outlined below.

3.2.2 Baseline Hydraulic Model Update Approach

3.2.2.1 Surface Update – No Modifications to Topographical Survey

Initially the topographical survey was combined with the LIDAR surface that was originally created for the hydraulic model for the South Ballincollig Drainage Study SFRA completed in 2021 without any modifications to the topographic survey. Combining the new topographical survey with the LIDAR surface presented a number of issues which had to be addressed. Some of these issues are described below.

1. Drainage ditches located in the western area of the Ballincollig lands were not surveyed so these drainage channels are not defined when the topographical survey is combined with the LIDAR surface which results floodplain storage and conveyance not being reasonably represented. If no modification is made to the new topographical survey flow will not be conveyed in this channel.

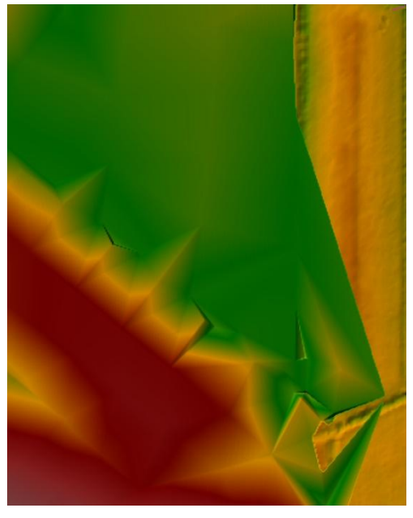


Figure 3.2 (Left): Topographic Survey Surface 2023

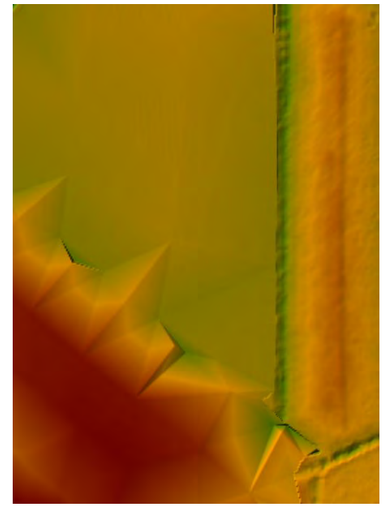
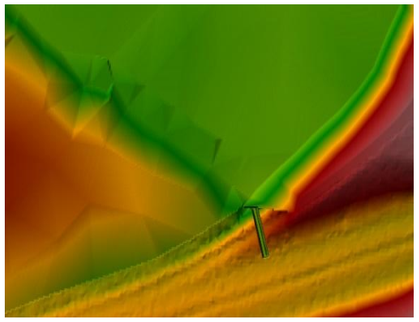


Figure 3.3 (Right): LIDAR Surface 2021

2. Drainage channel located immediately north of the N22 is not defined in the new topographical survey. If no modification is made to the new topographical survey flow will not be conveyed in this channel.



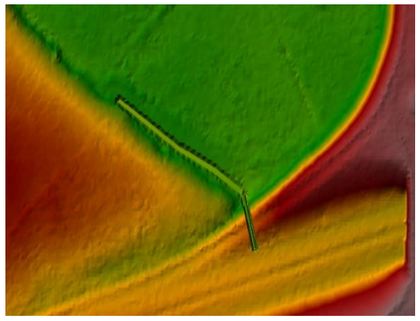
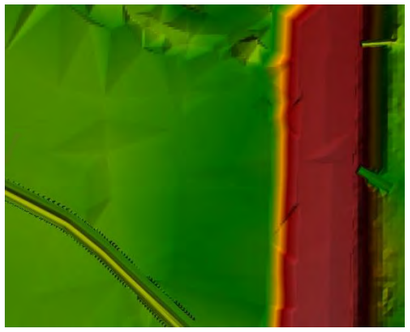


Figure 3.4 (Left): Topographical Survey Surface 2023

Figure 3.5 (Right): LIDAR Surface 2021

3. Drainage channel located immediately west of the N22 is not defined in the new topographical survey. If no modification is made to the new topographical survey flow will not be conveyed in this channel.



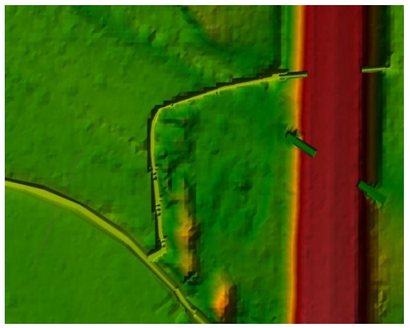


Figure 3.6 (Left): Topographical Survey Surface 2023

Figure 3.7 (Right): LIDAR Surface 2023

The screenshots presented above highlight some of challenges presented if the topographical survey is combined without making allowance for these drainage channels and ditches.

3.3 Surface Update –Modifications to Topographical Survey

In order to address this issue, the topographical survey was modified to remove survey points where channels/ditches are located to prevent these points from overwriting the channels/ditches captured in the LIDAR. A combination of both sources was then trialled, this involved modifying the topographical survey to remove survey points wherever channel drains/ditches were located and allowing the LIDAR surface to take precedence in these areas. An example is illustrated below.

The result of this modification was adopted as the terrain for the updated baseline model. The updated terrain is therefore a combination of the additional topographical survey information and the previously adopted LiDAR information where topographic survey information was removed or absent.

3.4 Baseline Hydraulic Model Update Results

3.4.1 Overview

The baseline model was then re-run for the 1% AEP and 0.1% AEP Current and MRFS flood events to compare the differences between the South Ballincollig Drainage Study SFRA baseline hydraulic model and the updated baseline hydraulic model which included the additional topographical survey information with some minor modifications as outlined above.

A comparison of flood extents for the 1% AEP & 0.1%AEP Current & MRFS flood events is illustrated below in Figure 3.9 to Figure 3.11. A comparison of the flood levels recorded at Nodes 0-20 are presented in Table 3.3. For ease of comparison the nodes used to compare flood levels in the South Ballincollig Drainage Study SFRA have also been adopted for this study.

These results indicate that the flood extents in the updated baseline hydraulic model increase in the eastern and western areas of the Maglin area. However, as the topographical survey levels are generally lower than the LIDAR levels this has led to a decrease in flood levels generally by approximately 40mm across the Maglin lands.

Overall, the change in flood extents has not been drastic as a result of combining the new topographical survey with the LIDAR survey to update the baseline hydraulic model. The increase in flood extent surrounding Node 8 is largely attributed to the decrease in survey level which has increased the extent of flooding in this area. Similar reasons are attributed to the increase in flood extents surrounding Nodes 16 && 17. The updated baseline hydraulic model will be adopted in order to progress the hydraulic analysis for this report.



Figure 3.8: Flood Level Node Locations

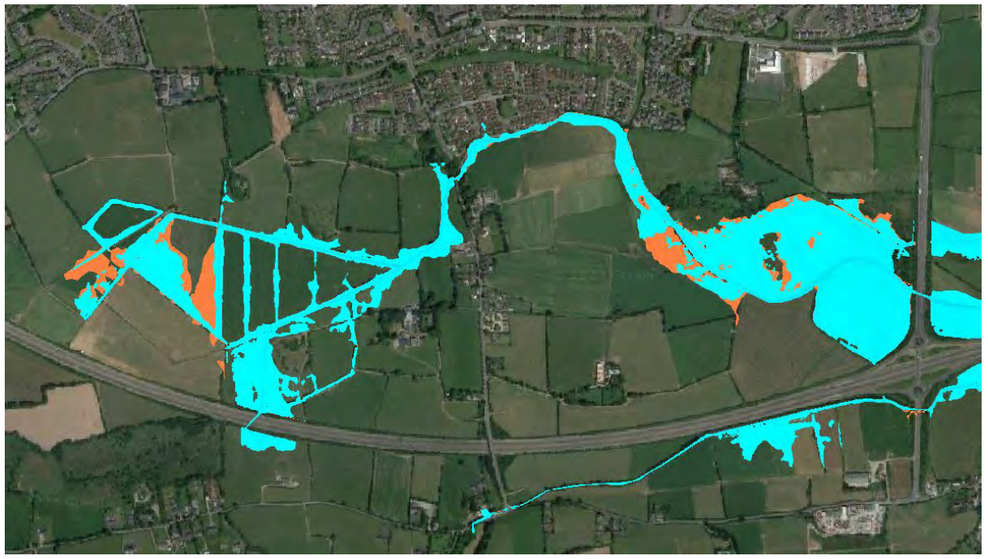


Figure 3.9: Comparison of South Ballincollig Drainage Study SFRA Baseline Hydraulic Model Results (Blue) v Updated Baseline Hydraulic Model Results (Orange) - 1% AEP Current Flood Event



Figure 3.10: Comparison of South Ballincollig Drainage Study SFRA Baseline Hydraulic Model Results (Blue) v Updated Baseline Hydraulic Model Results (Orange) - 0.1% AEP Current Flood Event

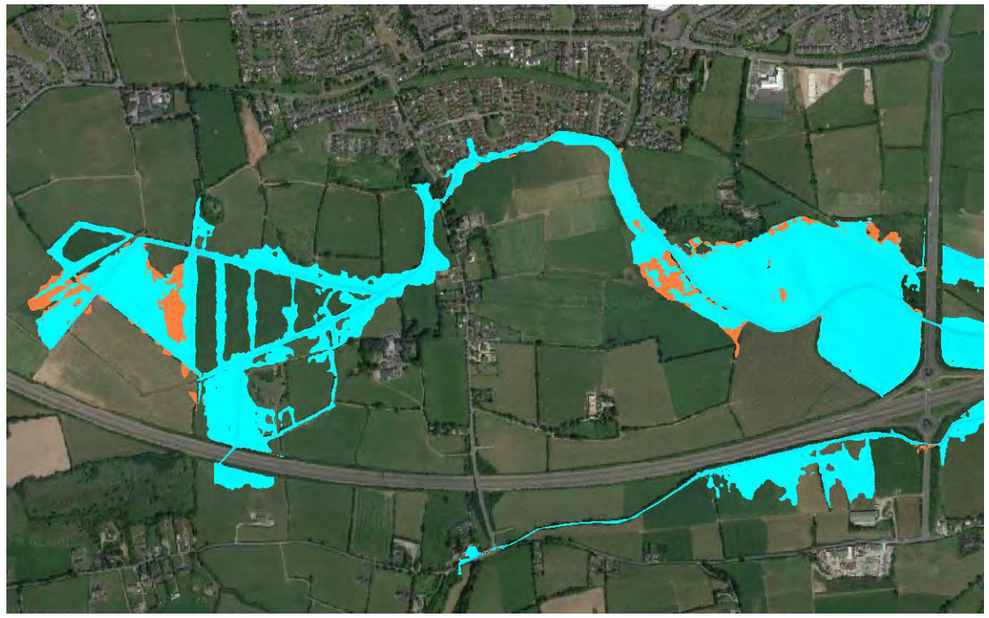


Figure 3.11: Comparison of South Ballincollig Drainage Study SFRA Baseline Hydraulic Model Results (Blue) v Updated Baseline Hydraulic Model Results (Orange) - 1% AEP MRFS Flood Event

Flood Levels at Node Points (South Ballincollig Drainage Study SFRA Baseline Hydraulic Model v Updated Baseline Hydraulic Model)			
Node ID	1% AEP Current (South Ballincollig Drainage Study SFRA) (mOD)	1% AEP Current (Updated Baseline Model Model) (mOD)	Difference (m)
0	19.08	19.08	0
1	18.84	18.84	0
2	18.67	18.67	0
3	18.44	18.42	-0.02
4	18.28	18.25	-0.03
5	18.18	18.14	-0.04
6	18.01	17.99	-0.02
7	17.33	17.30	-0.03
8	16.57	16.53	-0.04
9	16.24	16.11	-0.13
10	16.12	16.04	-0.08
11	15.96	15.93	-0.03
12	18.59	18.54	-0.05
13	18.48	18.45	-0.03
14	18.42	18.39	-0.03
15	18.35	18.32	-0.03
16	18.49	18.40	-0.09
17	-	-	-
18	15.98	15.95	-0.03
19	15.98	15.95	-0.03
20	16.07	16.00	-0.07

Table 3.1: Predicted Flood Levels at Node Points (South Ballincollig Drainage Study SFRA Baseline Hydraulic Model v Updated Baseline Hydraulic Model) – 1% AEP Current

Flood Levels at Node Points (South Ballincollig Drainage Study SFRA Baseline Hydraulic Model v Updated Baseline Hydraulic Model)			
Node ID	0.1% AEP Current (South Ballincollig Drainage Study SFRA) (mOD)	0.1% AEP Current (Updated Baseline Model Model) (mOD)	Difference (m)
0	19.16	19.16	0
1	18.90	18.90	0
2	18.76	18.76	0
3	18.58	18.56	-0.02
4	18.50	18.46	-0.04
5	18.43	18.38	-0.05
6	18.16	18.14	-0.02
7	17.41	17.40	-0.01
8	16.68	16.59	-0.09
9	16.37	16.30	-0.07
10	16.33	16.28	-0.05
11	16.30	16.25	-0.05
12	18.71	18.66	-0.05
13	18.65	18.62	-0.03
14	18.62	18.59	-0.03
15	18.55	18.52	-0.03
16	18.65	18.62	-0.03
17	18.65	18.62	-0.03
18	16.30	16.26	-0.04
19	16.30	16.26	-0.04
20	16.32	16.27	-0.05

Table 3.2: Predicted Flood Levels at Node Points (South Ballincollig Drainage Study SFRA Baseline Hydraulic Model v Updated Baseline Hydraulic Model) – 0.1% AEP Current

Flood Levels at Node Points (South Ballincollig Drainage Study SFRA Baseline Hydraulic Model v Updated Baseline Hydraulic Model)			
Node ID	1% AEP MRFS (South Ballincollig Drainage Study SFRA) (mOD)	1% AEP MRFS (Updated Baseline Model Model) (mOD)	Difference (m)
0	19.12	19.12	0
1	18.87	18.87	0
2	18.72	18.72	0
3	18.51	18.49	-0.02
4	18.4	18.36	-0.04
5	18.32	18.27	-0.05
6	18.1	18.07	-0.03
7	17.38	17.35	-0.03
8	16.63	16.56	-0.07
9	16.29	16.18	-0.11
10	16.2	16.14	-0.06
11	16.12	16.09	-0.03
12	18.65	18.64	-0.05
13	18.57	18.53	-0.04
14	18.53	18.50	-0.03
15	18.46	18.43	-0.03
16	18.58	18.52	-0.06
17	18.58	18.53	-0.05
18	16.14	16.10	-0.04
19	16.14	16.10	-0.04
20	16.18	16.12	-0.06

Table 3.3: Predicted Flood Levels at Node Points (South Ballincollig Drainage Study SFRA Baseline Hydraulic Model v Updated Baseline Hydraulic Model) – 1% AEP MRFS

4. Summary & Conclusion of Hydraulic Analysis

1. Malachy Walsh and Partners (MWP) has been commissioned by Murnane O'Shea to carry out the hydraulic analysis in relation to a proposed residential development located in Greenfields, Ballincollig, Cork.
2. This report was commissioned to evaluate the hydraulic impacts of additional topographical data, Ballincollig Distributor Road realignment, associated with the proposed residential development on flood levels.
3. A detailed hydrological analysis was carried out to estimate the flood flows throughout the site and the surrounding Maglin area for the South Ballincollig Drainage Study SFRA. The hydrology and flow estimation methods adopted for the South Ballincollig Drainage Study SFRA was reviewed and deemed suitable for reuse for the purpose of this hydraulic analysis to ensure consistency with the SFRA.
4. Additional topographic surveying has been completed in the Maglin area and made available to MWP in November 2023 by Murnane O'Shea. This combined with the modification of the Ballincollig Distributor Road layout since the completion of the South Ballincollig Drainage Study SFRA has led to an update in the baseline hydraulic model which was adopted for the SFRA which was used for this study.
5. The hydraulic analysis results indicate that the flood extents in the updated baseline hydraulic model increase slightly in the eastern and western areas of the Maglin area when compared to the SFRA flood extents. However, as the topographical survey levels are generally lower than the LIDAR levels used in the SFRA this has led to a decrease in flood levels generally by approximately 40mm across the Maglin lands. The updated baseline hydraulic model was deemed suitable for use in this study.

MWP

Appendix 3

3rd Party Landowner Consent Letter

The Secretary
Planning and Integrated Development
Cork City Council
City Hall
Anglesea Street
Cork
T12 T997

November 5th, 2025

Re **Flood Risk Assessment/Impact on Lands at Maglin, Carrigrohane, Ballincollig, Cork.**

Dear Sir/Madam,

I am the registered owner of the lands identified in Flood Risk Assessment report prepared by Malachy Walsh & Partners, namely Folio ref. CK 26218 & Folio CK 57571 that will witness a projected increase in the extent and depth of flooding by virtue of the proposed development of adjoining lands to the east and give our consent for the same.

Yours sincerely

Jerome Burke

Jerome Burke
Nohoval
Belgooly
Cork

APPENDIX 7-4 Drainage Impact Assessment – DOSA Consulting Engineers

DOSA

DENIS O'SULLIVAN & ASSOCIATES

CONSULTING ENGINEERS

RESIDENTIAL DEVELOPMENT, CARRIGANARRA, CORK

DRAINAGE IMPACT ASSESSMENT

DATE 10/04/2026

REVISION 8

JOB NO. 4208

Joyce House, Barrack Square, Ballincollig, Co. Cork
T 021 4871781 E info@dosa.ie W www.dosa.ie

DOCUMENT CONTROL

PROJECT NAME: Residential Development, Carriganarra, Cork

PROJECT NUMBER: 4208

REVISION	DATE	FILE NAME: Residential Development, Carriganarra, Cork			
8	10.04.2026	DESCRIPTION: Drainage Impact Assessment			
			PREPARED	CHECKED	APPROVED
		INITIAL	SO'G	LO'T	LO'T
		DATE	10.04.2026	10.04.2026	10.04.2026
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		DESCRIPTION:			
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		INITIAL			
		DATE			

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1 *Introduction*

DOSA Consulting Engineers were engaged as Engineers for the proposed residential development at, Carrignarra, Ballincollig, Cork. The purpose of this Drainage Impact Assessment Plan is to provide details of the Storm Water elements and Suds methodology associated with the proposed development.

1.1 Site Location

The subject site (currently greenfield) is located approximately 8.0km southeast of Cork City Centre in Carriganarra on the southern side of Ballincollig to the south of the Link Road. The site is a greenfield site characterised by its undulating topography and its even slope rising at the southern end. The existing Limeworth and Heathfield estate which is currently being constructed runs along the site's northern edge and the site is surrounded on the other 3 sides by farmland and sheds which are in ruins. A snapshot of the application boundary is outlined in Figure 1.1 below.



Figure 1.1 – Context Map (Source: Google Maps)

1.2 Scope of Assessment

This report deals with the following aspects associated with this development:

- Existing Site
- Site Investigations
- Soil Type Classification
- Storm Water Drainage Design
- Sustainable urban Drainage Systems (SuDS)
- Flood Risk Assessment and Exceedance Flows
- SuDS Maintenance

1.3 Site Topography

The topography of the site gently slopes from the north to a low point on the south-eastern boundary which is approximately +15.87m AOD. The elevation height along the perimeter from the north, west and southern side varies from +22.21m to +15.87m AOD. A full Topographical feature and level survey has been completed. Figure 1.3 shows a snip of the topographical survey.



Figure 1.3 – Site Topography

1.4 Existing Hydrological Environment

The site is within hydrometric area19 (Lee, Cork Harbour and Youghal Bay). Hydrometric area No19 includes the surface catchment drained by the River Lee and all streams entering tidal water in Cork Harbour and Youghal Bay and between Knockaverry and Templebreedy. The site is in the sub catchment of Glasheen(Corkcity)_SC_010 (EPA Segment Code 19_17). The surface water catchment divide is shown on Figure 1.4.

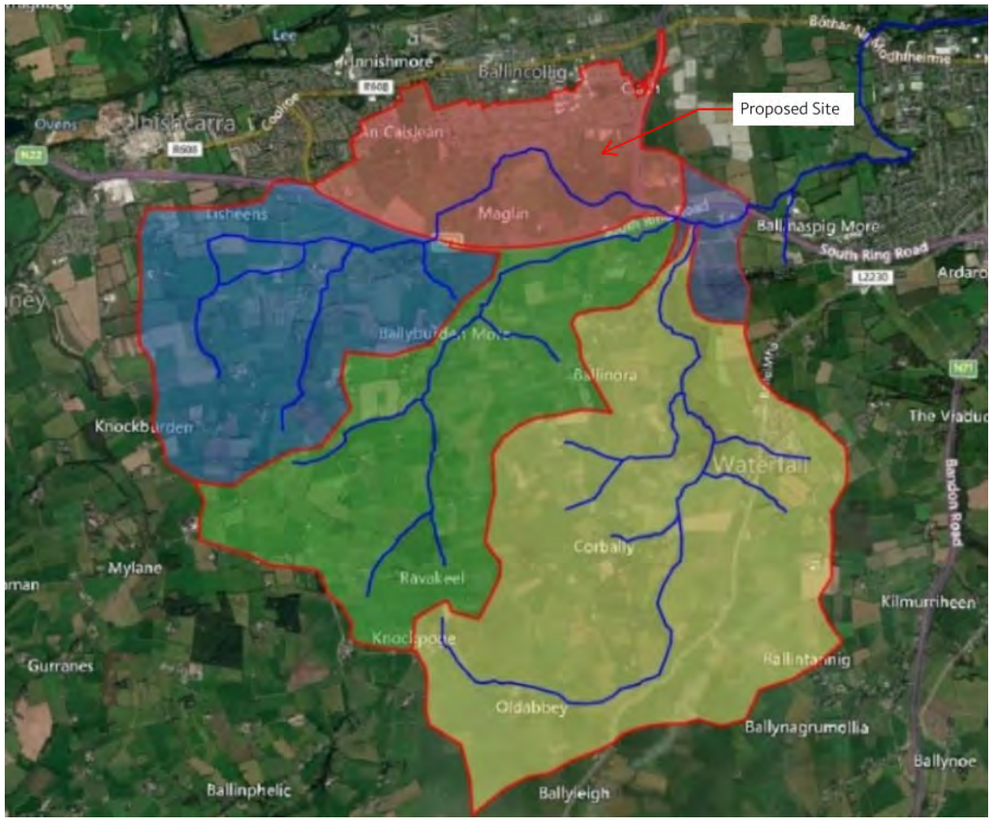


Figure 1.4 – Catchments (Source: MWP FRA)

The main hydrological features of the area is the "Maglin North" network. This watercourse flows in an easterly direction. The Maglin North watercourse is joined by the Maglin South River approximately 1km downstream from the subject site before discharging to the Curragheen River, which is approximately a further 2km downstream. The Curragheen River then flows in a north-easterly direction and joins the River Lee before ultimately discharges to Cork harbour. Figure 1.5 below illustrates the main hydrological features associated with the site.

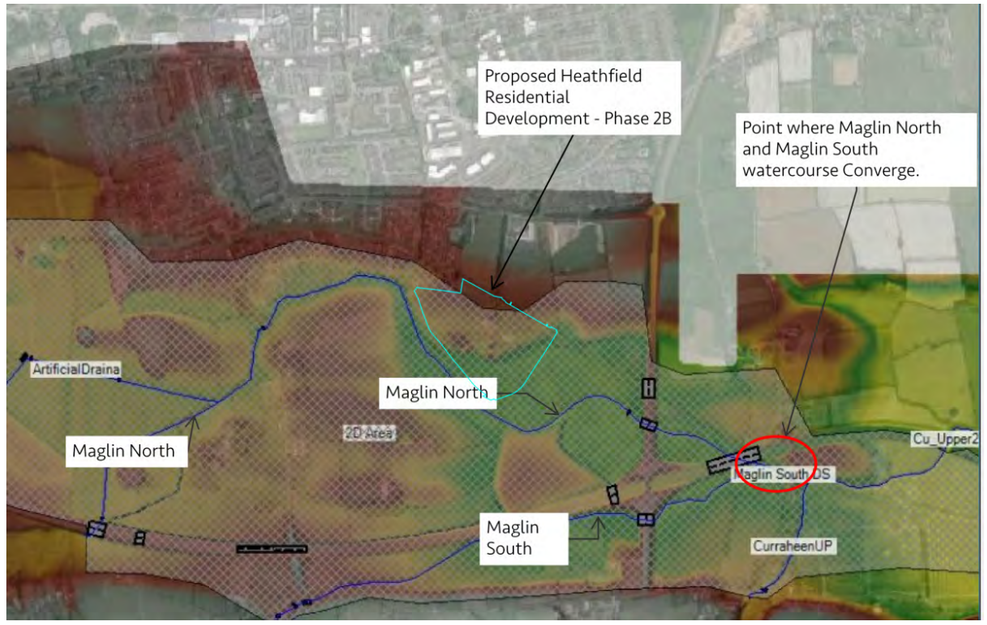


Figure 1.5 – Convergence of Watercourses (Source: MWP South Ballincollig Drainage Study)

1.5 Proposed Development

A Large-Scale Residential Development (LRD) at Carriganarra, Ballincollig, Cork. The development will consist of the demolition of existing agricultural buildings and the construction of a residential development of 300 no. residential units consisting of 128 no. dwellings houses, 172 no. apartment/duplex units, a two storey creche facility and all ancillary site development works. The proposed 128 no. dwelling houses will include 42 no. bedroom detached/semi-detached dwelling houses and 84 no. 3 bedroom semi-detached/townhouse dwelling houses. The proposed development also provides for the restoration of an existing vernacular farm building on site which will accommodate 2 no. 2 bedroom semi-detached units. The proposed 172 no. apartment/duplex units will include 18 no. 3 bedroom units, 109 no. 2 bedroom units and 45 no. 1 bedroom units, to be provided in 20 no. apartment/duplex buildings ranging in height from 3-4 storeys over basement level.

Vehicular access to the proposed development will be provided via the existing junction from the Killumney road serving the Heathfield residential development and existing sections of the Maglin Sustainable Access Corridor to the north. The proposed development provides for the extension of Maglin Sustainable Access Corridor and the provision of 4 no. pedestrian/cycle connections to the Heathfield residential development to the north which is under construction. Ancillary site works include the raising of existing ground levels on site, the provision of bicycle parking and bin storage facilities serving the proposed apartment/duplex and creche buildings, the delivery of active travel infrastructure, landscaping and servicing proposals including a temporary pumping station, and the undergrounding/diversion of an existing 38KV overhead ESB line which traverses the site.



Figure 1.6 – Proposed Development

1.6 Principle Design Considerations

During the design of the storm water drainage for the proposed site, including SuDS, the following key documents / standards were taken into consideration.

- Sustainable Drainage Strategy – South Ballincollig Drainage Study (December 2021)
- Cork City Council Development Plan specifically

  Section 9.8 of Chapter 9 – Environmental Infrastructure of the Cork City Development Plan "The traditional method of disposing of surface water runoff from impermeable surfaces such as roofs, roads and carparks is collection and redirection to drainage systems. This can result in localised flooding, higher waste treatment costs and the transfer of contaminants (such as oil from carparks) directly to water courses, resulting in pollution and affecting a river's ability to recharge naturally. Sustainable Urban Drainage Systems (SUDS) offer a more integrated approach to rainwater management. It involves a method of replicating the natural characteristics of rainfall runoff from any site, ensuring water is infiltrated or conveyed more slowly to the drainage system and ultimately to water courses via permeable paving, swales, green roofs, rainwater harvesting, detention basins, ponds and wetlands. Chapter 5 Climate and Environment includes more detail in terms of the types of SUDS that can be used to achieve these goals. Where appropriate and possible, Cork City Council will encourage the use of SUDS and will prepare guidance on how SUDS can be applied to developments over the period of the plan."
- CIRIA report C753 The SuDS Manual-v6
- Greater Dublin Strategic Drainage Study (GDSDS)
- Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas Water Sensitive Urban Design - Best Practice Interim Guidance Document, (CDP Objective 9.4) - The Department of Housing, Local Government and Heritage.

2 *Surface Water Design Overview*

The completed development site is a mix of soft landscaping and hard paving or roofing. The existing topography produces one catchment area but the development will be split into six separate catchment areas. Groundwater flow direction is interpreted to be from the north to the southeastern boundary.

Discharge from the development site will be along the western boundary to the existing Maglin North watercourse with a filter drain running alongside the spine road discharging directly to the ground using infiltration measures with an overflow if required to an additional outfall to the existing Maglin North watercourse.

The proposed storm water drainage system has been designed to cater for all surface water runoff from all hard surfaces within the proposed development including roadways, roofs, parking areas and green areas etc. The development has been split into a number of catchment areas.

The proposed surface water drainage network will collect surface water runoff from the site via a piped network prior to discharging off site via the attenuation tanks, flow control devices and separator arrangement. Final discharge rates will be at Q_{bar} greenfield run-off rates.

Prior to entering the system, the stormwater generated will be treated through a number of nature-based solutions in line with adopted SuDS measures.

The storm sewer network was designed using Innovyze Micro Drainage modelling software. Outputs from the storm sewer design can be found in the Appendices of the Infrastructure Report.

Refer to DOSA Stormwater Drawing Series for details of the proposed surface water network.

All flow velocities within the network fall within the limits of 0.75 and 3m/sec as set out in "Recommendations for Site Development Works" as published by the Department of Environment. The storm water network and infiltration basin are designed to accommodate the 100-year return period plus an additional 20% to account for the effects of climate change.

2.1 Proposed Sustainable Urban Drainage (SuDS) Strategy

For the proposed development, a "SuDS triangle" was utilised to ensure all three functions are provided for within the SuDS strategy.

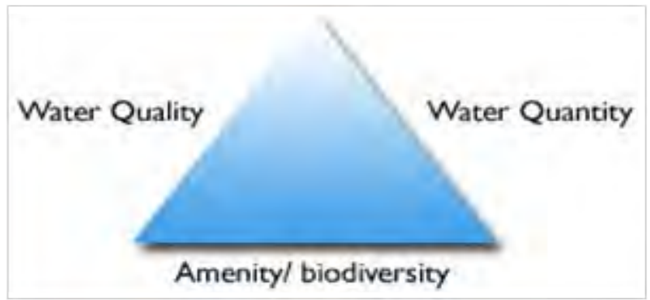


Figure 2.1– SuDS Triangle

By considering the three functions of the triangle, a SuDS system will allow for water quality treatment through natural processes by.

- Encouraging infiltration (where appropriate) and attenuating peak flows.
- Improving water quality by providing treatment to storm water prior to discharge.
- Providing habitat and function where possible for those using the area (including wildlife).

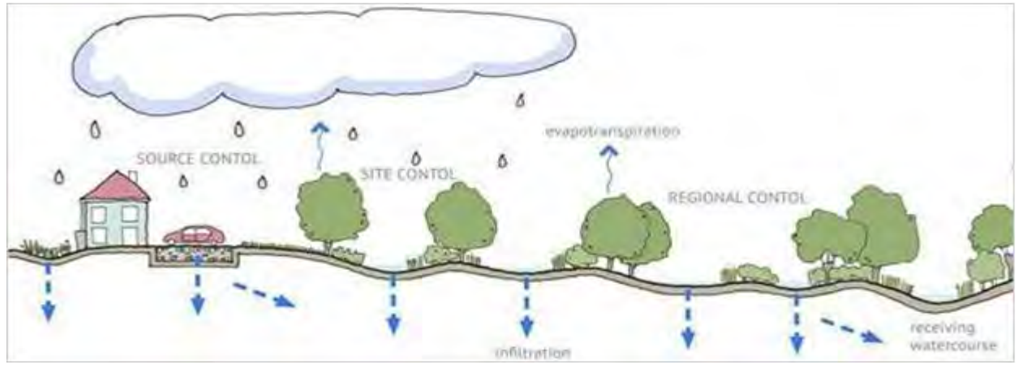


Figure 2.2– SuDS Treatment Train

The principles of a SuDS treatment train were used during the design of the surface water drainage system. The treatment train as illustrated in the image below provides an understanding of prevention and source control to reduced water run-off from a site and improve water quality.

Criterion 1: River Water Quality Protection

Satisfied by providing stormwater attenuation tanks and treatment of surface water run-off by SuDS features such full retention fuel/oil separators at surface water discharge points.

Criterion 2: River Regime Protection

Satisfied by attenuating surface water run-off in association with flow control devices prior to discharge off site at Greenfield runoff rate. Site critical duration storm used to assess attenuation volume.

Criterion 3: Level of Service (Flooding) for the Site

Satisfied by reviewing available flood hazard information relating to the site's proximity to tidal and fluvial flood plains (up to 1 in 100-year flood event).

Criterion 4: River Flood Protection

Satisfied by attenuating surface water discharge to greenfield runoff rates, addressing flood risk associated with the 1 in 100-year storm and avoiding development in flood plains.

Following a comprehensive review of the design of the storm water drainage system we considered all options under the SuDS guidance policies referred to in the Greater Dublin Drainage Strategy. A preliminary feasibility of the applicable SuDS Techniques was conducted. The preliminary analysis indicated that the following techniques were suitable attenuation tanks, infiltration basins, tree pits, filter drains, Blue/Green roofs, rainwater harvesting.

Each proposal was examined and evaluated on its merits / suitability under site specific constraints for use in the proposed development site. Our design approach summary is as follows:

2.2 SuDS Appraisal

2.2.1 Introduction

In developing a SuDS strategy particular reference is made to the *"South Ballincollig Drainage Strategy – South Ballincollig Drainage Study"*

The purpose of this report is to prepare a Sustainable Drainage Strategy (SDS) for the overall development area. This includes:

- Provide a clear, creative, cost-effective and innovative SuDS which would be adopted for the main infrastructure design and by future designers on a site specific basis;
- Identify suitable locations for different types of SuDS;
- Identify key amenity features & potential habitats, such as wetlands or ponds;
- Set out all mitigation measures required for each area of the site, including confirmation of the minimum finished floor levels and ground levels throughout the study area & the maximum discharge rates from the developed sites;
- Identify the route, inverts & outfalls of the proposed main drainage system serving the developed area, including interfaces with existing or future foul trunk mains, rising mains or other utilities;
- Set out firm and clear requirements in relation to the incorporation of SuDS in both the development
- masterplan and the future development of the zoned lands.

Whilst the report is broad ranging and sets out certain recommendations etc it also acknowledges certain constraints associated with the site. Section 4.3 Key Challenges Posed by Subject Lands affect the SuDS strategy.

Section 4.3.3 Unstable Subsurface/ Potential Karstification (Extracted from report)

This site potentially has areas which are prone karstification as the subject area is underlain by carboniferous limestone bedrock. This may lead to instability issues within these areas if water is encouraged to infiltrate these areas. Further site investigation is recommended to assess the risk of unstable/karstified subsurface. A number of issues can arise when implementing a SuDS scheme on a site that may be prone to subsurface soil or rock instability. These issues arise mainly due to the effects of SuDS components that encourage water infiltration. Water infiltration into the ground can cause instability in poorly consolidated soils because the water can wash out the soil or cause it to compact. Also, rocks such as the limestone and sandstones found in this area may slowly dissolve over time. Water from infiltration systems can also cause slope or retaining wall failure, because water pressure may increase in the soil behind the slope or wall. SuDS for sites where there are soils or rocks prone to instability should not use infiltration as a runoff destination, and it may be necessary to line systems to prevent any water infiltrating the ground. This will depend on the risks associated with any potential instability and the likely volume of water discharging to the infiltration device when compared to natural exposure to rainfall on the same area. A small amount of infiltration to provide interception may not be a problem. An appropriate risk assessment may

need to be carried out on a case by case basis. The use of SuDS in such areas with rock/soil instability risks will require advice from a geotechnical specialist.

Table 4.1 of Section 4.3.7 highlights the following

Attribute	Description	Influence on SuDS Design
Fluvial Flooding	The SFRA assesses the flood risk within the site. Parts of the site have been identified as being at risk of flooding. The areas at risk follow the path of the Maglin River through the site and are illustrated on the SFRA map.	The siting and design of SuDS should take cognisance of the predicted flood extents and levels.
Karstification	The site has a number of physical constraints in the form of a karst limestone underground cavers system associated with an extensive central area at risk of flooding which form tributaries to Maglin Steam, running west to east.	Areas that experience karstification may limit the feasibility of infiltration solutions. Further ground investigation is required to confirm this constraint.
Topography	Elevation within the site was found to be between 20 – 30m AOD, with an average of 23m AOD. The site has a slight dip from west to east as ground level approaches sea-level within Cork City.	Flat topography influences existing and proposed flow routes and should be considered at design stage of SuDS components.
Groundwater Flooding	Groundwater flooding was not identified as a significant risk in the plan area.	This is based off relatively old data and further monitoring is warranted.
Archaeological Heritage & Architectural Heritage	There are 8 archaeological features recorded on the site as shown on the map. There are 4 Fulacht Fia's, 2 Lime Kilns, a standing stone, and a country house Maglin House which are all protected. Ballincollig cave pNHA 001249 is the only proposed Natural Heritage Area in the site. Most notable of the features is the Ballincollig Castle, which is a protected structure (RPS 467). It is important that any proposed development does not diminish the importance of the castle in the landscape and that some of its original purpose as a look out over the surrounding landscape is maintained.	Ballincollig Castle requires a 100m buffer around the castle. SuDS features should not impact on protected structures/recorded monuments.
Land Use	The site is largely undeveloped agricultural land that has been zoned for residential, educational, public open space and also contains a proposed spine road.	Proposed land use is relatively low risk to water quality requirements with the exception of the proposed spine road.
Groundwater Levels, Soil Permeability & Infiltration Potential	Groundwater levels are not confirmed however it is anticipated that certain areas of the site could experience high groundwater. GSI mapping indicates soils would have medium to high permeability.	Solutions relying on infiltration may be unsuitable where high GW levels occur. Where high GW is not present, soil permeability should be sufficient to accommodate infiltration. Further investigation required.

Table 4.1: Site Constraints

Extensive Site investigations summarised in the accompanying report confirm the presence of Karst and as a result has informed the SuDS selection and Proposed Management Train for this development.

In endeavouring to design a system having regard to the recommendations in Section 6.1.3 Drainage Proposal for Residential Developments

- That all runoff within the curtilage of the property boundary pass through at least one suitable SuDS component prior to discharging to downstream SuDS components.
- Storage up to the 1 in 100 year event including climate change allowance shall be provided within the curtilage of the property boundary, with maximum discharge rates/volumes in accordance with Section 3.
- Runoff from public areas (such as roads, parking areas, hard and soft landscaped areas, and footpaths) shall pass through at least one SuDS component prior to discharging to the final downstream detention/retention SuDS components.

- Runoff from roofs can be managed using water butts, rainwater harvesting, rain gardens, infiltration trenches, permeable paving, and soakaways.
- Runoff from hardstanding areas can be managed using permeable paving, filter strips, swales, and bioretention systems.
- The final SuDS components located within the development shall comprise basins/ponds/wetlands, prior to discharge to the Maglin River or local surface water sewer.

The conclusion is that the site investigations restrict the ability to implement a number of these recommendations.

In developing a SuDS Management Train reference has been made to Section 5.6 of the Drainage Study

A summary of possible SuDS components is included on Table 5-2 below. **Since there is currently limited site specific information with respect to groundwater levels and infiltration potential, and also because the site layouts have not yet been established, very few components have been eliminated. This provides developers flexibility to develop suitable systems in accordance with the sustainability and discharge hierarchies provided above.** Further technical detail on how these components can be designed for various ground conditions can be examined in "Part D: Technical Detail of the CIRIA SuDS Manual C753". SuDS components that have been disregarded include attenuation tanks and oversized pipes. These components should only be used as a last resort and it is envisaged that more sustainable measures will be feasible for developments in this plan area.

SuDS Component	Control Type	Design Criteria						If Infiltration Suitable	If Infiltration Unsuitable	Comments
		Peak Runoff	Frequent Runoff Volumes	Extreme Runoff Volumes	Water Quality	Amenity	Bio-diversity			
RWH	Source		✓	✓		✓		✓	✓	Suitable for residential and education zones.
Green/Blue Roofs	Source		✓		✓	✓	✓	✓	✓	Suitable for residential and education zones.
Infiltration Systems	Source/Site	✓	✓	✓	✓	✓	✓	✓		Only suitable if groundwater level and subsurface conditions allow.
Trees	Source/Site	✓	✓		✓	✓	✓	✓	✓	Suitable for wide variety of land use types and site conditions.
Filter Strips	Source/Site		✓		✓			✓	✓*	May be used with a liner if infiltration not suitable.
Filter Drains	Source/Site	✓			✓			✓		Not suitable in unstable ground conditions or high groundwater levels.
Swales	Source/Site	✓	✓	✓	✓	✓	✓	✓	✓*	May be used with impermeable lining in areas where infiltration unsuitable.
Pervious Pavements	Source/Site	✓	✓	✓	✓			✓	✓*	May be used with impermeable lining in areas where infiltration unsuitable.
Bioretention Systems	Site	✓	✓	✓	✓	✓	✓	✓	✓*	Can be designed for areas where infiltration not suitable.
Detention Basins	Site/Regional	✓	✓		✓	✓	✓	✓	✓*	Ensure storage capacity not reduced by high groundwater levels.
Ponds & Wetlands	Regional	✓			✓	✓	✓	✓	✓*	Can be used with liner if infiltration undesirable.

Table 5.2: SuDS Potential for the Plan Area

✓* = Alteration to design may be required.

Whilst acknowledging the above the execution of site specific investigations has provided more specific and detailed information to formulate the SuDS management Train

As a result the following methodologies are being implemented as part of the SuDS treatment train approach:

2.2.2 Rainwater Harvesting

In relation to rainwater harvesting an option is to provide a water butt with each individual dwelling. This could be located to the rear of each unit. This water butt will only have the ability to catch the rear sloping side of the dwelling and the reuse would be for watering plants. The intention would be that the homeowner retrospectively provides these.

2.2.3 Infiltration Basins

The proposal as submitted in the LRD application was to incorporate infiltration basins in green spaces to compliment the SuDS strategy.

Infiltration basins are vegetated depressions designed to store runoff on the surface and infiltrate it gradually into the ground. They are normally dry except in periods of heavy rainfall. The infiltration basins proposed to be located in various green areas and designed so that there would be no water storage at any time. They will act as infiltration only. The substrata incorporated additional permeable material and the basins are to cater only for the specific open areas highlighted on Drawing No.'s 4208-0282- Schematic SUDS Layout Plan & Details (Sheet 1 of 2) & 4208-0283 - Schematic SUDS Layout Plan & Details (Sheet 2 of 2).

2.2.4 Filter drain

Trenches filled with permeable material and a perforated collection pipe at the invert with an optional permeable 'sandy' topsoil at surface. These will treat, convey, and attenuate runoff at source, and can infiltrate to the ground where the subgrade is suitable. These systems will allow some form of storage for small rainfall events and can result in water evaporation and adsorption in small quantities, therefore there will be less run-off from these areas in small rainfall events thus mimicking the natural response for this catchment. The LRD Application proposed to locate these along the proposed pedestrian/cycle pathways and will allow groundwater to recharge to its natural state. All proposed filter drains are indicated on Drawing No.'s 4208-0282- Schematic SUDS Layout Plan & Details (Sheet 1 of 2) & 4208-0283 - Schematic SUDS Layout Plan & Details (Sheet 2 of 2).

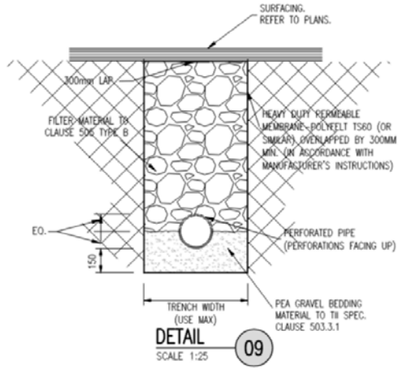


Figure 2.3– Typical Filter Drain Detail

The runoff and infiltration from the filter drains in the public areas have not been incorporated in any reduction of areas from an attenuation storage calculation perspective. Theoretically the installation of these filter drains in public areas contribute to a possible volumetric reduction in required attenuation. This potential reduction has not been factored into the attenuation calculations.

2.2.5 Tree Pits

Trees can be planted within a range of infiltration SuDS components to improve their performance, as root growth and decomposition increase soil infiltration capacity. Alternatively, they can be used as standalone within soil-filled tree pits, tree planters or structural soils, collecting and storing runoff and providing treatment via filtration and phytoremediation. Tree pits and planters will be designed to collect and attenuate runoff by providing additional storage within the underlying structure. The soils around trees can also be used to filter out pollutants from runoff directly. Tree pits are proposed to be in green space areas to treat and control runoff, while at the same time providing amenity value to adjacent pedestrian, and residential zones. It is also proposed, where possible to fit tree pits along the estate road to drain and treat surface water runoff from the road network. This will allow for treatment of first flush and low flows while high flows will discharge into the surface water network during extreme rainfall events. Rainwater gullies will still be provided downstream of any tree pit to drain runoff during an extreme rainfall event.

Trees Pits are proposed as indicated on Drawing No.'s 4208-0282- Schematic SUDS Layout Plan & Details (Sheet 1 of 2) & 4208-0283 - Schematic SUDS Layout Plan & Details (Sheet 2 of 2).

Calculations in relation to the infiltration rates of same are included in Appendix B. The proposed detail is as per Fig 2.4 below.

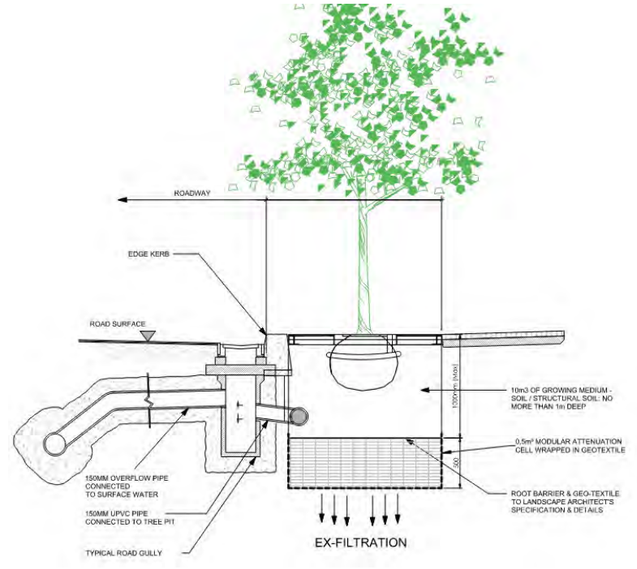


Figure 2.4– Tree Pit Detail

2.2.6 Attenuation Tanks

Whilst acknowledging that attenuation tanks are a last resort site investigations have concluded that they are the most suitable solution due to the presence of the Karst substrata.

The proposed attenuation system attenuates surface water to restrict the outflow to the equivalent of the existing agricultural runoff. This ensures the development will not give rise to any impact downstream of the site. It is the council's preference not to use proprietary modular systems, so it is proposed to use reinforced concrete underground tanks. These systems will be impermeable and no infiltration of the runoff to the ground is proposed. These systems will be used under the large open spaces within the development. Elements such as blue/green roofs, filter drains, tree pits, infiltration basins whilst having a reducing effect of the attenuation volumes required have been ignored from the stormwater network and attenuation design. The use of same are added benefits to the overall system. The location of each attenuation tank has been indicated on the Drawing No's 4208-0220 - Proposed Stormwater & Foul Network Layout (Sheet 1 of 2) & 4208-0221 - Proposed Stormwater & Foul Network Layout (Sheet 2 of 2). The general arrangement drawings for the proposed attenuation tanks are indicated on Drawing No.'s 4208-0240-Proposed Attenuation Tank 01, 4208-0210-Proposed Attenuation Tank 02, 4208-0242-Proposed Attenuation Tank 03, 4208-0243-Proposed Attenuation Tank 04, 4208-0244-Proposed Attenuation Tank 05 & 4208-0245-Proposed Attenuation Tank 06.

In summary

	No. of Tanks Required	Attenuation Volume required
LRD Application	6 No. Attenuation Tanks	2243 m^3

2.2.7 Flow Control Device

It is proposed to provide a hydro brake, or similar approved, at the outfall of the surface water catchment to restrict the outflow of water from the subject site. The hydro-brakes will be fitted with a pull cord bypass and a penstock valve installed on the inlet to the manhole for maintenance purposes. The restricted outlets will be designed to the following:

Catchment Ref	Attenuation Ref	Restricted Outlet
Catchment A	Tank No. 1	4.800 l/s
Catchment B	Tank No. 2	1.900 l/s
Catchment C	Tank No. 3	1.900 l/s
Catchment D	Tank No. 4	7.900 l/s
Catchment E	Tank No. 5	2.600 l/s
Catchment F	Tank No. 6	2.500 l/s
Catchment G	Blue & Green Roof	2.500 l/s
Catchment G	Spine Road	2.900 l/s

2.2.8 Petrol Interceptor

It is proposed to provide a petrol interceptor upstream of the attenuation tanks to ensure that any remaining hydro-carbons or pollutants within the runoff from trafficked areas are treated prior to outfall to the existing watercourse. It is proposed to provide a Conder Bypass Separator Types or similar approved.

In conclusion the water quality from this catchment should be of a high quality due to the above-mentioned measures, which are applied in a treatment train to treat the water before discharge at a restricted rate to the local network.

The above measures ensure a suitable management train is provided.

Catchment Ref	Attenuation Ref	Petrol Interceptor Specification
Catchment A	Tank No. 1	1 No. CNSB20s
Catchment B	Tank No. 2	1 No. CNSB4s
Catchment C	Tank No. 3	1 No. CNSB20s
Catchment D	Tank No. 4	1 No. CNSB30s & 1 No. CNSB4s
Catchment E	Tank No. 5	1 No. CNSB15s
Catchment F	Tank No. 6	1 No. CNSB4s
Catchment G	Blue & Green Roof	1 No. CNSB4s

2.2.9 Rain Gardens/Bioretention Tree Pit

Rain Gardens/Bioretention Tree pits are small, planted areas with stormwater controls that collect and treat stormwater runoff. Shallow landscaped basins make use of soils and vegetation to remove pollutants. This treated runoff shall be collected in these basins and form part of a wider SuDS approach for the areas adjacent the Main Distributor Road within the development.

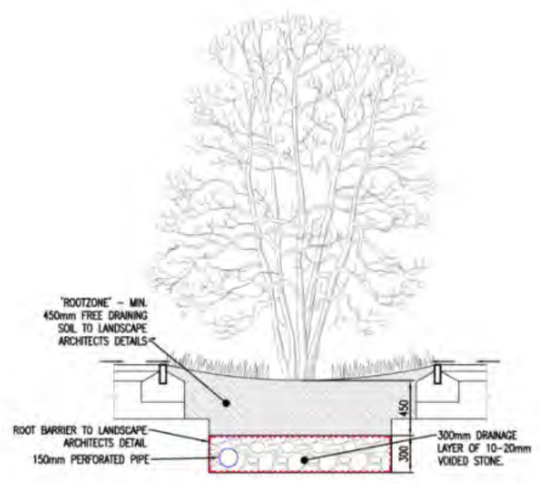


Figure 2.5– Typical Raingarden/Bioretention Tree Pit Arrangement

The proposed raingardens are included on Drawing No.'s 4208-0282- Schematic SUDS Layout Plan & Details (Sheet 1 of 2) & 4208-0283 - Schematic SUDS Layout Plan & Details (Sheet 2 of 2).. It is proposed to include them along the main access road and along green areas within the development. Theoretically the installation of these Raingarden/Bioretention tree pits in public areas (approximately 1220 m2) contribute to a possible volumetric reduction in required attenuation in the overall development , however they have been omitted from providing any reduction in these attenuated volume requirements.

Surface water runoff treated will infiltrate to the substrata. Design calculations in relation to the required depth of infiltration are included in Appendix B.

2.2.10 Green /Blue Sedum Roofs

Green/Blue and Sedum roofs involve covering a roof of a building with vegetation laid over a drainage & storage layer and a waterproofing membrane. They are designed to intercept and store rainwater and therefore, reduce surface water runoff. They are suited to the flat type of roof being proposed for the proposed apartment buildings. Sedum roofs have ecological and aesthetic benefits and remove pollutants from rainwater.

It is proposed to provide blue/ green roofs to the apartment buildings in the development. Attenuation specific to these areas will be provided on the roof. Volumetric calculations in relation to the apartment buildings is included in Appendix B. The provision of same has facilitated the reduction in the volumetric requirements of the overall attenuation required.

Apartment	Roof Area	Attenuation Volume required	Storage Depth Required	Attenuation Volume provided
Block 01	964m²	50.15 m³	52mm	57.84 m³
Block 02	867m²	45.10 m³	52mm	52.02 m³
Block 03	867m²	45.10 m³	52mm	52.02 m³
Total	2701m²	140.35 m³		161.88 m³

The net result of providing blue roofs is that there is a reduction in required runoff to be attenuated within the development in attenuation tanks. These SuDS elements will be located in areas that will be contained in Management Companies and will not be required to be taken in charge by Cork City Council.

2.2.11 Existing Ditches, Trees and Hedgerows Within Site

Within Site where possible, existing ditches, trees and hedgerows are to be maintained. Incorporating these existing drainage features into the proposed overall SuDS strategy would assist in the conveyance and treatment of the generated surface water runoff. The retention of existing trees and hedgerows will also assist in the reduction of surface water runoff by evapotranspiration.

2.2.12 SuDS Components Affected by Site Specific Investigations

The results of the site-specific site investigations resulted in the following components being omitted from design consideration due predominantly to the presence of Karst

- Infiltration Systems
- Permeable Paving
- Ponds & Wetlands
- Swales

2.3 Management Train

The management train commences with source control through the provision of rain-water butts (potentially) in the rear gardens. This will also reduce the water consumption required of each housing unit. This employment of these source controls along with the usage of localised tree pits and infiltration/ filter drains will aid to reduce the peak runoff rate, placing less stress on the facilities downstream.

The second stage of the management train, site control, is provided by the introduction of the hydrocarbon interceptors in open areas which provide a degree of treatment before discharging to the attenuation system.

The attenuation tanks offer a third stage of treatment, regional control, by slowing the storm water discharge down and removing additional silts which may remain in the storm water.

2.4 Surface Water System

Discharge from the development site will be along the western boundary to the existing Maglin North watercourse with the spine road discharging directly to the ground using infiltration measures.

To reduce the effects of the surface runoff on potential flooding, a Stormwater Management Plan will be applied to surface water discharges into adjacent watercourses. The Stormwater Management Plan can be applied to control the rate of runoff from new development. The maximum permitted surface water outflow from the new development is to be restricted to that of the existing Greenfield site by the usage of attenuation storage.

Control of runoff by attenuation methods requires a hydraulic control to restrict the magnitude of flows passing downstream, together with an upstream storage capacity to contain the volume of runoff held back by the hydraulic control. The flows are proposed to be attenuated in the surface water system by adopting a flood storage attenuation tank along with restricted outlets as the control devise. The storage volume required has been designed using the computer aided design package Windes 10.4.

The attenuation strategy for the site is for the detention of flows in interlinked attenuation tanks.

2.5 Surface Water Drainage Network

The surface water drainage network for the proposed development was modelled using the Micro drainage software application. The surface water pipe lengths, slopes, contributing impermeable areas, upstream invert levels, upstream cover levels and pipe diameters were entered into the model using the drawings supplied.

2.6 Design Criteria:

The proposed surface water drains have been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS), the Department of the Environment's Recommendations for Site Development Works for Housing Areas, the Department of the Environment's Building Regulations "Technical Guidance Document Part H Drainage and Waste Water Disposal" and BS EN 752: 2008 Drain and Sewer Systems Outside Buildings.

- Return period for pipe work design — 5 years surcharge
- Return period for attenuation design — 100 years
- Soil Type — 0.3
- Allowable Outflow (Q1) — 24.700 l/s
- Time of entry — 5 minutes
- M5 – 60 — 18.80 mm
- Ratio "r" — 0.250
- Pipe Friction (Ks) — 0.6 mm
- Minimum Velocity (based on pipe flowing full) — 1.0 m/s
- Rainfall Runoff from Roads and Footpaths — 100%
- Rainfall Runoff from Roofs — 80%
- Rainfall Runoff from Driveways — 80%

- Rainfall Runoff from Green Areas 20%
- Rainfall Depth Factored for Climate Change (as per GDSDS) 20%

(in accordance with GDSDS Volume 2, Chapter 6, Table 6.2 – see below)

Climate Change Category	Characteristics
River flows	20% increase in flows for all return periods up to 100 years
Sea level	400+mm rise (see Climate Change policy document for sea levels as a function of return period)
Rainfall	10% increase in depth (factor all intensities by 1.1)
	Modify time series rainfall in accordance with the GDSDS climate change policy document

Table 6.2 Climate Change Factors to be Applied to Drainage Design

2.7 Storm Water Outfall

Storm water from the proposed development shall discharge into the existing watercourse 'Maglin North' located to the south-western boundary of the site via a hydro brake manhole, which will limit the amount of water discharging to the network. The amount of water discharged from the hydro brake manhole will be determined by using the allowable Greenfield Runoff rate for the developable area of the site. It is to be noted that all on site storm water storage facilities have been sized to cater for all storm water generated within the site boundary of the development. The discharge will be onto an area of stone riprap setback approximately 10m from the watercourse. This will dissipate energy and avoid bank erosion / scouring in the streambed

2.8 SuDS Calculations

Calculations of the various SuDS elements proposed are contained in Appendix B of this report. This report should also be read in conjunction with the Infrastructure Report submitted as part of the application. Attenuation Tank Sizes and Petrol Interceptor Sizing/Specifications have been included as part of the Stormwater Network Design in this report. The nature-based SuDS principles proposed will have a positive impact from a sustainable impact.

A contingency has been built in by providing SuDS measures and not including their volumetric benefits in the attenuation calculations, namely

- Filter drains along public paths
- Raingarden/Bioretention Tree Pits along access road and greens areas within the development
- Tree-pit infiltration and storage
- Infiltration basins in public green areas/open spaces

3 *Site Investigations*

DOSA conducted Site Investigations on the site. The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods. The scope of the site investigation works undertaken for this project included the following:

- Visit project site to observe existing conditions.
- Excavate. Trial Pits to confirm Geophysical Results.
- Carry out infiltration test of existing ground conditions

3.1 Trial Pits

The trial pits were excavated using a 21T tracked excavator. The trial pits were conducted to assess and classify the in-situ ground material and to confirm the geophysical investigations. The location of the trial pits was checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were, logged and photographed by any prior to backfilling. Notes were made of any services, inclusions, pit stability, groundwater encountered, and the characteristics of the strata encountered and are presented on the trial pit logs which are pending.

3.2 Soil Infiltration Rate

DOSA Consulting Engineers carried out a soakaway trial to access the soil infiltration rate of the subsoil. These results have been indicated in the Soil Infiltration Assessment Report.

4 *Existing Site Hydrology*

A review of Historical Ordinance Survey Ireland information (www.osi.ie) was conducted to determine if the OSI 6- inch Maps indicated historic water courses / surface water features within the site. The maps indicate no existing watercourses inside the site, refer to figure 4.0 below.

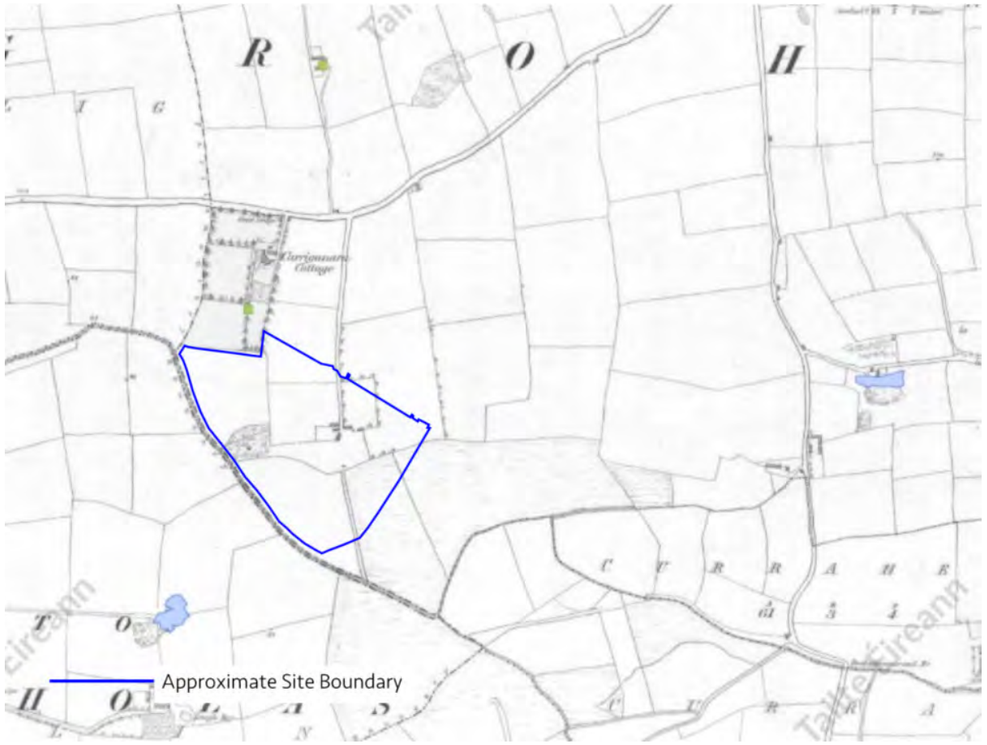


Figure 4.0: Historic 6" Mapping

The main hydrological feature of the area is the "Maglin North" watercourse. This watercourse flows in an easterly direction. The Maglin North watercourse is joined by the Maglin South River approximately 1km downstream from the subject site before discharging to the Curragheen River, which is approximately a further 2km downstream. The Curragheen River then flows in a north-easterly direction and joins the River Lee before ultimately discharges to Cork harbour. The main watercourses are illustrated below in figure 4.1.



Figure 4.1: Hydrological Features of the Area

5 *Maintenance Regime for SuDS Devices*

The SuDS features proposed above for the site will require the following maintenance: It should be noted that as part of the as-builts and taking in charge process, documentation in relation to Operation and maintenance etc will be provided. The proposed SuDS strategy has been developed to try and strike a balance between efficient and robust operation and the minimising of frequent and on-going maintenance requirements. The maintenance of all SuDS features shall remain the responsibility of the developer until such time as any proposed taking in charge has been completed.

5.1.1 Underground attenuation systems

Inspection of the system should be conducted monthly for the first 3 months and then annually to ensure the system is working correctly. Debris should be removed monthly from the catchment surface where it may cause risk to the performance of the underground attenuation system. As required sediment from pre-treatment (catch pit) manholes prior to the attenuation system should be removed to ensure on going performance of the system. The inside of the tank should be surveyed every 5 years or as required if performance is reduced with any sediment build up removed if necessary.

The locations of all six tanks have readily accessible areas adjacent. Off road parking for maintenance vehicles and crew can be provided for all three as indicated on relevant drawings listed above.
In terms Of Operation and Maintenance the use of Reinforced concrete tanks is robust and maintenance free. The typical arrangement is the following train

- A Petrol interceptor which is accessible only via an on-grade heavy duty manhole cover.
- An inlet manhole to the tank will have a sump incorporated to trap silt so as to reduce the need to access the tank.
- The SuDS train is followed by a reinforced concrete attenuation tank. This is accessed via a number of heavy-duty manholes covers and fall arrest gates (anticipated requirement to enter is extremely low). In the unlikely event of entry being necessary only trained personnel in confined spaces will be permitted in any tank and this will be detailed and highlighted in any handover/maintenance files at taking in charge stage. There are no moving parts or plant associated with these tanks.
- The outflow will be controlled by a hydro brake located in an outlet manhole abutting the tank. This will be a vortex arrangement and separate access to that of the tank itself.

5.1.2 Tree Pits

Maintenance of trees will be greatest in the first few years, which will include regular inspection of tree condition including inlets and outlets, removal of invasive vegetation and possibly irrigation during long dry periods. As any handover process (taking in charge) is medium to long term it is anticipated that the Tree Pit regime will be well established and operational with little maintenance required.

5.1.3 Filter Drains

Inspection of the system should be conducted monthly on the inlet / outlet pipework and any control systems for blockages. Inspection of pre-treatment systems including should be conducted every 6 months for catch pits manholes prior to the filter drain with removal of silt or other build-ups. Removal of silt build-up may be required more frequent. Annual cleaning of roof runoff gutters etc should be part of the maintenance of the drainage system to ensure debris is removed prior to entering the network. Perforated pipework should be cleared of blockage if required.

5.1.4 Hydro brake Manhole:

Normally little maintenance is required as there are no moving parts within a hydro brake, however, after installation, hydro brakes should be inspected to ensure the hydro brake orifice is not blocked monthly for three months and thereafter at six monthly intervals and hosed down if required. Remove rubbish or debris from hydro brake if present. Hydro-Brake Flow Controls are fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur. The hydro brake will be located in a manhole separate to the tanks. As a result, any access will be similar to entering a standard manhole.

5.1.5 Petrol Interceptor:

Systems should be visually inspected for every rainfall event for 30 days after installation and the amount of sediment measured to give the operator an idea of the expected rate of deposition. Systems should then be inspected every 6 months to verify the appropriate level of maintenance. Floating debris and solids should be removed, and the sump cleaned with a conventional sump vacuum cleaner. Filter media should be replaced, and sediments, oils and grease should be removed where required.

5.1.6 Blue Roof Maintenance:

Maintenance of a blue roof is critical to the viability to its function. It is recommended that:

1) Following any significant storm event, the outlets should be visually inspected to ensure no blockage has occurred.
2) Following any significant traffic or remedial works that take place on or around the roof, each of the outlets should be visually inspected to ensure all drainage holes are clear and free draining.
3) Quarterly each outlet, should be inspected and cleared of any build up or debris. All leaf litter mainly autumnal visit should be removed from the roof surface. Debris must be removed from the roof and not simply flushed down rainwater pipes.
4) Cut back tree limbs that overhang the roof to give at least a 1 metre clearance, this will significantly reduce any risk of any blockage to outlets

Blue Roofs are only proposed in private curtilage. As a result, it is maintenance will be the responsibility of a management company and not that of the council. Safe working procedures in relation to the maintenance of these roofs post construction will be detailed in Risk Assessments and associated method statements and included in any as-built package and hand over documentation at taking in charge stage.

5.1.7 Green Roof Maintenance

With the right conditions, green roofs are self-regulating but a minimum of two inspections per year should be conducted.

A typical maintenance programme includes:

1) Roof Evaluation - a comprehensive review of your green roof to determine what remedial work, if any, needs to be done.
2) Removal of Unwanted Items - Over time a green roof can become congested with leaves, debris, and other unwanted vegetation, which can be removed as part of the service.
3) Inspection - of roof outlets and removal of any encroaching vegetation to enable water to flow freely through rainwater pipes.
4) Application of fertiliser - To help restore your green roof to its best, an organic slow-release granular fertiliser if required will encourage growth.

Green Roofs are only proposed in private curtilage. As a result, it is maintenance will be the responsibility of a management company and not that of the council. Safe working procedures in relation to the maintenance of these roofs post construction will be detailed in Risk Assessments and associated method statements and included in any as-built package and hand over documentation at taking in charge stage.

6 Design Compliance Summary

The Drainage Impact Assessment and SuDS Treatment Train Design has been developed in accordance with the reference documents described earlier. Primarily it has been developed to take account of the recommendations in the "*South Ballincollig Drainage Study*". Whilst it deviates from some of the recommendations (due to site specific investigations) made we believe that the overall strategy achieves the objectives set out. We believe that any deviations proposed are in compliance with the acknowledgment in Section 5.6

Appendix A – Schematic SuDS Train

janarra Estate

Filter Drains

Attenuation tank

Tree Pits

Infiltration Basin

Attenuation tank

Attenuation tank

Green/ Blue Roofs

Attenuation tank

15m x 25m Pumping station Compound

Foul Network Pumping Station

TC LINE

MATCHLINE

Key Plan
Scale 1:5000

Legend:

- Tree Pit (Refer to Detail on dwg 4208-0285)
- Filter Drain (Refer to Detail on dwg 4208-0285)
- Blue/ Green Roofs (Refer to Detail on dwg 4208-0285)
- Raingarden/ Bioretention tree pit (Refer to Detail on dwg 4208-0285)
- Stormwater Attenuation areas (Refer to dwg 4208-0220 & 0221)
- Infiltration Basin (Refer to Detail on dwg 4208-0285)

REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
P	K.M.	S.O'G.	L.O'T.	10.04.'26	LRD Planning Application Issue

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CLIENT: MOS Homes Limited.

PROJECT: Carriganarra LRD, Ballincollig, Cork.

DRAWING TITLE: Schematic SUDS Layout Plan (Sheet 1 of 2)

SIZE	SCALE	DRAWN	CHECKED	APPROVED	PROJECT NO.	DRAWING NO.	STATUS
@A1	1:500	K.M.	S.O'G.	L.O'T.	4208	0282	P

Filter Drains

Infiltration Basin

Attenuation tank

Attenuation tank

Attenuation tank

Bioretention Tree Pit/ Raingarden

BIN & BIKE AREA

MATCHLINE

MATCHLINE

Key Plan
Scale 1:5000

Legend:

Tree Pit	(Refer to Detail on dwg 4208-0285)
Filter Drain	(Refer to Detail on dwg 4208-0285)
Blue/ Green Roofs	(Refer to Detail on dwg 4208-0285)
Raingarden/ Bioretention tree pit	(Refer to Detail on dwg 4208-0285)
Stormwater Attenuation areas	(Refer to dwg 4208-0220 & 0221)
Infiltration Basin	(Refer to Detail on dwg 4208-0285)

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DRAWING TITLE
Schematic SUDS Layout Plan (Sheet 2 of 2)

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@A1	1:500	K.M.	S.O'G.	L.O'T.	4208 – 0283 – P

Carriganarra Estate

Filter Drains

Attenuation tank

Infiltration Basin

Tree Pits

Green/ Blue Roofs

Foul Network Pumping Station

Bioretention Tree Pit/ Raingarden

The Meadows

Heathfield

THE DRIVE

38KV

Key Plan
Scale 1:5000

Legend:

- Tree Pit (Refer to Detail on dwg 4208-0285)
- Filter Drain (Refer to Detail on dwg 4208-0285)
- Blue/ Green Roofs (Refer to Detail on dwg 4208-0285)
- Raingarden/ Bioretention tree pit (Refer to Detail on dwg 4208-0285)
- Stormwater Attenuation areas (Refer to dwg 4208-0220 & 0221)
- Infiltration Basin (Refer to Detail on dwg 4208-0285)

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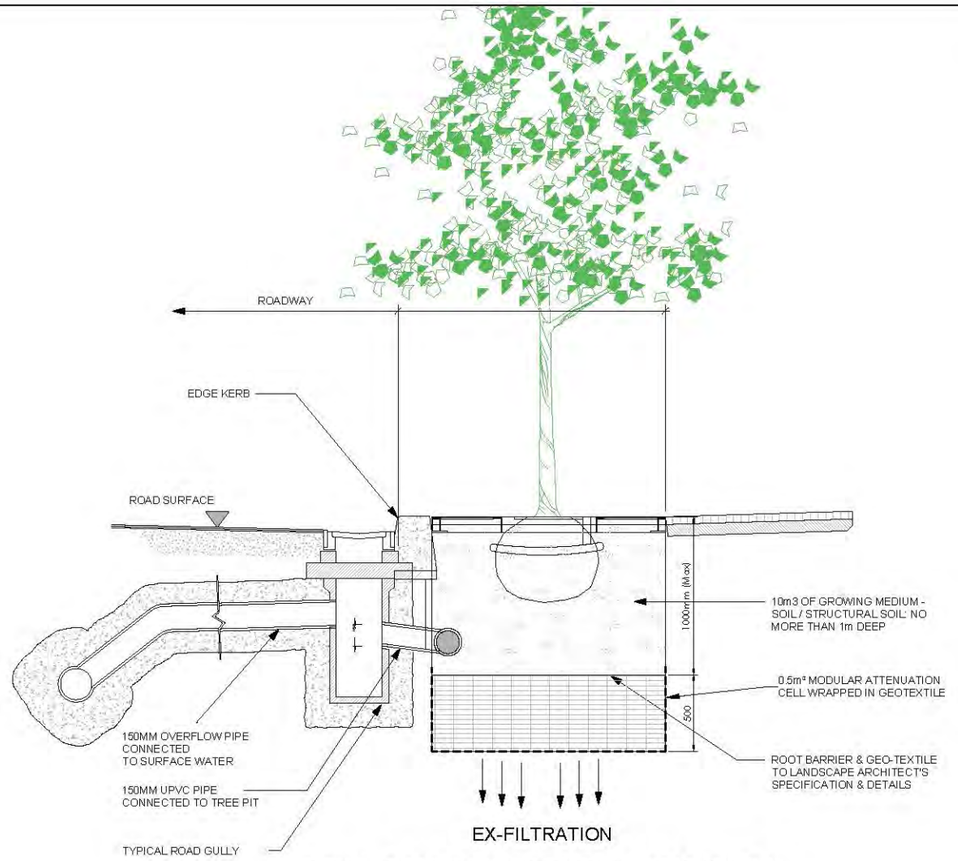
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DRAWING TITLE: Schematic SUDS Layout Plan

SHEET: A1

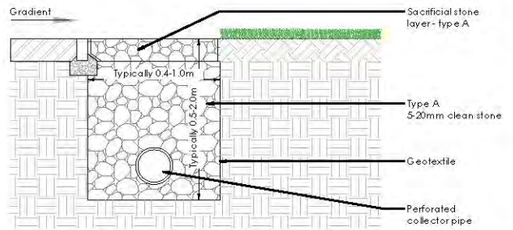
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PROJECT NO. 4208 _ DRAWING NO. 0284 _ STATUS/DEST P



EX-FILTRATION

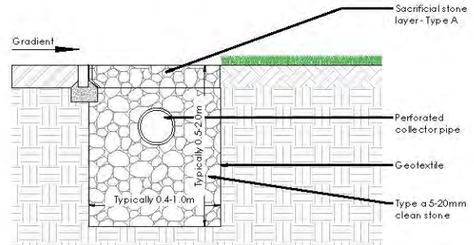
TYPICAL ROAD GULLY TO TREE PIT DETAIL (TYPE 1)



FILTER DRAIN WITH COLLECTOR PIPE

Filter Drain with Collector Pipe

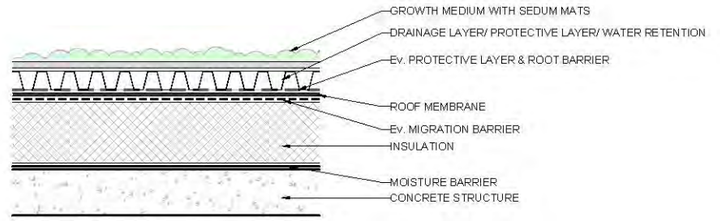
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FILTER DRAIN - INFILTRATION HIGH LEVEL OVERFLOW PIPE

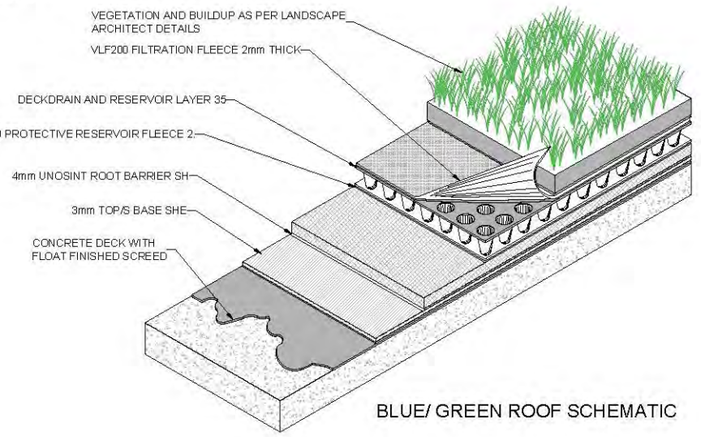
Filter Drain - Infiltration with High Level Overflow Pipe

Scale 1:20

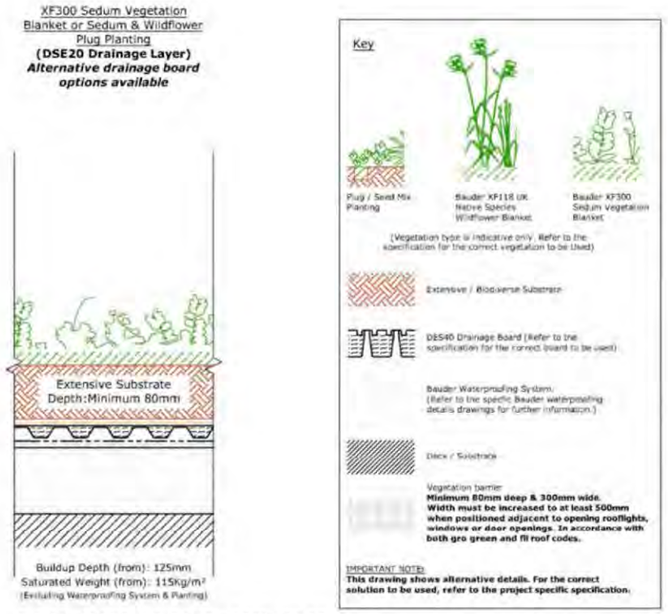


(TYPICAL) SECTION THRU BLUE/ GREEN ROOF

SCALE 1:20



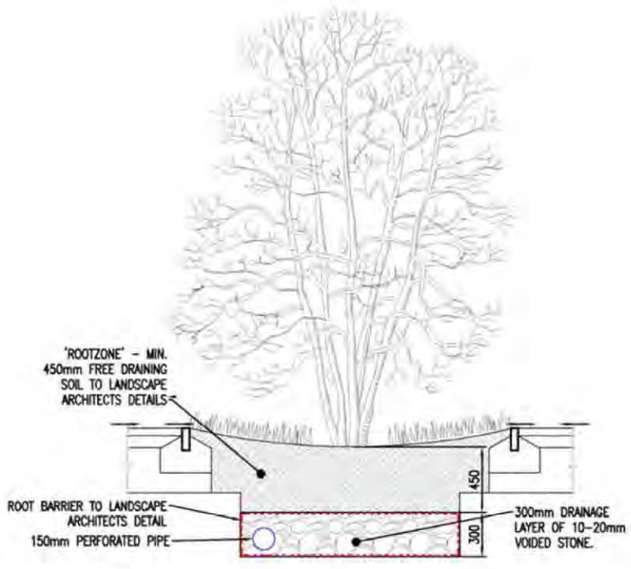
BLUE/ GREEN ROOF SCHEMATIC



TYPICAL SECTIONS THROUGH GREEN ROOF

(DETAIL SOURCED FROM BAUDER LIMITED)

N.T.S.



TYPICAL SECTION THROUGH RAIN GARDEN/ BIORETENTION TREE PIT

SCALE 1:25

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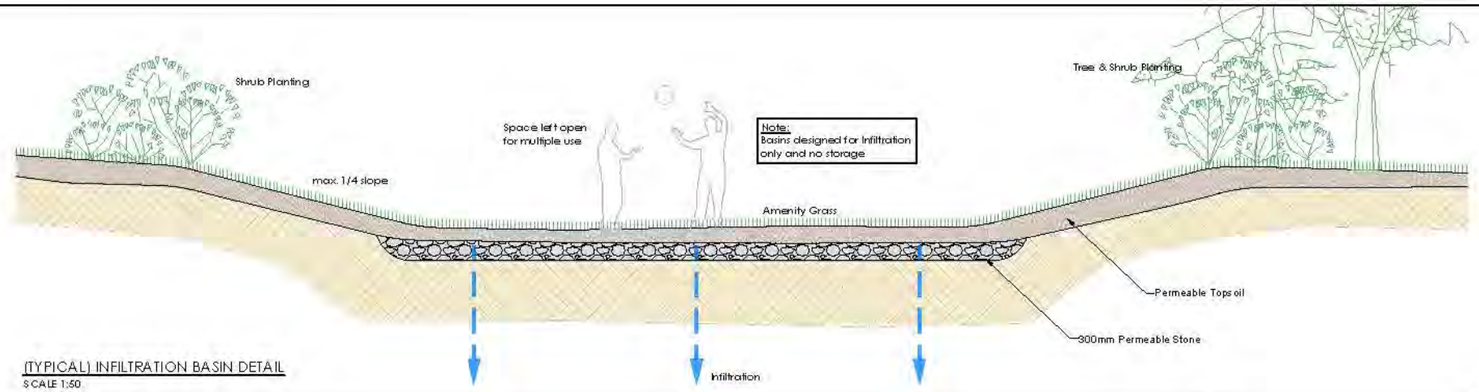
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DRAWING TITLE: Schematic SUDS Details (01 of 02)

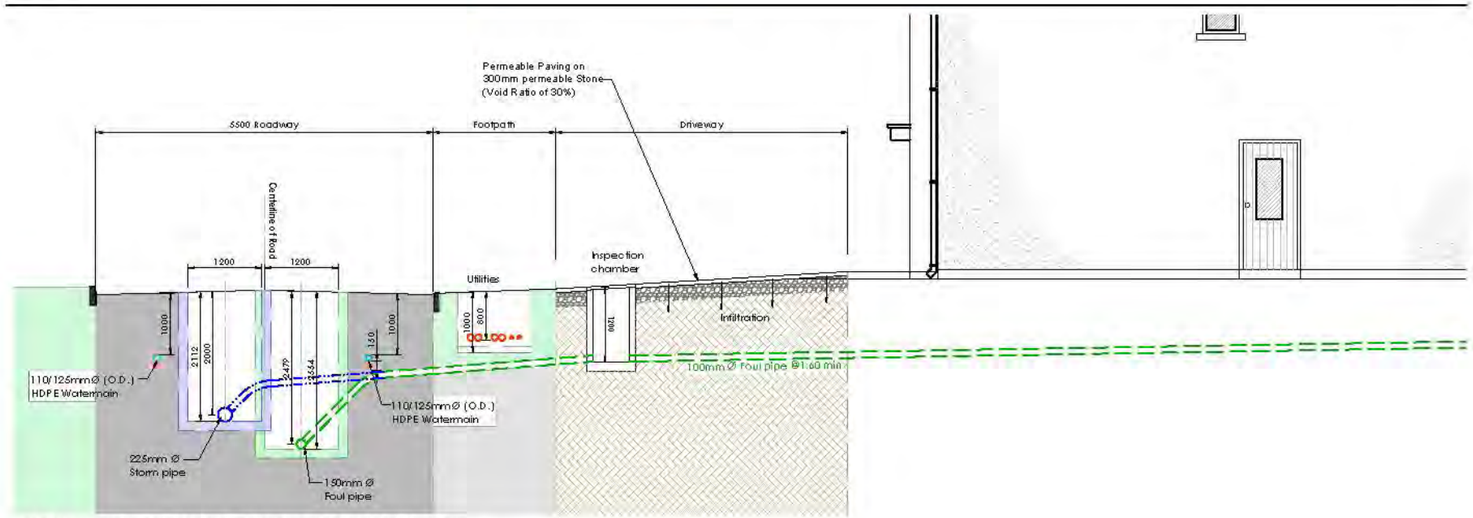
SHEET: A1/ A3

SCALE: As shown

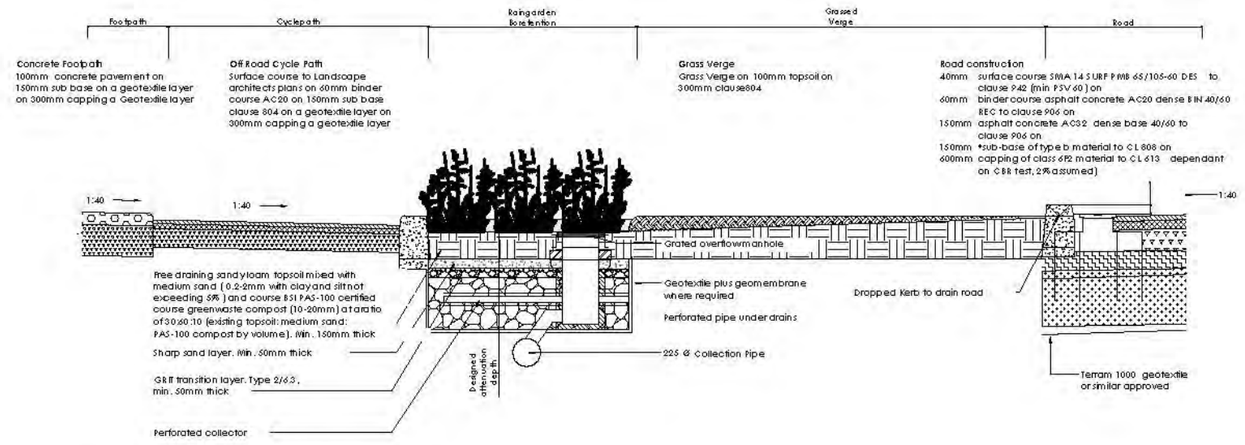
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(TYPICAL) INFILTRATION BASIN DETAIL
SCALE 1:50



(TYPICAL) DWELLING SECTION INCLUDING PERMEABLE PAVING
SCALE 1:50



(TYPICAL) BIORETENTION /ATTENUATION DETAIL ALONG MAGGLIN SUSTAINIBLE ACCESS CORRIDOR
SCALE 1:25

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DRAWING TITLE: Schematic SUDS Details (02 of 02)
SHEET: A1 / A3
SCALE: As shown
PROJECT NO.: 4208 | DRAWING NO.: 0286 | STATUS: P

Appendix B - SuDS Calculations

Tekla Tedds
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Project				Job no.	
Residential Development, Carriganarra LRD, Ballincollig, Cork				4208	
Calcs for				Start page no./Revision	
Blue/Green Roof				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
S.O.'Grady	12/12/2025	L.O'Toole	12/12/2025	L.O'Toole	12/12/2025

ATTENUATION DESIGN

In accordance with CIRIA publication C753 - The SUDS Manual

Tedds calculation version 1.0.04

Allowable discharge method

Site characteristics

Location	Other
Hydrological region	3
Soil type (Wallingford Procedure W.R.A.P map)	4
Standard percentage runoff	SPR = **0.47**
Average annual rainfall	SAAR = **1025** mm
5 year return period rainfall of 60 minute duration	M5_60min = **18.8** mm
Ratio 60-minute to 2 day rainfalls of 5 year return	r = **0.30**
Rainfall intensity increase due to global warming	$p_{climate}$ = **20**%

Catchment details

Subcatchment	Name	Area (ha)	PIMP (%)	Impermeable. area (ha)
1;	Blue Roofs;	0.27;	100.0	0.27;
	Total	0.27;	100.0	0.27;

Greenfield runoff rates

Catchment area	AREA = **50.00** hectare
Greenfield runoff rate (50 hectare site)	$\bar{Q}_{rural}$ = 0.00108m³/s × (AREA/1km²)$^{0.89}$ × (SAAR/1mm)$^{1.17}$ × SPR$^{2.17}$ = **377.1** l / s
Greenfield runoff rate	$\bar{Q}$ = $\bar{Q}_{rural}$ / AREA × A = **2.1** l / s
Greenfield runoff rate per unit area	$\bar{Q}_A$ = $\bar{Q}$ / A = **7.5** l / s / hectare

Estimated site discharges

FSR growth rate (2 year)	FSR_{2yr} = **0.93**
Discharge (2 year)	Q_{2yr} = $\bar{Q}$ × FSR_{2yr} = **1.9** l/s
FSR growth rate (30 year)	FSR_{30yr} = **1.75**
Discharge (30 year)	Q_{30yr} = $\bar{Q}$ × FSR_{30yr} = **3.6** l/s
FSR growth rate (100 year)	FSR_{100yr} = **2.08**
Discharge (100 year)	Q_{100yr} = $\bar{Q}$ × FSR_{100yr} = **4.3** l/s

Table equations

Total surface water	$V_w = A_{imp} \times M$
Permitted dischrage	$Q_{allow} = Q_{2yr} \times D$
Storage volume required	$V_{req} = V_w - Q_{allow}$

Attenuation storage

Duration (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	30 year rainfall (mm)	Total surf water (m³)	Permit dischrge (2 years) (m³)	Storage vol. reqd (m³)
5	0.34;	7.7;	1.47;	11.3;	30.88;	0.58;	30.30
10	0.49;	11.1;	1.49;	16.5;	45.23;	1.16;	44.08
15	0.59;	13.3;	1.49;	19.9;	54.52;	1.73;	52.79
30	0.77;	17.4;	1.48;	25.8;	70.76;	3.47;	67.29

Duration (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	30 year rainfall (mm)	Total surf water (m^3)	Permit dischrge (2 years) (m^3)	Storage vol. reqd (m^3)
60	1.00;	22.6;	1.47;	33.1;	90.82;	6.93;	83.88
120	1.25;	28.2;	1.45;	40.9;	112.19;	13.86;	98.33
240	1.57;	35.4;	1.43;	50.5;	138.75;	27.73;	111.02
360	1.78;	40.2;	1.41;	56.7;	155.72;	41.59;	114.13
600	2.12;	47.8;	1.38;	66.1;	181.44;	69.32;	112.12
1440	2.84;	64.1;	1.35;	86.4;	237.24;	166.37;	70.87

Attenuation storage required

Vol. increase due to head-discharge relationship p_{hydro} = **1.25**

Maximum attenuation storage required $V_{req_max} = V_{max} \times p_{hydro}$ = **142.7** m^3

Interception storage

Interception rainfall depth d_{int} = **5** mm

Volume of interception storage required $V_{int_req} = 0.8 \times A_{imp} \times d_{int}$ = **10.98** m^3

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.06

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **10.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.300**
5-year return period rainfall of 60 minutes duration	M5_60min = **18.8** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **20** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **400** mm
Width of pit	w = **650** mm
Length of pit	l = **5000** mm
Percentage free volume	V_{free} = **30** %
Soil infiltration rate	f = **51.8×10^{-6}** m/s
Wetted area of pit 50% full	$a_{s50} = l \times d + w \times d$ = **2260000** mm^2

Table equations

Inflow (cl.3.3.1)	$I = M100 \times A$
Outflow (cl.3.3.2)	$O = a_{s50} \times f \times D$
Storage (cl.3.3.3)	S = I - O

Note: The following Z2 table values are user defined.

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.34;	7.7;	1.92;	14.7;	0.15;	0.04;	0.11
10	0.49;	11.1;	1.97;	21.8;	0.22;	0.07;	0.15
15	0.59;	13.3;	1.98;	26.3;	0.26;	0.11;	0.16
30	0.77;	17.4;	1.96;	34.0;	0.34;	0.21;	0.13
60	1.00;	22.6;	1.91;	43.1;	0.43;	0.42;	0.01
120	1.25;	28.2;	1.86;	52.6;	0.53;	0.84;	0.00
240	1.57;	35.4;	1.81;	64.0;	0.64;	1.68;	0.00
360	1.78;	40.2;	1.77;	71.0;	0.71;	2.53;	0.00
600	2.12;	47.8;	1.73;	82.8;	0.83;	4.21;	0.00
1440	2.84;	64.1;	1.66;	106.6;	1.07;	10.11;	0.00

Required storage volume S_{req} = **0.16** m^3

Soakaway storage volume $S_{act} = l \times d \times w \times V_{free}$ = **0.39** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume $t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f)$ = 11min 24s

PASS - Soakaway discharge time less than or equal to 24 hours

Tekla Tedds	Project				Job no.	
DOSA Joyce House Barrack Square Ballincollig, Cork	Residential Development, Carriganarra LRD, Ballincollig, Cork				4208	
	Calcs for				Start page no./Revision	
	SuDS Measures - Infiltration Basin				1	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	S.O.'Grady	12/12/2025	L.O'Toole	12/12/2025	L.O'Toole	12/12/2025

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.06

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **4.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.300**
5-year return period rainfall of 60 minutes duration	M5_60min = **18.8** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **20** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **300** mm
Width of pit	w = **1500** mm
Length of pit	l = **1500** mm
Percentage free volume	V_{free} = **30** %
Soil infiltration rate	f = **51.7×10^{-6}** m/s
Wetted area of pit 50% full	a_{s50} = l × d + w × d = **900000** mm^2

Table equations

Inflow (cl.3.3.1)	I = M100 × A
Outflow (cl.3.3.2)	O = a_{s50} × f × D
Storage (cl.3.3.3)	S = I - O

Note: The following Z2 table values are user defined.

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.34;	7.7;	1.92;	14.7;	0.06;	0.01;	0.04
10	0.49;	11.1;	1.97;	21.8;	0.09;	0.03;	0.06
15	0.59;	13.3;	1.98;	26.3;	0.11;	0.04;	0.06
30	0.77;	17.4;	1.96;	34.0;	0.14;	0.08;	0.05
60	1.00;	22.6;	1.91;	43.1;	0.17;	0.17;	0.00
120	1.25;	28.2;	1.86;	52.6;	0.21;	0.34;	0.00
240	1.57;	35.4;	1.81;	64.0;	0.26;	0.67;	0.00
360	1.78;	40.2;	1.77;	71.0;	0.28;	1.01;	0.00
600	2.12;	47.8;	1.73;	82.8;	0.33;	1.68;	0.00
1440	2.84;	64.1;	1.66;	106.6;	0.43;	4.02;	0.00

Required storage volume S_{req} = **0.06** m^3

Soakaway storage volume S_{act} = l × d × w × V_{free} = **0.20** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume t_{s50} = S_{req} × 0.5 / (a_{s50} × f) = 10min 45s

PASS - Soakaway discharge time less than or equal to 24 hours

Tekla Tedds	Project				Job no.	
DOSA Joyce House Barrack Square Ballincollig, Cork	Residential Development, Carriganarra LRD, Ballincollig, Cork				4208	
	Calcs for				Start page no./Revision	
	SuDS Measures - Raingarden/Bioretention Tree Pit				1	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	S.O.'Grady	12/12/2025	L.O'Toole	12/12/2025	L.O'Toole	12/12/2025

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.06

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **5.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.250**
5-year return period rainfall of 60 minutes duration	M5_60min = **18.8** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **20** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **300** mm
Width of pit	w = **1500** mm
Length of pit	l = **2000** mm
Percentage free volume	V_{free} = **30** %
Soil infiltration rate	f = **51.8×10^{-6}** m/s
Wetted area of pit 50% full	a_{s50} = l × d + w × d = **1050000** mm^2

Table equations

Inflow (cl.3.3.1)	I = M100 × A
Outflow (cl.3.3.2)	O = a_{s50} × f × D
Storage (cl.3.3.3)	S = I - O

Note: The following Z2 table values are user defined.

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.32;	7.1;	1.91;	13.6;	0.07;	0.02;	0.05
10	0.47;	10.5;	1.97;	20.8;	0.10;	0.03;	0.07
15	0.57;	12.8;	1.98;	25.3;	0.13;	0.05;	0.08
30	0.75;	17.0;	1.96;	33.3;	0.17;	0.10;	0.07
60	1.00;	22.6;	1.91;	43.1;	0.22;	0.20;	0.02
120	1.29;	29.1;	1.86;	54.0;	0.27;	0.39;	0.00
240	1.69;	38.1;	1.79;	67.9;	0.34;	0.78;	0.00
360	1.96;	44.2;	1.75;	77.3;	0.39;	1.17;	0.00
600	2.35;	52.9;	1.71;	90.4;	0.45;	1.96;	0.00
1440	3.27;	73.7;	1.63;	119.8;	0.60;	4.70;	0.00

Required storage volume S_{req} = **0.08** m^3

Soakaway storage volume S_{act} = l × d × w × V_{free} = **0.27** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume t_{s50} = S_{req} × 0.5 / (a_{s50} × f) = 12min 16s

PASS - Soakaway discharge time less than or equal to 24 hours

Tekla Tedds	Project				Job no.	
DOSA Joyce House Barrack Square Ballincollig, Cork	Residential Development, Carriganarra LRD, Ballincollig, Cork				4208	
	Calcs for				Start page no./Revision	
	SuDS Measures - Tree Pit				1	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	S.O.'Grady	12/12/2025	L.O'Toole	12/12/2025	L.O'Toole	12/12/2025

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.06

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **10.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.300**
5-year return period rainfall of 60 minutes duration	M5_60min = **18.8** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **20** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **1000** mm
Width of pit	w = **1200** mm
Length of pit	l = **1200** mm
Percentage free volume	V_{free} = **30** %
Soil infiltration rate	f = **51.7×10^{-6}** m/s
Wetted area of pit 50% full	a_{s50} = l × d + w × d = **2400000** mm^2

Table equations

Inflow (cl.3.3.1)	I = M100 × A
Outflow (cl.3.3.2)	O = a_{s50} × f × D
Storage (cl.3.3.3)	S = I - O

Note: The following Z2 table values are user defined.

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.34;	7.7;	1.92;	14.7;	0.15;	0.04;	0.11
10	0.49;	11.1;	1.97;	21.8;	0.22;	0.07;	0.14
15	0.59;	13.3;	1.98;	26.3;	0.26;	0.11;	0.15
30	0.77;	17.4;	1.96;	34.0;	0.34;	0.22;	0.12
60	1.00;	22.6;	1.91;	43.1;	0.43;	0.45;	0.00
120	1.25;	28.2;	1.86;	52.6;	0.53;	0.89;	0.00
240	1.57;	35.4;	1.81;	64.0;	0.64;	1.79;	0.00
360	1.78;	40.2;	1.77;	71.0;	0.71;	2.68;	0.00
600	2.12;	47.8;	1.73;	82.8;	0.83;	4.47;	0.00
1440	2.84;	64.1;	1.66;	106.6;	1.07;	10.72;	0.00

Required storage volume S_{req} = **0.15** m^3

Soakaway storage volume S_{act} = l × d × w × V_{free} = **0.43** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume t_{s50} = S_{req} × 0.5 / (a_{s50} × f) = 10min 5s

PASS - Soakaway discharge time less than or equal to 24 hours

APPENDIX 7-5 Water Framework Directive Assessment - Keohane Geological & Environmental Consultancy

Carriganarra Large-scale Residential Development
Carriganarra
Carrigrohane
Ballincollig
Cork

Water Framework Directive Compliance Assessment Report

Prepared for:
MOS Homes Limited
Link Road
Ballincollig
Cork

Prepared by:
Keohane Geological & Environmental Consultancy
Ivy House
Clash
Carrigrohane
Cork

April 2026

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1. Introduction

1.1 Background

MOS Homes Limited intends to apply to Cork City Council for a large-scale residential development (LRD) on zoned lands in Carriganarra townland located at the eastern side of Ballincollig. A description of the proposed development is provided in Section 3.0 below. In summary, the proposed development consists of the demolition of an existing farmyard and associated agricultural buildings and the construction of a residential development of 300 no. units (128 no. dwelling houses and 172 no. apartment/duplex units). Associated works include connection to the existing Uisce Eireann potable water network and foul sewer network (which is treated at Ballincollig wastewater treatment plant). The site location is shown in Figure 1. The proposed development is shown on Figure 2.

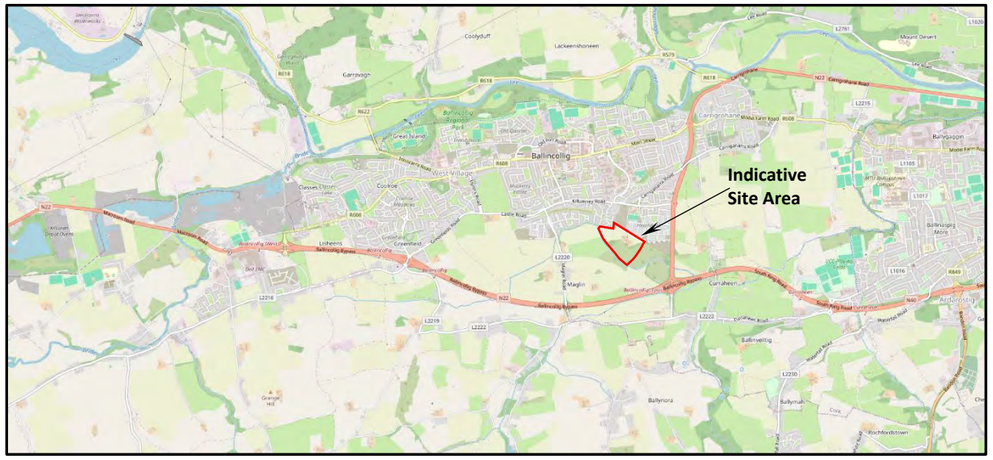


Figure 1: Site Location Map

1.2 Scope and Purpose

The purpose of this report is to assess the development's compliance with the Water Framework Directive (WFD). The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU, was signed into law in October 2000. It requires EU member States to achieve water quality of at least *Good Status* in rivers, lakes, groundwater, estuaries and coastal waters by 2027 at the latest. The Directive was transposed into Irish law by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003).



Figure 2: Proposed Site Layout

As noted, the Directive requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027. Any new development must ensure that it doesn't compromise this core requirement of the Directive.

The WFD is implemented through the River Basin Management Plans (RBMP) in 6-year cycles. WFD Cycle 1 covered the period 2010 – 2015; WFD Cycle 2 covered the period 2016 – 2021; and WFD Cycle 3 covers the period 2022 – 2027. Ireland's 31 local authorities coordinate water quality management across a 5-region structure. The Carriganarra site is in the South West region.

The River Basin Management Plan objectives include:

- Ensure full compliance with relevant EU legislation.
- Prevent deterioration.
- Meet the objectives for designated protected areas.
- Protect high-status waters.
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at:
  - targeting water bodies close to meeting their objective.
  - addressing more complex issues that will build knowledge for subsequent cycles.

2.0 WFD Waterbodies & Designated Sites

2.1 Surface Water Bodies

The site is within hydrometric area 19 (Lee, Cork Harbour and Youghal Bay). Hydrometric area No 19 includes the surface catchment drained by the River Lee and all streams entering tidal water in Cork Harbour and Youghal Bay and between Knockaverry and Templebreedy, extending to an area of 2,153km^2. The Carriganarra site is in the:

- Lee, Cork Harbour and Youghal Bay WFD catchment/Hydrometric Area 19 – refer to Figure 3.
- Glasheen (Cork City)_SC_010 WFD sub-catchment – refer to Figure 4.
- Curraheen (Cork City)_010 WFD River sub-basin – refer to Figure 5.

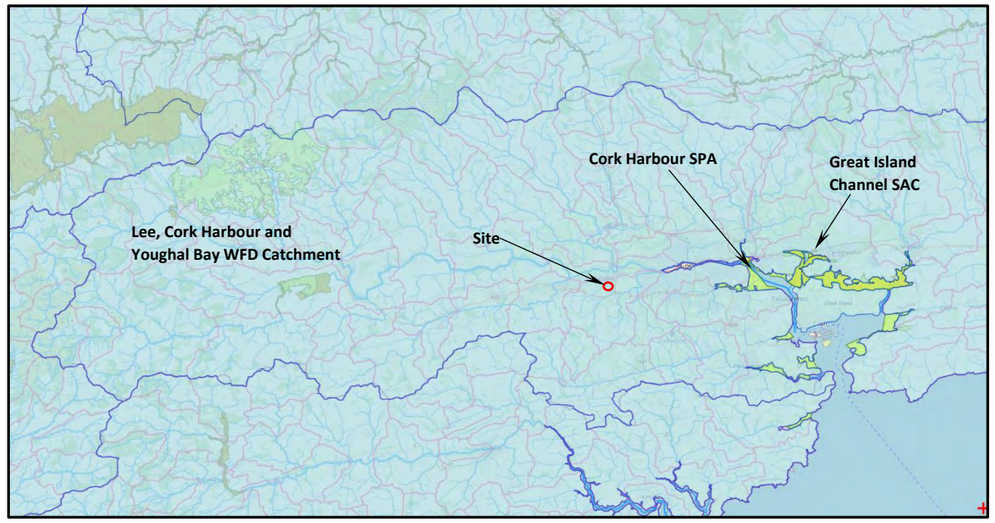


Figure 3: WFD Catchment Area - Lee, Cork Harbour and Youghal Bay

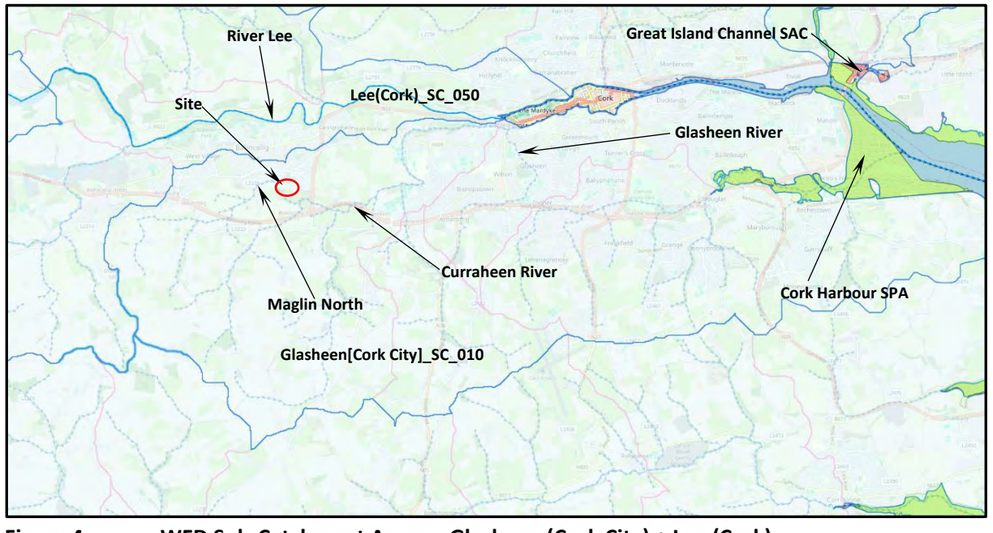


Figure 4: WFD Sub-Catchment Areas – Glasheen (Cork City) + Lee (Cork)



Figure 5: WFD Sub-Basin Area - Curraheen (Cork City)_010 + Lee(Cork)_090

The Maglin North[1] is a second order watercourse that rises in the townland of Grange, to the southwest of the site. It flows north for approximately 1.3km, then turns east, passing under the Ballincollig By-pass in Kilnaglory, flowing generally in an easterly direction. The Lisheens Stream[2] (a first order stream) joins the Maglin North River just east of Ballincollig Castle. The Maglin North River flows in a southerly direction along the western site boundary, then flows east joining the Maglin South River just west of Clash Road and just south of the Ballincollig By-pass. It is noted that the Maglin South River was diverted as part of the Ballincollig By-pass construction. The river now flows along the southern side of the motorway. The Maglin River meets the Curraheen River just east of Clash Road and flows east towards Bishopstown, turns north and then east again, joining with the Glasheen River near Victoria Lodge on the Wilton Road. The Glasheen River joins the south channel of the River Lee near Victoria Cross. The local drainage is shown on Figure 6.

The Maglin North was included in the OPW's arterial drainage scheme carried out under the Arterial Drainage Act (1945) to improve land for agriculture and to mitigate flooding. These works included dredging, bridge modification and embankment construction.

The connection works to the Uisce Eireann networks are located within the same WFD sub-basin as the Carriganarra site. The Ballincollig WWTP is located in, and discharges treated water to, the Lee(Cork)_050 WFD river waterbody sub-catchment and Lee(Cork)_090 WFD river waterbody sub-basin.

[1] The EPA name for the Maglin North River is the Grange Hill Stream. The stream is named Maglin North River in the South Ballincollig Drainage Study, and this nomenclature is used in this report.
[2] The EPA name 'Lisheens Stream' is used in this report. This watercourse is referred to as 'Artificial Drain' in the South Ballincollig Drainage Study. Lisheens Stream is used in this report to distinguish this watercourse from the other artificial drains in the study area.

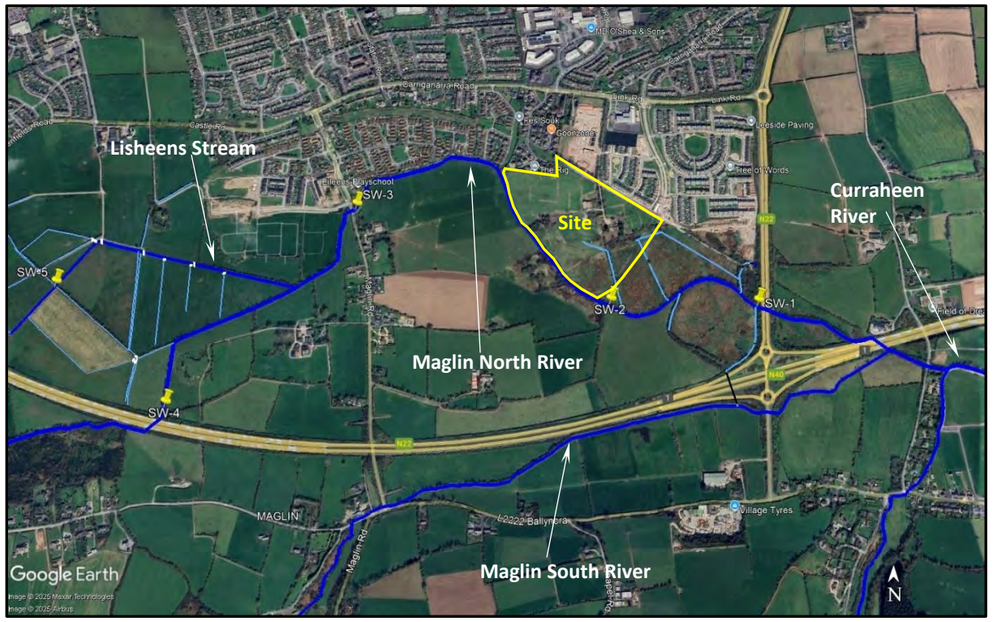


Figure 6: Local Drainage Network

2.1.1 Surface Water Quality

The EPA monitors water quality in the rivers and streams across the country – refer to https://gis.epa.ie/EPAMaps/ for most recent data. However, there are no water quality (Q-value) monitoring points on the Maglin North River or rivers further downstream of the site. The river waterbody WFD status 2016 – 2021 and 2019 – 2024 for the Maglin North River, Curraheen River and all streams draining this WFD River sub-basin is Moderate – refer to Figure 7. This is based on 'expert judgement' (i.e., in the absence of water quality data).



Figure 7: River Waterbody WFD Status 2019-2024

All waterbodies in the Curraheen WFD River sub-basin are assigned 'At Risk' due to elevated phosphate concentrations – Figure 8. According to the WFD Cycle 3 (for the Glasheen sub-catchment, including Curraheen sub-basin), further investigation is required to determine what is impacting nutrient conditions. Monitoring of surface water quality along the Maglin North River as part of the EIA process did not indicate nutrient enrichment. The Curraheen Sub-basin is noted to be under anthropogenic pressures (pressure subcategory is not defined).

The wastewater treatment plant (WWTP) for the area, operated by Uisce Éireann, is located in Ballincollig near the GAA grounds. The treated water is discharged to the River Lee. This stretch of the River Lee (Lee (Cork)_090) was assigned Good WFD river waterbody status for 2016-2021 but has now been assigned Moderate for 2019 – 2024, reverting to the 2013-2018 WFD river waterbody status. It is assigned 'Not At Risk'. The latest (2023) Q-values upstream (Inniscarra Bridge) and downstream (Leemount Bridge) of the WWTP discharge point is Q4, indicating Good status.

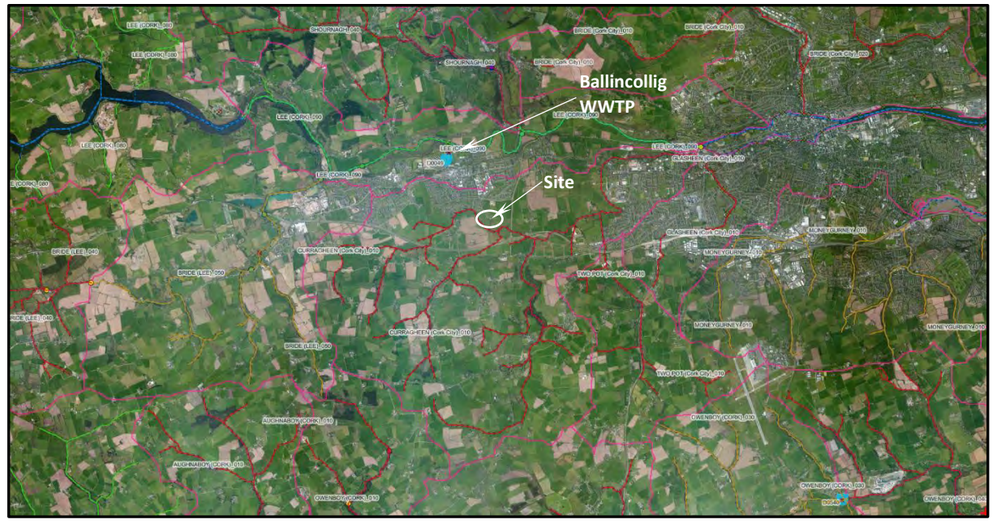


Figure 8: WFD River Waterbodies Risk

2.2 Groundwater Bodies

The site is underlain by the Little Island Formation and Waulsortian Limestone Formation, both consisting predominately of limestones. The GSI has classified these formations as Regionally Important Aquifer - Karstified (diffuse) (Rkd). Regionally important karstified (Rkd) aquifers generally are capable for providing sufficient water for public, commercial and industrial purposes. Transmissivity values of up to 1,100m^2/day are recorded. Borehole productivity class is generally III - IV, where class I is the best and V being the worst. Class III - IV have specific capacities of between 10 and 100m^3/day/m.

These formations form part of the Ballincollig WFD groundwater body, which extends from Crookstown in the west to Lough Mahon in the east. The ground waterbody WFD status 2016 - 2021 and 2019 – 2024 are Good. It is categorised at 'Not at Risk'. The Lee Vally Gravels are located to the north of the Ballincollig WFD ground waterbody, extending primarily along the Bride Valley and Lee Valley (downstream of the abbey at Inniscarra). It also includes the Curraheen River valley downstream of the Munster Agricultural Society showgrounds. The Lee Valley Gravels WFD ground waterbody is categorised as 'At Risk'.



Figure 9: WFD Ground Waterbodies Risk

2.3 Designated Sites

The designated sites downstream of the Carriganarra site are:

- Great Island Channel SAC & pNHA – site code 001058.
- Cork Harbour SPA - site code 004030.
- Douglas River Estuary pNHA - site code 001046.
- Dunkettle Shore pNHA - site code 001082.
- Rockfarm Quarry, Little Island pNHA - site code 001074.
- Monkstown Creek pNHA – site code 001979.
- Lough Beg (Cork) pNHA – site code 001066.
- Whitegate Bay pNHA – site code 001084.
- Ballincollig Caves pNHA – site code 001249.

In addition to these, the Lee Valley pNHA (site code 000094) is downstream of the discharge from the Ballincollig WWTP.

Designated sites are shown on Figure 10.

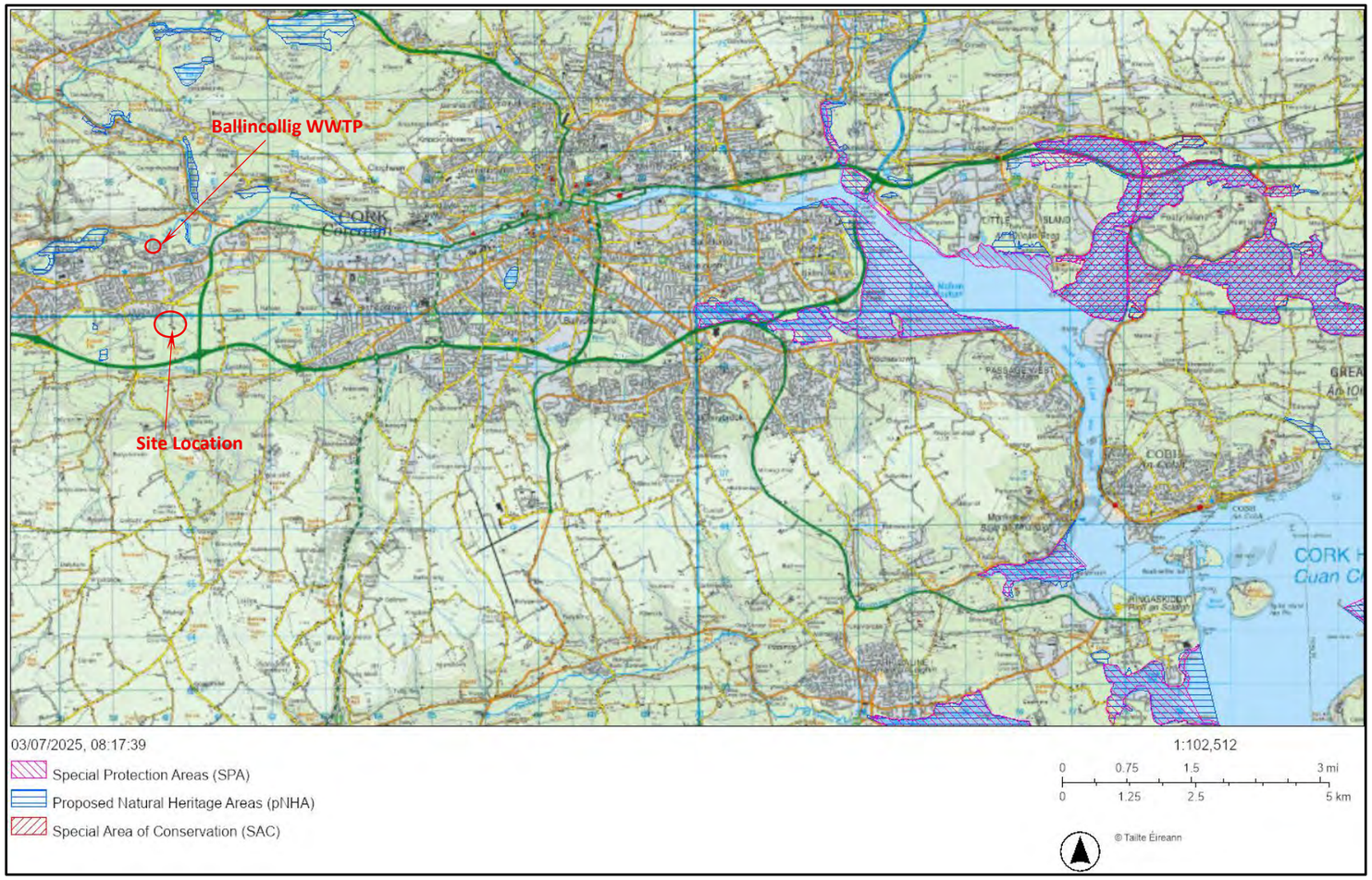


Figure 10: Designated Sites

3.0 Proposed Development

The proposed development comprises a 10-Year Planning Permission for a Large-Scale Residential Development (LRD) at Carriganarra townland, Carrigrohane, Ballincollig, Cork.

The proposed development consists of the demolition of an existing farmyard and associated agricultural buildings and the construction of a residential development of 300 no. units (128 no. dwelling houses and 172 no. apartment/duplex units). Vehicular access to the proposed development will be provided via 2 no. entrances from the proposed extension of the sustainable access corridor (from Heathfield), which will extend to the western side of the Maglin North River. Several separate pedestrian entrances will also be provided to adjoining residential developments. Ancillary site works include the provision of bicycle parking and bin storage facilities serving the proposed apartment/duplex buildings, a creche facility, open spaces, raising of ground levels between the proposed residential units and the sustainable access corridor, and undergrounding of an existing overhead powerline. It will also include provision for future crossings (pedestrian and vehicular) of the Maglin North River. Associated works include connection to the existing Uisce Eireann potable water network and foul sewer network (which is treated at Ballincollig wastewater treatment plant). The proposed site layout is shown in Figure 2.

3.1 Characteristics of Proposed Development

The aspects of the proposed development that have the potential to affect the surface water and / or the groundwater environment are discussed in the subsections below.

3.1.1 Land Use Change

The Carriganarra site consists of several fields and the old derelict farmyard and buildings. The farmhouse was demolished following a fire several years ago. Fields are separated by sod & stone ditch typically with dense hedgerow. Many of the field boundaries mapped in the historic OSI maps are still present. The southern end of the farm lane, consisting of tree-lined sod & stone ditches, is included within the site. The route of the former railway (Cork & Macroom Direct Railway) forms the north-eastern boundary of the site.

There are internal field boundary drains on the southern part of the site, but these are dry except during prolonged heavy rainfall. These discharge to the Maglin North River.

The fields are described in the Biodiversity Chapter of the EIAR as improved agricultural grassland GA1/Dry calcareous and neutral grassland GS1 on the north side of the site. It has poor species diversity. Species present include Plantain, Red bartsia, Yarrow, Clovers, Poa sp., Timothy and Crested dogstail. Improved agricultural grassland GA1/Wet grassland GS4 occur on the southern side of the site. This habitat has poor species diversity. Rushes dominate this habitat with Sharp flowered rush and Soft rush. Broadleaved herbaceous species include Marsh foxtail, Meadowsweet, Angelica and Creeping buttercup.

Other habitats on site include hedgerows, treelines, mixed broadleaved woodland, recolonizing bare ground, stone walls, drainage ditches, artificial surfaces and lowland depositing river.

The development site extends to approximately 13.5ha. Of this, approximately 6.5ha will be finished with hard paving (including sustainable access corridor) or roofing, with the remaining 7ha landscaped and green space.

3.1.2 Flood Risk

Malachy Walsh & Partners (MWP) carried out a site-specific flood risk assessment (FRA) for the Carriganarra development. This FRA was taken to stage 3 as potential flooding was identified in the South Ballincollig Drainage Study[3]. This study indicated that the 0.1% AEP (Annual Exceedance Probability) high end future scenario flooding will extend into the southern part of the site. Much of the proposed sustainable access corridor passes through the potential flood extents. As the sustainable access corridor extends into the flood extents area and parts of the flood plain will be raised (approximately 4.3ha total), modelling was carried out to assess the potential impacts on flooding extents and magnitude. This is discussed further in Section 4.1 and mitigation of flood risk is discussed in Section 5.1.

3.1.3 Discharges to Surface Water

Discharge to surface water will be via SuDS features, including rainwater harvesting (water butts – to be retrofitted by homeowners), infiltration basins, filter drains, tree pits, raingarden / bioretention tree pits, blue / green roofs, and attenuation tanks fitted with flow control devices. Hydrocarbon interceptors will also be installed upstream of each attenuation tank. Treated surface water from the development will be discharged to the Maglin North River near the south-western corner of the site. SuDS features to management runoff from the sustainable access corridor and filled areas include filter strips, filter drains and bioretention strips. The filled areas will be graded to direct overland flow to the filter drains to bring surface water to the west. The overall management will limit discharge from the site to greenfield rates. Discharge from the site will be to 2 No. areas of stone riprap at the head of constructed open drains with setbacks of approximately 10m from the river. These will dissipate energy and avoid bank erosion / scouring in the drains and riverbed.

3.1.4 Discharges to Groundwater

There will be no direct discharges to groundwater. As the site is underlain by limestone formations which are susceptible to karstification, use of infiltrating SuDS features, which would concentrate flows to the subsurface, are minimised. Of the 13.5ha of site area, approximately 7ha will consist of open space and landscaping. Incident rainfall in these areas will continue to percolate into subsoil and recharge the aquifer.

3.1.5 Foul Water Discharge

The development will be serviced by mains sewer which will be treated at Ballincollig WWTP. This WWTP (EPA license number D0049-01) has tertiary treatment with nitrogen and phosphorous removal. Discharge of treated water is to the River Lee. The increased volumes of wastewater associated with the development (143 m^3/day) will increase the loading to the receiving water and increase pressure on its assimilative capacity.

The Ballincollig WWTP has a capacity of 33,000 PE. According to the latest Annual Environment Report for this facility, the quality of the treated water discharged to the River Lee is compliant for all test parameters. Uisce Eireann has confirmed its capacity to treat sewage from the Carriganarra site. The proposed wastewater connection for the development will be:

[3] Malachy Walsh and Partners, October 2021. Strategic Flood Risk Assessment South Ballincollig Drainage Study.

- Via a new pumping station located in the south-western quadrant of the site. This pumping station will cater for the 300 No. units of this LRD application and 467 No. units from previous and under construction MOS developments.
- The new pumping station will then utilise the existing rising main which discharges to the Uisce Éireann network via a discharge manhole into a gravity sewer in front of the Gaelscoil.
- This gravity network then runs into the existing Uisce Éireann Maglin pumping station (in Glincool housing estate).
- The Maglin pumping station discharge to the Ballincollig WWTP.

3.1.6 Potable Water Supply

The development will be serviced by mains water. The drinking water supply for the proposed development is sourced from the Inniscarra Reservoir – a man-made reservoir on the River Lee. The development will therefore place an increased demand on this surface water supply. When completed, residents of the development will use approximately 163m^3/day.

Uisce Éireann confirmed that there is capacity for the potable water connection for the proposed development without infrastructure upgrades.

3.1.7 Contamination

Polluting materials stored, use and / or generated on site include hydrocarbons, concrete and silt. These present a risk of polluting the surface water and groundwater environment primarily during the construction phase.

4.0 Potential Impact on Water Bodies

The potential impacts to the water environment are discussed below for the construction and operational phases of the Carriganarra residential development. Decommissioning impacts are not considered relevant for this development.

4.1 Construction Phase

The housing development will be built in three phases over an approximate 4-year period. There is potential for direct and indirect impacts on surface water quality during construction activity from several sources. These are:

- Increased sediment loading in the surface water runoff from the site and entering the Maglin North River via the existing man-made drains, or directly along the western site boundary. Earthworks for the housing development will take place greater than 10m from the riverbank – the sustainable access corridor and bridge will be the closest works to the river. Earthworks will also take place at / near the drains on the site, with road construction and raising of ground levels. Once the earthworks and landscaping are completed, the risk of sediment loading of watercourses is significantly reduced.
- Potential spillage of oil and diesel used on site for plant and equipment. During construction there would be typically 8 to 10 machines on site (excavators, dump trucks, teleporters, generators etc.). These would be refuelled every 2 to 3 days. This is either done using refuelling bowsers owned by the plant hire contractors or at the site compound where fuel will be stored. The machines also use hydraulic oils and motor oils. There is potential for leaks and spillages of diesel or oils during refuelling, breakdowns (e.g., breaking of a hydraulic hose) etc.
- Release of cement to watercourses during concrete pours for apartment and housing foundations. Some of these will be near the field boundary drains discharging to the Maglin North River, so concrete spillages could reach the river. In addition, the construction of the sustainable access corridor bridge will be in close proximity to the river.
- In addition, the chutes of concrete trucks are typically rinsed down on site. There will be approximately 1,988 concrete loads brought to site over the construction period. If not carried out properly, concrete washdown water could reach watercourses, affecting its pH.

The potential impacts on groundwater quality are of a similar nature to the surface water environment as discussed above. This includes potential impacts on groundwater quality from hydrocarbon spills or leaks from construction machinery. Concrete pours and silt do not present a significant risk to the groundwater environment.

Based on the ground investigations conducted, dewatering of excavations (pumping of groundwater) on the housing development is not predicted.

Groundwater (aquifer) vulnerability will be increased with the removal of topsoil and overburden. While this will not change the current aquifer vulnerability rating (extreme to moderate), the depth of protection provided by the topsoil / overburden will be reduced in areas of cut. It is reversible with the construction of foundations and roads which will provide a barrier to downward migration of any pollutants.

During the construction phase foul effluent will be generated at the welfare facilities. The number of workers on site during the construction phase will vary depending on site activities. During peak activity, there would be approximately 100 workers on site. This would generate up to approximately 3m^3 of foul sewage per day. Depending on how this is managed, it could present a risk to the underlying aquifer (or receiving surface water body).

4.2 Operational Phase

There is less potential for direct and indirect impacts on surface water quality during the operational phase of the residential development. The site would be fully landscaped, there would be no earthworks, no concrete pours and comparably little hydrocarbons used or stored. The potential sources of surface water contamination during the operational phase are:

- The parking of cars and the storage of home-heating fuel within the development may result in the leakage of small amounts of oil resulting in contamination of surface water. Any leaks or spillage is likely to be small in scale.
- The underlying bedrock formations are susceptible to karstification, which could result in subsidence. Inappropriate management of runoff from the site could affect underlying karst bedrock.
- The development will be serviced by mains sewer which will be treated at Ballincollig WWTP. This WWTP has tertiary treatment with nitrogen and phosphorous removal. Discharge of treated water is to the River Lee. The increased volumes of wastewater associated with the development (approximately 143 m^3/day) will increase the loading to the receiving water and increase pressure on its assimilative capacity.

The proposed development will increase the hardstanding areas as roads, and housing units are constructed. The runoff characteristics of the developed site will be different to the greenfield site conditions, with increases in runoff volumes and rates. The changes in runoff are primarily associated with the operational phase. These potential direct and indirect impacts on hydrology are:

- The development site extends to approximately 13.5ha. Of this, approximately 6.5ha will be finished with hard paving (including sustainable access corridor) or roofing, with the remaining 7ha landscaped and green space. The runoff from the entire developed site will discharge to the Maglin North River.
- The proposed sustainable access corridor will extend across the flood plain as mapped in the Ballincollig drainage study. It will displace flood storage capacity and the bridge across the river could affect the river hydraulics depending on design. During flooding events over the operational phase of the development, the flood waters that would have occupied that space will be displaced to other locations, potentially increasing flood levels and / or extents.
- Raising of ground levels by approximately 0.5m between the sustainable access corridor and the residential units will have similar potential impacts. These works will also affect the flows in the site's drains within the planning boundary.
- In addition to the surface water quality and hydrology effects, the development will place additional pressure on the water supply resources in Cork. As noted, the development will be serviced by mains water. On-site groundwater wells are not proposed. The drinking water supply for the proposed development is sourced from the Inniscarra Reservoir – a man-made reservoir on the River Lee. The development will therefore place an increased demand on this surface water supply. When completed, residents of the development will use approximately 163m^3/day. According to the EPA web-mapping the Inniscarra Reservoir is not identified as being under river abstraction pressure and Uisce Éireann has confirmed capacity in the existing potable water infrastructure to service the site.

The potential impacts on groundwater quality are of a similar nature to the surface water environment as discussed above. This includes potential impacts on groundwater quality from hydrocarbon spills or leaks from parked cars and home heating oil (if used).

Interception of incident rainfall will reduce the volume of water entering the groundwater environment. This could result in lower groundwater recharge and subsequently lowering of groundwater levels. There would also be a reduction in stream baseflow from the aquifer, but this would be offset by direct discharge of stormwater to the river.

As noted, the development will be serviced by mains sewer with no direct discharge for foul effluent to groundwater or surface water. However, leakage from the sewer pipework at the development could impact on groundwater quality.

5.0 Mitigation

The avoidance and mitigation to be implemented to protect the water environment are discussed below for the construction and operational phases of the Carriganarra residential development. As noted, decommissioning is not considered relevant for this development.

5.1 Construction Phase

The mitigation measures to be implemented for the construction phase are set out below:

- Design considerations in the site layout to avoid and reduce impacts to surface water include the provision of a minimum 10m buffer setback of the housing units from the Maglin North River.
- The infilling of the lands between the sustainable access corridor and the residential units will also be set back 10m from the riverbank.
- The bridge to be constructed at part of the sustainable access corridor will be a clear-span structure. Inland Fisheries Ireland will be consulted on the proposed design for agreement. Its construction will follow current guidelines on work in the riparian zone, including IFI (2016) and NRA (2005). Its construction will require Section 50 consent from the OPW (a process to ensure that the structure doesn't interfere with river hydraulics). Abutments will be set back 2.5m from the riverbank to allow unobstructed passage of fish and wildlife. Silt fences will be erected between any earthworks and the river during ground investigation and construction works.
- Following mobilisation to site, surface water management infrastructure will be the first works carried out. Additional controls will be installed as needed as construction progresses through the site, and/or as identified during site inspections of surface water management infrastructure.
- The attenuation tanks required for phase 1 of the development will be installed early in the construction sequencing to control runoff rates as the site gets developed. The attenuation infrastructure will be progressively expanded through the site ahead of housing construction. This will ensure that there is always adequate capacity in the system to deal with design flows.
- Foul sewage generated at the welfare facilities during the early construction phases will be piped to a sealed tank and collected by a waste collection contractor (with the appropriate waste collection permit) for discharge at a licensed WWTP. Once the development is connected to the Uisce Eireann network, the workers' welfare facilities will be piped to the on-site foul sewer network.
- During the construction phase, best practices will be employed to minimise the release of sediment laden storm water runoff, including;
    - Areas stripped of vegetation will be kept to a minimum; enough to keep pace with house construction. On-going landscaping and restoration of completed units will be carried out. This will reduce areas of soil exposed to erosion.
    - Stripped and excavated soils will be managed in accordance with best practice. Soil stockpiles will be setback a minimum of 50m from any watercourse. Silt fencing will be erected downgradient to stockpiles to filter runoff water.
    - Silt fencing will be erected along the western boundary of the site where topography slopes towards the river. This fencing will be maintained for the construction phase until development (storm water drains / paving / landscaping) is complete in adjacent areas.

    - Construction phase settlement ponds will be constructed to hold runoff water from earthworks areas. These will be located and moved as the development progresses through the site.
    - Check dams, sandbags and / or straw bales will be installed along the field boundary drains to slow flows and remove silt. Additional check dams will be installed during filling of area between the sustainable access corridor and the residential units. Check dams will be constructed using clean stone and geotextile spanning across the drainage channel.
    - Alterations to the drains during filling of the areas between the sustainable access corridor and the residential units will be carried out in dry summer months, when there is little or no flow.
    - The public road serving the site will be kept clean of mud and debris. A street sweeper will attend site regularly to clean the road when there are truck movements in and out of the site.
    - Earthworks will be suspended during extreme weather conditions. An extreme rainfall event will be classified as an event that corresponds to the Met Éireann Orange – Weather Alert for rainfall. The Site Manager will monitor the weather forecast to make preparations ahead of adverse weather conditions.

Met Eireann Orange Weather Alert for Rainfall
50 mm – 80 mm in 24 hrs
40 mm – 60 mm in 12 hrs or less
30 mm – 50 mm in 6 hrs or less

- If required, dewatering of the excavations will be to temporary silt traps. Flow from the silt traps, placed upgradient of the silt fencing protecting watercourses, will be diffuse.
- The release of cement to watercourses will be prohibited. Concrete pours will occur in contained areas using shuttering. Rinsing down of concrete trucks will be done at a dedicated location on site – adjacent to the construction site compound, or at a suitable alternative location, a minimum distance of 75m from any watercourse. Signage will be erected at each concrete pour location directing drivers to the rinse down area. This rinse down area will be removed at the end of the construction phase.
- Hydrocarbons (oils, diesel and chemicals) will be stored and managed in an appropriate manner to ensure no negative effects.

The infrastructure to be used to manage and treat surface water, and to control erosion at the construction site are:

- To reduce the volume of water to be treated during construction and to reduce the erosion potential of exposed soils, clean surface water runoff will be diverted around earthworks areas. This will be done with the use of diversion channels. Diversion channels are shallow interceptor drains to divert overland flows.
- Silt fences will be erected on the downslope side of any earthworks areas to intercept any overland flows that could potentially be carrying silt / fines. These are constructed with geotextile embedded in the topsoil and supported with wooden pegs.
- Check dams will be installed at appropriate locations along the field boundary drains. These will be constructed using geotextile supported by two wooden pegs, sandwiched by clean washed filter gravel, as illustrated. Alternatively, straw bales will be used.

5.2 Operational Phase

Mitigation measures to be employed during the operation phase are:

- The runoff from the site will be controlled and managed using a suite of SuDS and engineering controls designed for a 1:100-year storm event plus a 20% allowance for climate change. These will include rainwater harvesting (water butts – to be retrofitted by homeowners), infiltration basins, filter drains, tree pits, raingarden / bioretention tree pits, blue / green roofs, and attenuation tanks fitted with flow control devices. Hydrocarbon interceptors will also be installed upstream of each attenuation tank. SuDS features to management runoff from the sustainable access corridor and filled areas include filter strips, filter drains and bioretention strips. The filled areas will be graded to direct overland flow to the filter drains to bring surface water to the west. The overall management will limit discharge from the site to greenfield rates.
- With the potential for oil spills and leaks from cars parked in the development, hydrocarbon interceptors and grit traps are included in the drainage design to protect the water quality in the Maglin North River. The hydrocarbon interceptors will be cleaned and maintained by the management company.
- The SuDS infrastructure proposed has regard to the underlying karst limestone bedrock. Infiltration to the subsurface has been minimised. Engineering solutions are proposed to manage stormwater runoff – 6 No. tanks are proposed. Discharge from the site will be to 2 No. areas of stone riprap at the head of constructed open drains with setbacks of approximately 10m from the river. These will dissipate energy and avoid bank erosion / scouring in the drains and riverbed.
- The foul sewer for the facility will connect into the Uisce Eireann sewer network, which discharges to the Ballincollig WWTP – EPA license number D0049-01. This is a tertiary treatment plant with a capacity of 33,000 PE. According to the latest Annual Environment Report for this facility, the quality of the treated water discharged to the River Lee is compliant for all test parameters. Uisce Eireann has confirmed capacity in the Ballincollig WWTP to treat sewage from the Carriganarra site.
- A Site-Specific Flood Risk Assessment (SSFRA) was prepared for the proposed development. The SSFRA had regard to findings of the Ballincollig drainage study, which identified flooding extending into the southern portion of the site for a 1:100-year rainstorm event. The conclusion of the SSFRA is that, with the recommended mitigation, the development is at low risk of flooding for the design event and that it will result in slight changes to the flood levels in adjoining lands. It concluded that there will be higher flood levels upstream of the sustainable access corridor of up 360mm extending approximately 350m upstream. Downstream of the sustainable access corridor increases of up to 50mm extending for 250m would be experienced. These increase flood levels occur in areas already identified as being at risk of flooding, with only a slight increase in extents on the upstream side of the sustainable access corridor.
- Groundwater (aquifer) vulnerability will be temporary increased as the site is stripped and reprofiled for development. The progressive construction of paved roads, foundations and landscaping will provide protection to the aquifer.
- To conserve water usage (and consequently reduce the volume of foul sewerage generated), each house will be fitted with a water meter, aerated shower heads, aerated strainers in taps, duel flush cisterns etc.

6.0 Predicted Residual Impacts

With the implementation of the avoidance and mitigation measures as detailed above, the predicted residual impacts of the proposed development on the water environment are:

- The impacts on surface water quality are predicted to have not significant, localised temporary negative effects during the construction phase and imperceptible, localised brief negative effects during the operational phase. No significant indirect impact is predicted on the aquatic habitats and fauna downstream of the site.
- The impacts on hydrology / runoff characteristics of the site are predicted to have imperceptible, local, permanent negative effects during the operational phase.
- The impacts on groundwater / aquifers are predicted to have imperceptible, localised, permanent negative effects.
- The impacts on water infrastructure (drinking water treatment and WWTP) are predicted to have likely imperceptible, regional, permanent negative effects.

7.0 WFD Compliance

WFD status for the river waterbodies, ground waterbodies and designated sites hydraulically linked to the Carriganarra LRD project are defined in Section 2. Avoidance and mitigation measures, detailed in Sections 4 and 5 above, demonstrate that the proposed development will have no significant impacts on the water quality of the underlying ground waterbody or surface waterbodies at and downstream of the site. It can therefore be concluded that compliance of the WFD will be achieved. As detailed in Section 6 above (and in Chapter 7 of the EIAR), the significance of the residual effects on the water environment is determined to be 'Imperceptible'. There will be no change in the WFD status of any hydraulically connected waterbodies resulting from the Carriganarra LRD:

- There will be no effects on downstream protected areas. It is consistent with the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC).
- It will not cause a deterioration in the status of any surface and ground waterbodies assessed.
- The potential for the Lee(Cork)_090 WFD river waterbody achieving good status will not be jeopardised.
- The good status of the Ballincollig WFD ground waterbody will not be jeopardised.
- The potential for the Curraheen (Cork City)_10 WFD river waterbody (or other waterbodies further downstream) achieving good status will not be jeopardised.
- There will be no conflict with the objectives set in the River Basin Management Plan.

It can therefore be concluded that the proposed development is compliant with the requirements of the Water Framework Directive (2000/60/EC).

CHAPTER EIGHT

BIODIVERSITY

APPENDIX 8-1 Classification scheme outlined in the Guidelines for Assessment of Ecological Impacts of National Road Schemes - National Roads Authority, 2009
APPENDIX 8-2 Botanical survey Results
APPENDIX 8-3 Aquatic surveys - – Dixon Brosnan Ecology
APPENDIX 8-4 AA Screening/Natura Impact Statement – Dixon Brosnan Ecology
APPENDIX 8-5 Proposed bird nesting locations plan - Deady Gahan Architects
APPENDIX 8-6 Invasive Species Management Plan - Dixon Brosnan Ecology

APPENDIX 8-1 Classification scheme outlined in the Guidelines for Assessment of Ecological Impacts of National Road Schemes - National Roads Authority, 2009

Appendix 8.1. TII 2009 Guidelines

Examples of valuation at different geographical scales

Ecological valuation: Examples

International Importance:
 	
• **'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation and Proposed Special Protection Area (pSPA).**
 	
• **Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).**
• **Features essential to maintaining the coherence of the Natura 2000 Network.[1]**
• **Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.**
• **Resident or regularly occurring populations (assessed to be important at the national level) [2] of the following:**
  ○ **Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or**
  ○ **Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.**
• **Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).**
• **World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).**
• **Biosphere Reserve (UNESCO Man & The Biosphere Programme).**
• **Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).**
• **Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).**
• **Biogenetic Reserve under the Council of Europe.**
• **European Diploma Site under the Council of Europe.**
• **Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).[3]**

National Importance:
 	
• **Site designated or proposed as a Natural Heritage Area (NHA).**
• **Statutory Nature Reserve.**
• **Refuge for Fauna and Flora protected under the Wildlife Acts.**
• **National Park.**
• **Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.**
• **Resident or regularly occurring populations (assessed to be important at the national level)[4] of the following:**
  ○ **Species protected under the Wildlife Acts; and/or**
  ○ **Species listed on the relevant Red Data list.**
• **Site containing 'viable areas'[5] of the habitat types listed in Annex I of the Habitats Directive.**

County Importance:
 	
• **Area of Special Amenity.[6]**
• **Area subject to a Tree Preservation Order.**
• **Area of High Amenity, or equivalent, designated under the County Development Plan.**
• **Resident or regularly occurring populations (assessed to be important at the County level)[7] of the following:**
  ○ **Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;**
  ○ **Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;**
  ○ **Species protected under the Wildlife Acts; and/or**
  ○ **Species listed on the relevant Red Data list.**
• **Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.**
• **County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, [8] if this has been prepared.**
• **Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.**
• **Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.**

Local Importance (higher value):
 	
• **Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;**
• **Resident or regularly occurring populations (assessed to be important at the Local level)[9]of the following:**
  ○ **Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;**
  ○ **Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;**
  ○ **Species protected under the Wildlife Acts; and/or**
  ○ **Species listed on the relevant Red Data list.**
• **Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;**
• **Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.**

Local Importance (lower value): • **Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;** • **Sites or features containing non-native species that are of some importance in maintaining habitat links.**

1 See Articles 3 and 10 of the Habitats Directive.

2 It is suggested that, in general, 1% of the national population of such species qualifies as an internationally important population. However, a smaller population may qualify as internationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

3 Note that such waters are designated based on these waters' capabilities of supporting salmon (*Salmo salar*), trout (*Salmo trutta*), char (*Salvelinus*) and whitefish (*Coregonus*).

4It is suggested that, in general, 1% of the national population of such species qualifies as a nationally important population. However, a smaller population may qualify as nationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

5 A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change (for example, as a result of climatic variation).

6 It should be noted that whilst areas such as Areas of Special Amenity, areas subject to a Tree Preservation Order and Areas of High Amenity are often designated on the basis of their ecological value, they may also be designated for other reasons, such as their amenity or recreational value. Therefore, it should not be automatically assumed that such sites are of County importance from an ecological perspective.

7 It is suggested that, in general, 1% of the County population of such species qualifies as a County important population. However, a smaller population may qualify as County important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

8 BAP: Biodiversity Action Plan

9 It is suggested that, in general, 1%of the local population of such species qualifies as a locally important population. However, a smaller population may qualify as locally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle

APPENDIX 8-2 Botanical survey Results

Appendix 8.2. Floral species recorded during botanical survey

Treeline WL2/Hedgerow WL1 with some dry meadows and grassy verge GS2 on margins	
Common Name	**Latin Name**
Alder	*Alnus glutinosa*
Alexanders	*Smyrnium olusatrum*
Angelica	*Angelica archangelica*
Ash	*Fraxinus excelsior*
Beech	*Fagus sylvatica*
Bindweed	*Convolvulus arvensis*
Blackthorn	*Prunus spinosa*
Bracken	*Pteridium aquilinum*
Bramble	*Rubus fruticosus*
Broadleaf dock	*Rumex obtusifolius*
Bush vetch	*Vicia sepium*
Cleavers	*Galium aparine*
Cocksfoot	*Dactylis glomerata*
Common bent	*Agrostis capillaris*
Cow parsley	*Anthriscus sylvestris*
Creeping buttercup	*Ranunculus repens*
Curled dock	*Rumex crispus*
Dog rose	*Rosa canina*
Dog violet	*Viola riviniana*
Elder	*Sambucus nigra*
False broom	*Brachypodium sylvaticum*
False oat grass	*Arrhenatherum elatius*
Field thistle	*Cirsium discolor*
Foxglove	*Digitalis purpurea*
Gorse	*Ulex europaeus*
Ground ivy	*Glechoma hederacea*
Hard shield fern	*Polystichum Aculeatum,*
Hart's-tongue fern,	*Asplenium scolopendrium*
Hawthorn	*Crataegus monogyna*
Hedge parsley	*Torilis arvensis*
Hedge woundwort	*Stachys sylvatica*
Herb Robert	*Geranium robertianum*
Hogweed	*Heracleum sphondylium*
Holly	*Ilex aquifolium*
Ivy	*Hedera helix*
Larch	*Larix decidua*
Lesser celandine	*Ficaria verna*
Leylandii	*Cupressus × leylandii*
Lords and Ladies	*Arum maculatum*
Male fern	*Dryopteris affinis*
Meadow vetchling	*Lathyrus pratensis*
Meadowsweet	*Filipendula ulmaria*
Montbretia	*Crocosmia × crocosmiiflora*
Nettle	*Urtica dioica L*
Nipplewort	*Lapsana communis*
Pennyworth	*Umbilicus rupestris*
Perennial ryegrass	*Lolium perenne*
Poplar	*Populus sp.*
Prickly South thistle.	*Sonchus asper*
Primrose	*(Primula vulgaris*
Ragweed	*Ambrosia artemisifolia*
Ribwort plantain	*Plantago lanceolata*
Soft hair grass	*Deschampsia cespitosa*
Soft shield fern	*Polystichum setiferum*
Spindle	*Euonymus europaeus*
Sycamore	*Acer pseudoplatanus*
Velvet bent	*Agrostis canina*
Wild Rose	*Rosa canina*
Willow	*Salix sp.*

Mixed broadleaved woodland WD1	
Common Name	**Latin Name**
Alder	*Alnus glutinosa*
Bindweed	*Convolvulus arvensis*
Blackthorn	*Prunus spinosa*
Bramble	*Rubus fruticosus*
Broadleaf dock	*Rumex obtusifolius*
Buddleia	*Buddleja davidii*
Cocksfoot	*Dactylis glomerata*
Couch grass	*Elymus repens*
Elder	*Sambucus nigra*
Elm	*Ulmus sp.*
Field thistle	*Cirsium discolor*
Grey willow	*Salix cinerea*
Hawthorn	*Crataegus monogyna*
Ivy	*Hedera helix*
Nettle	*Urtica dioica L*
Soft hair grass	*Deschampsia cespitosa,*
Sycamore	*Acer pseudoplatanus*
Wild clematis	*Clematis vitalba*
Willowherb	*Epilobium angustifolium*
Yorkshire fog	*Holcus lanatus*

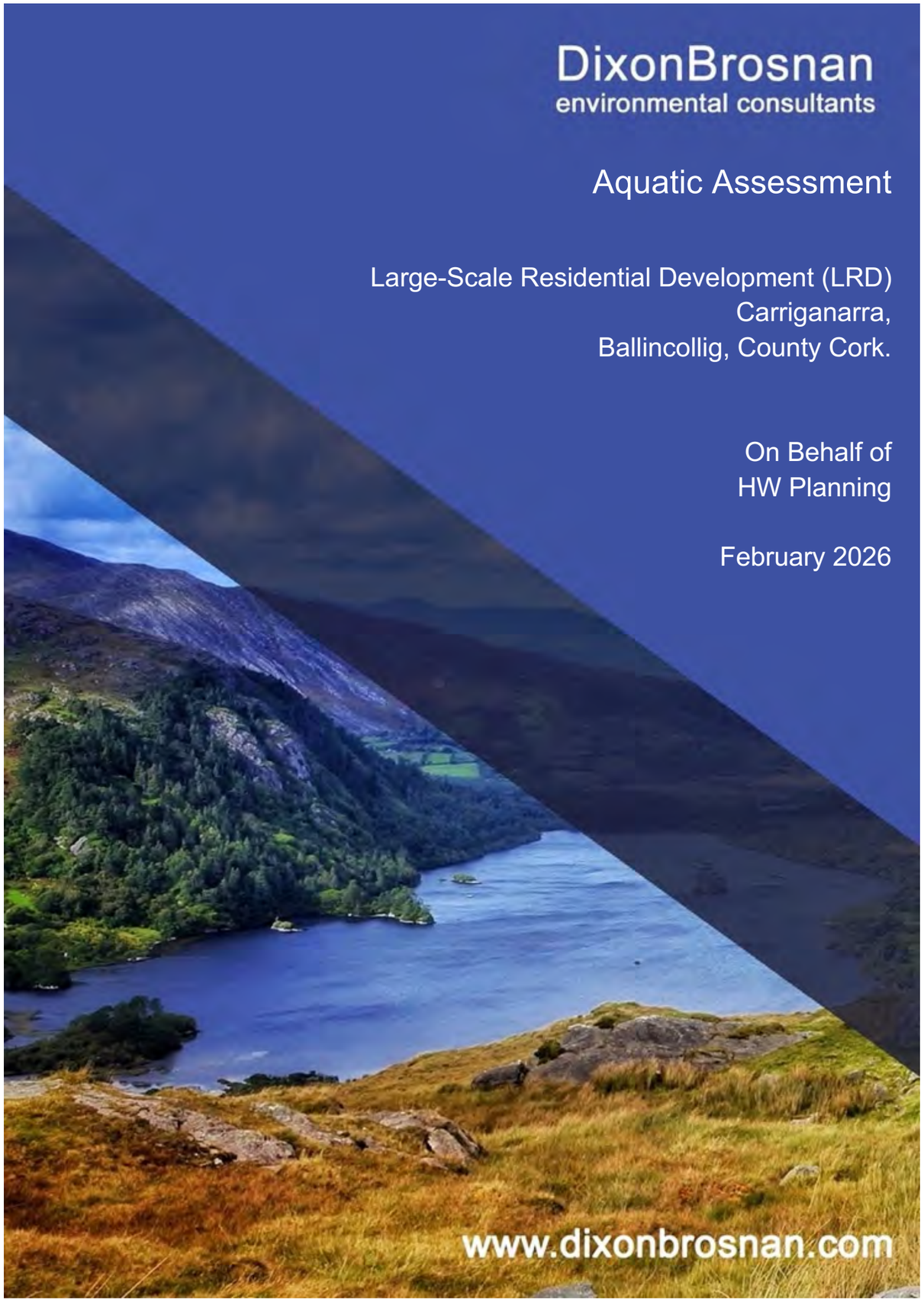
Area around old farmyard Scrub WS2/Dry meadows and grassy verge GS2/Recolonising bare ground ED3	
Common Name	**Latin Name**
Bramble	*Rubus fruticosus*
Brassicas	*Brassicaceae sp.*
Buddleia	*Buddleja davidii*
Cleavers	*Galium aparine*
Cocksfoot	*Dactylis glomerata*

Creeping buttercup	*Ranunculus repens*
Dandelion	*Taraxacum vulgaria*
Elm	*Ulmus sp.*
Field thistle	*Cirsium discolor*
Herb Robert	*Geranium robertianum*
Leylandii	*Cupressus × leylandii*
Nettle	*Urtica dioica L*
Oxeye daisy	*Leucanthemum vulgare*
Perennial ryegrass	*Lolium perenne*
Prickly sow thistle	*Sonchus asper*
Ragweed	*Ambrosia artemisifolia*
Red bartsia	*Odontites vernus*
Red clover	*Trifolium pratense*
Ribwort plantain	*Plantago lanceolata*
Silverweed	*Potentilla anserina*
Soft hair grass	*Deschampsia cespitosa,*
Spear thistle	*Cirsium vulgare*
Spurge	*Euphorbia sp.*
Sycamore	*Acer pseudoplatanus*
Wild clematis	*Clematis vitalba*
Wild Rose	*Rosa canina*
Willow	*Salix sp.*
Willowherb	*Epilobium angustifolium*
Woodsage	*Teucrium scorodonia*
Yorkshire fog	*Holcus lanatus*
Yellow flag	*Iris pseudacorus*

Improved and semi-natural grasslands within interior of the site	
Common Name	**Latin Name**
Annual meadow grass	*Poa annua*
Broadleaf dock	*Rumex obtusifolius*
Cock's foot	*Dactylis glomerata*
Common bent	*Agrostis capillaris*
Common mouse ear	*Cerastium fontanum*
Creeping bent	*Agrostis stolonifera*
Creeping buttercup	*Ranunculus repens*
Curled dock	*Rumex crispus*
Daisy	*Bellis perennis*
Dandelion	*Taraxacum vulgaria*
Field thistle	*Cirsium discolor*
Greater plantain	*Plantago major*
Herb Robert	*Geranium robertianum*
Meadowsweet	*Filipendula ulmaria*
Nettle	*Urtica dioica L*
Perennial ryegrass	*Lolium perenne*

Red clover	*Trifolium pratense*
Red fescue	*Festuca rubra*
Remote sedge	*Carex remota*
Ribwort plantain	*Plantago lanceolata*
Rough meadowgrass	*Poa trivialis*
Rush	*Juncus effusus*
Shepherd's purse	*Capsella bursa-pastoris*
Smooth meadow grass	*Poa pratensis*
Soft hair grass	*Deschampsia cespitosa,*
Spear thistle	*Cirsium vulgare*
Speedwell	*Veronica persica*
Sweet vernal grass	*Anthoxanthum odoratum*
White clover	*Trifolium repens*
Yorkshire fog	*Holcus lanatus*
Annual meadow grass	*Poa annua*
Broadleaf dock	*Rumex obtusifolius*
Black Medick	*Medicago lupulina*
Cock's foot	*Dactylis glomerata*
Common bent	*Agrostis capillaris*
Common mouse ear	*Cerastium fontanum*
Creeping bent	*Agrostis stolonifera*
Creeping buttercup	*Ranunculus repens*
Curled dock	*Rumex crispus*
Daisy	*Bellis perennis*
Dandelion	*Taraxacum vulgaria*
Eyebright	*Euphrasia officinalis*
Field thistle	*Cirsium discolor*
Herb Robert	*Geranium robertianum*
Hogweed	*Heracleum sphondylium*
Nettle	*Urtica dioica L*
Perennial ryegrass	*Lolium perenne*
Ragged robin	*Lychnis flos-cuculi*
Red clover	*Trifolium pratense*
Red fescue	*Festuca rubra*
Rough meadowgrass	*Poa trivialis*
Shepherd's purse	*Capsella bursa-pastoris*
Smooth meadow grass	*Poa pratensis*
Soft hair grass	*Deschampsia cespitosa,*
Spear thistle	*Cirsium vulgare*
Speedwell	*Veronica persica*
Stitchwort	*Stellaria holostea*
Sweet vernal grass	*Anthoxanthum odoratum*
White clover	*Trifolium repens*
Yorkshire fog	*Holcus lanatus*

APPENDIX 8-3 Aquatic surveys - – Dixon Brosnan Ecology



DixonBrosnan

environmental consultants

Project	Aquatic Assessment for Large Scale Residential Development Carriganarra, Ballincollig, County Cork	
Client	HW Planning	
Project Ref.	26007	
Report No.	26007.03	
Client Ref.	-	
Date	**Revision**	**Prepared By**
11/02/26	Issue to client	Sorcha Sheehy BSc PhD
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1. Introduction

1.1 Background

DixonBrosnan Environmental Consultants were commissioned to assess the potential impacts of a proposed Large-Scale Residential Development (LRD) at Carriganarra, Ballincollig, Cork, and all associated site works on terrestrial and aquatic flora and fauna.

This report describes and evaluates the aquatic habitats within the Maglin North Stream in the vicinity of the proposed LRD.

1.2 Aim of Report

The survey, which consisted of aquatic surveys at three sampling stations, was carried out to assess the current water quality of the streams at these stations.

This report has been written in accordance with the Chartered Institute of Ecological and Environmental Management (CIEEM) *Guidelines for Ecological Report Writing* (CIEEM 2017).

1.3 Authors of Report

This report was prepared by Carl Dixon MSc. (Ecological Monitoring). Carl Dixon MSc (Ecology) is a senior ecologist who has over 25 years' experience in ecological and water quality assessments with particular expertise in freshwater ecology. He also has experience in mammal surveys, invasive species surveys and ecological supervision of large-scale projects. Projects in recent years include the Waste to Energy Facility Ringaskiddy, Shannon LNG Project, supervision of the Fermoy Flood Relief Scheme, Skibbereen Flood Relief Scheme, Upgrade of Mallow WWTP Scheme, Douglas Flood Relief Scheme, Great Island Gas Pipeline etc. He has carried out ecological surveys and prepared AA/NIS reports for a range of projects.

2. Location

The proposed development site is located approximately 8.0km southeast of Cork City Centre in Carriganarra on the southern side of Ballincollig to the south of the Link Road. The site is a greenfield site characterised by its undulating topography and its even slope rising at the southern end. The existing Limeworth and Heathfield estate which is currently being constructed runs along the site's northern edge and the site is surrounded on the other 3 sides by farmland and sheds which are in ruins. The site location is shown below in **Figure 1**.

The proposed development site is located within hydrometric area 19 (Lee, Cork Harbour and Youghal Bay). Hydrometric area No 19 includes the surface catchment drained by the River Lee and all streams entering tidal water in Cork Harbour and Youghal Bay and between Knockaverry and Templebreedy, extending to an area of 2,153km^2. The site is in the Curraheen (Cork City) _010 WFD River sub-basin; Glasheen (Cork City) _SC_010 WFD sub-catchment; and River Lee WFD catchment.

Watercourses in the vicinity of the proposed development site are shown in **Figure 2**. The Maglin North stream (known by the EPA as the Grange Hill Stream) runs along the western boundary of the proposed development site. This is a second order tributary of the River Lee which rises in the townland of Grange, to the southwest of the proposed development site.

The Maglin North flows north for approximately 1.3km, then turns east, passing under the Ballincollig By-pass in Kilnaglory, flowing generally in an easterly direction. The Maglin North River flows in a southerly direction along the western boundary of the proposed development site, then flows east joining the Maglin South River just west of Clash Road and just south of the Ballincollig By-pass. It is noted that the Maglin South River was diverted as part of the Ballincollig By-pass construction. The river now flows along the southern side of the motorway.

The discharge of stormwater from the proposed development will be to the Maglin North River at the south-western boundary of the site through a 300mm diameter culvert and hydro-brake to control flow rates.

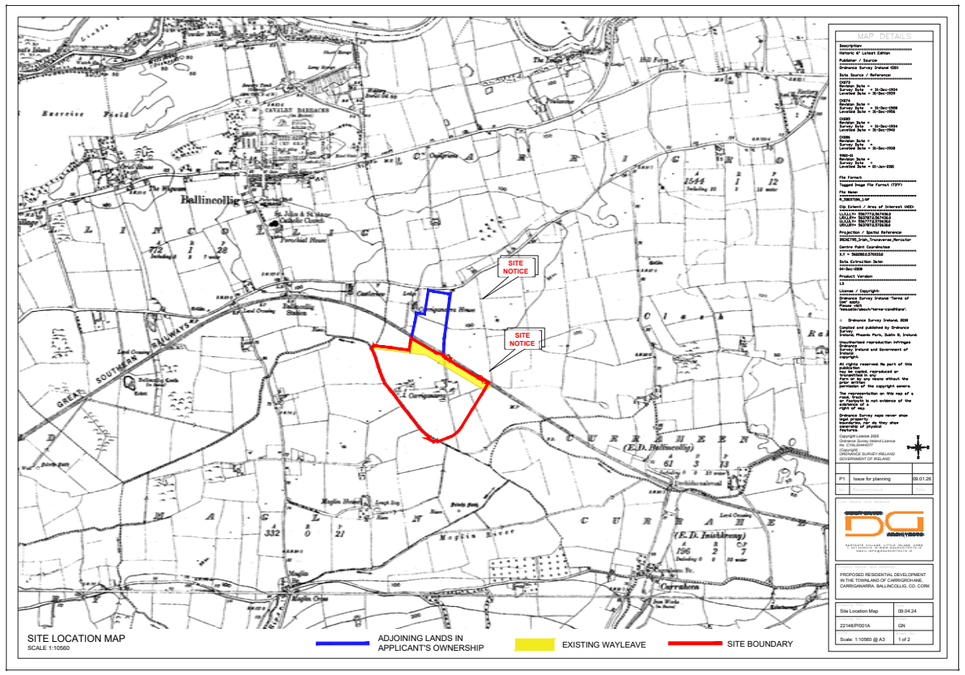


Figure 1. Waterbodies in the vicinity of the proposed development site



Figure 2. Location of watercourses (blue line) in the vicinity of proposed development site (yellow line) | Source KGEC

3. Survey Methodology

Long-term water quality can be ascertained by the following methodology as utilised by the EPA in its standard monitoring programme

3.1. EPA methodology

Biological sampling is carried out at each station using the kick-sampling technique as per Environmental Protection Authority (EPA) methodology (Feeley *et al.,* 2020). This biotic index is used by the EPA and allows river quality to be compared under standardized guidelines. This method divides macro-invertebrates into five groups, depending on their sensitivity to pollution as presented in **Table 1**.

The kick-sampling technique involved using a ‘D’ shaped hand net (mesh size 0.5 mm; 350 mm diameter). Sweeps through the sediment and deep sediment was carried out. The substrate immediately upstream of the net was kicked for two minutes to dislodge invertebrates. Stone washings were not carried out as there was no suitable substrate within the survey area. Samples are transferred to plastic containers and preserved using 70% alcohol. Samples are subsequently sieved and sorted using a white sorting tray. Identification is undertaken in the laboratory using a high-powered binocular microscope and using standard identification keys.

An assessment is also made of the fisheries value of the watercourse and macrophytes were recorded.

Table 1. Macroinvertebrate Sensitivity Classes

Group	Sensitivity
A	Sensitive
B	Less Sensitive
C	Tolerant
D	Very tolerant
E	Most tolerant

Having determined the relative proportions of the various organisms in a sample, water quality can be inferred by a comparison of this data with that which might be expected from unpolluted habitats of the type under investigation. The Q-value determined using the fauna collected at each station therefore provides an indication of the quality of the water at that station. The relationship between Q values and water quality is set out in **Table 2**. The relationship between the Q-rating system and the Water Framework Directive classification as defined by the Surface Waters) Regulations 2009 (S.I. 272 of 2009) is shown in **Table 3**.

Table 2. Q-value and water quality

Q-value	Water quality	Status
5	Good	Satisfactory
4	Fair	Satisfactory
3	Doubtful	Unsatisfactory
2	Poor	Unsatisfactory
1	Bad	Unsatisfactory

Table 3. Correlation between the WFD classification and Q values

Ecological status WFD	Q Values
High	Q5, Q4-5
Good	Q4
Moderate	Q3-4
Poor	Q3, Q2-3
Bad	Q2, Q1

3.2 Site survey

The field survey was undertaken on 25th of September 2025. Further assessments were carried out on the 25th January 2026 and 5th February 2026.

It is noted that the Malin North is generally considered as unsuitable for biological monitoring using EPA methodology as it is a depositing watercourse i.e. deep fine sediment limited flows with an absence of riffle habitat and high shade levels. Following the site inspection it was determined that the stream is not suitable for Q value determination using EPA methodology. As the site is considered unsuitable for Q value determination, a more general kick sampling assessment was carried out over a 40m section of the river at each of the sampling sites. The objective was to assess macroinvertebrate populations rather than to determine Q values at a specific point.

4. Characteristics of Sampling Stations

The Maglin North Stream is a heavily channelised with a straightened channel, a soft mud substrate and large volumes of woody detritus. Flow is generally laminar, with no significant riffle glide sequences or deep pools. The high earth banks are lined, predominantly with Alder. Willow also common. Shade levels are generally high, which suppresses macrophyte growth and as a consequence there is no significant instream aquatic vegetation. Some Fools watercress was recorded where light levels are higher, however it is limited in extent

There is probably sufficient flow within the stream to support permanent fish populations. Species such as Stickleback and European eel could therefore occur. Brown trout is also likely to occur, although there is an absence of spawning gravels or high value nursery habitatIn general the stream provides sub-optimal habitat for Brown trout with populations likely to be sparse and localised.

Kick sampling was carried out at three sites SW1 and SW2 was carried on 25th September 2025 (See **Figure 2**). A third site S3, the location of the proposed bridge connection to the Maglin Sustainable Access Corridor, was also surveyed. Further aquatic assessments were carried out on the 25th January 2026 and 5th February 2026. General water quality (chemistry) survey were completed at SW1-SW5 (by Keohane Geological & Environmental Consultancy (KGEC)). In general the watercourse has a deep silt substrate and the EPA methodology for ascribing Q values is considered inappropriate.

A review of the water quality data (by Keohane Geological & Environmental Consultancy (KGEC), which is detailed in the Chapter 7 Hydrology of this EIAR suggests that water quality is generally satisfactory but with considerable variation.

Chapter 7 notes the following

The results indicate varying water quality along the channel, but with no consistent pattern:

BOD concentrations range from 0.3 to 3.4mg/l. BOD concentrations ≤1.5 mg/l indicate good status and concentrations ≤1.3mg/l indicate high status. BOD exceeded 1.5 mg/l on several occasions and at all sampling locations in the September 2025 sampling event. Flows were low during this sampling event.

Total ammonia concentrations ranged from 0.02 to 0.097mg/l. Total ammonia concentrations ≤0.065mg/l indicate good status and concentrations ≤0.040mg/l indicate high status. The concentrations in SW-1 to SW-4 were all above 0.065mg/l in February 2024, so the waters didn't achieve good status for this parameter. However, the total ammonia results for May and September 2025 were (apart from SW3 in September 2025) all below 0.065mg/l indicating good status.

Total phosphorus concentrations ranged from 0.023 to 0.189mg/l. Total phosphorus concentrations ≤0.025mg/l indicate good status and concentrations ≤0.010mg/l indicate high status.

The concentrations were all above 0.025mg/l for all sampling events at most locations, indicating that the waters didn't achieve good status for this parameter. The only result less than 0.25mg/l occurred at SW-5 in May 2025.

Turbidity and TSS concentrations are low in all samples.

The EPA Phosphorus Pollution Impact Potential 3 at the site is ranked 6 and 7. The EPA Nitrate Pollution Impact Potential 4 at the site is ranked 2 and 3.

4.1 Sampling Site 1 SW1

Sampling site 1 (SW1) is located c.560m downstream of the proposed development site.

The river channel is this area is shaded by Willow, Alder and Bramble. The substrate is soft and muddy with woody detritus along part of the channel. The stream is relatively deep at this location (c.2.5m) and c2m wide.

In general this section is of some value for fish, particularly coarse fish, which are likely to use the undercut banks, tree roots, etc for refugia. However, there are limited spawning opportunities in this section of the stream. This area of the river is not of high fisheries value, is likely to have low flows during the summer months making it unlikely to support significant fish populations. No Otter holts or evidence of otter such as couches and spraints were recorded within 150m.



Plate 1. River channel at SW1



Plate 2. River Channel at SW

4.2 Sampling Site 2 SW2

This sampling location corresponds to the SW2 location shown in **Figure 2**, just downstream of the proposed development site.

In general, the river channel is narrow channel (c.2m wide) and lined with mature Alder. The substrate in this area is deep and muddy and not suitable for kick sampling. This channel is large enough to support fish such as European eel and Stickleback.. Generally quite heavy shade and thus limited macroinvertebrate development within the river channel.

No Otter holts or evidence of otter such as couches and spraints were recorded within 150m..

A large drainage ditch runs through the proposed development site, meeting the Maglin North Stream c.60m downstream of SW2. This drainage ditch is shaded and channelized with Willow and alder along its length. Standing water and rush are present in some areas of the drain, which is likely to dry up during the summer months.



Plate 3. Adjoining habitat around SW2



Plate 4. River channel at SW2



Plate 5. Area upstream of SW2



Plate 6. Drainage ditch within proposed development site



Plate 7. Drainage ditch within proposed development stie.

4.3 Sampling Site 3 – S3

This site is located at the proposed bridge connection to adjoining lands. Stream flows here are laminar within a straightened channel and no significant riffle habitat. The substrate is deep silt with patchy overlay of light gravel. Some mature Alder on the riverbanks with moderate to high shade levels. Other species noted include Ivy and Hart's tongue fern. No Otter holts or evidence of otter such as couches and spraints were recorded within 150m.



Plate 8. Proposed bridge location S3

5. Survey Results

As the site is considered unsuitable for ! value determination via kick sampling, a more general assessment was carried out approximately 20m upstream and downstream of the sampling sites. The objective was to assess macroinvertebrate populations rather than to determine Q values at a specific point.

The following species/genera were detected

- *Limniphidae*
- *Betis rhodani*
- *Gammerus duebueni*
- *Asellus aquatica*
- *Tupulidae*
- *Oligocheata*
- *Chironomous* sp.
- *Chiromidae*
- *Simulidae*

Numbers of macroinvertebrates were generally low and many of these species were confined to very small areas of fine gravels. These species are typical of a small watercourse which is likely to have limited flow in dry conditions and which may be affected by local agricultural activity. However Q values could not be assigned to specific points due to the nature of the substrate. In general, the results are indicative of some level of water quality impairment probably due to diffuse run-off from intensive agriculture within the catchment area.

6. Results Summary

6.1 Biological Monitoring

The EPA methodology specifically notes the following:

Macroinvertebrate criteria do not apply to rivers with mud, bedrock or sand substrate, very sluggish or torrential flow, head-water or high altitude streams and those affected by significant ground water input, excessive caldification, drainage, canalisation, culverting, marked shading etc

It is noted that the Maglin North Stream is generally considered as unsuitable for biological monitoring using EPA methodology as it is a depositing watercourse with deep fine sediment, minimal flows with an absence of riffle habitat and with dense macrophyte growth which clogs the channel.

The species recorded such as *Asellus aquatica* (water louse) and Chironomidae (fly larvae) are generally recorded where there is low oxygen levels and decaying vegetation. However, in this instance this may be due at least partially to morphological conditions. Morphologically the watercourse is characterised by a straightened channel and an absence of riffle habitat with dense mud. Whilst some increase in nutrient levels associated with run-off from intensive pasture in proximity to the site - which will the exacerbated by sluggish flows and minimal dilution - may occur, the nutrient status of the watercourse could not be assessed via an analysis of macroinvertebrate populations.

Overall, therefore this watercourse is not considered suitable for assessment via the EPA Q value methodology and Q values could not be assigned.

6.2 Macrophytes and Fisheries

There is sufficient flow within the Maglin North stream to support permanent fish populations. Species such as Stickleback and European eel could therefore occur. Brown trout is also likely to occur, although there is an absence of spawning gravels or high value nursery habitat. In general the stream provides sub-optimal habitat for Brown trout with populations likely to be sparse and localised. No suitable habitat for lamprey was recorded. No evidence of Otter was recorded.

Macrophyte development has been significantly limited by high shade levels along most of the channel where it adjoins the proposed site. No significant beds of aquatic vegetation were recorded. Where light levels were higher, due to small gaps in the adjoining treelines, Fools Watercress was recorded as the primary species.

7. Conclusion

Overall this is a permanent watercourse which is of local value and is likely to support limited fish populations. The channel has poor structural diversity and a soft mud substrate. Water quality is likely to be variable with limited dilution due to low flows in dry weather and some possible nutrient enrichment due to intensive agricultural management within the overall catchment. Although the river does support invertebrate populations it is considered unsuitable for assessment via standard kick-sampling methodology and thus Q values were not assigned.

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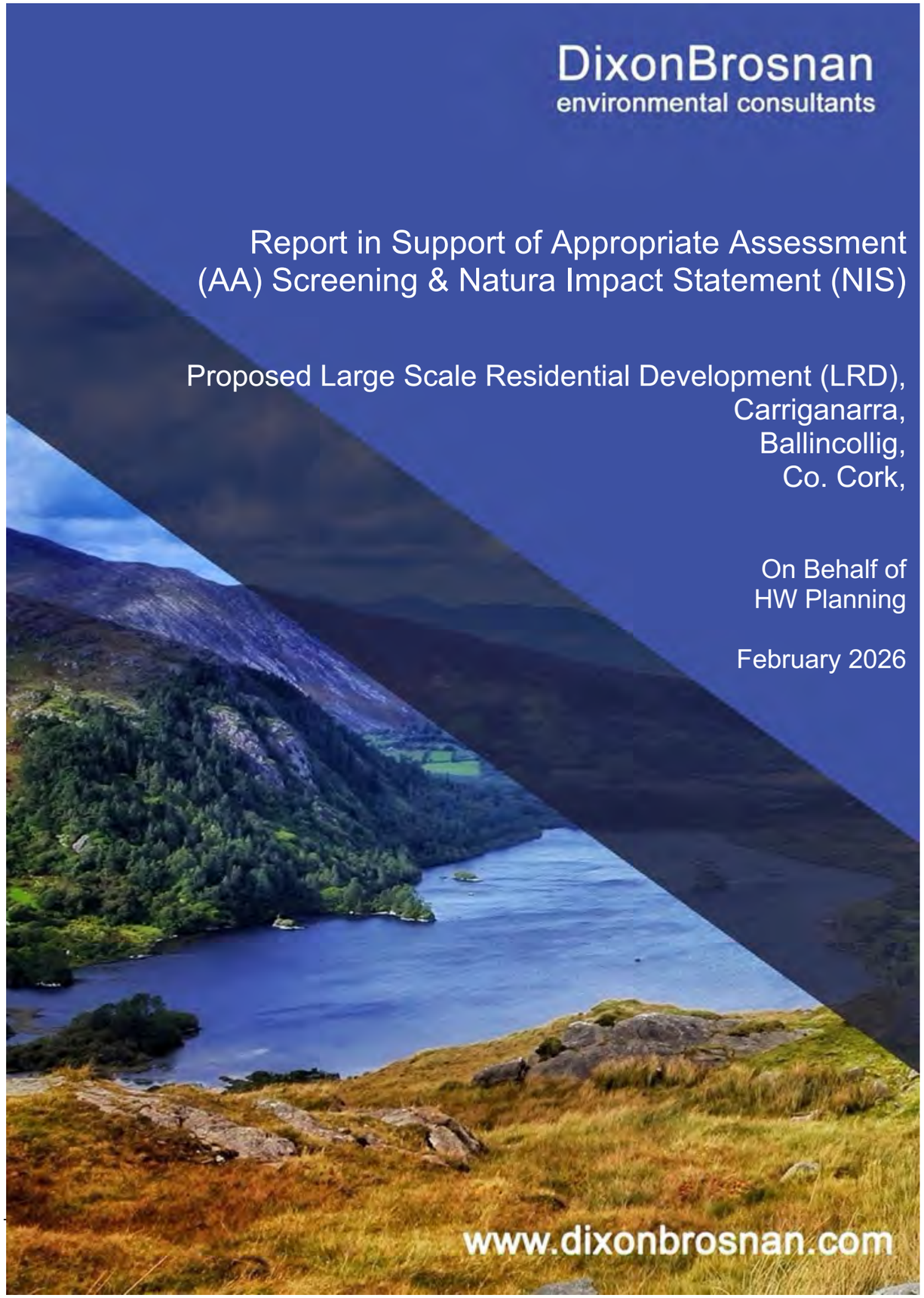
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APPENDIX 8-4 AA Screening/Natura Impact Statement – Dixon Brosnan Ecology



DixonBrosnan

environmental consultants

Project	Report in Support of Appropriate Assessment (AA) Screening & Natura Impact Statement (NIS) for Proposed Large Scale Residential Development, Carriganarra, Ballincollig, Co. Cork	
Client	HW Planning	
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Report No.	26007.01	
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09/02/26	First Draft	Sorcha Sheehy PhD
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1. Introduction

1.1 Background

The information in this report has been compiled by DixonBrosnan Environmental Consultants, on behalf of the applicant. It provides information on and assesses the potential for the Proposed Large Scale Residential Development (LRD) at Carriganarra, Ballincollig, Co. Cork, to impact on any Natura 2000 sites within its zone of influence. The information in this report forms part of and should be read in conjunction with the planning application documentation for the proposed development.

The Birds Directive (2009/147/EC) and the Habitats Directive (92/42/EEC) put an obligation on EU Member States to establish the Natura 2000 network of sites of highest biodiversity importance for rare and threatened habitats and species across the EU. In Ireland, the Natura 2000 network of European sites comprises Special Areas of Conservation (SACs, including candidate SACs) and Special Protection Areas (SPAs). SACs are selected for the conservation of Annex I habitats (including priority types which are in danger of disappearance) and Annex II species (other than birds). SPAs are selected for the conservation of Annex I birds and other regularly occurring migratory birds and their habitats. The annexed habitats and species for which each site is selected correspond to the qualifying interests of the sites and from these the conservation objectives of the site are derived. The Birds and Habitats Directives set out various procedures and obligations in relation to nature conservation management in Member States in general, and of the Natura 2000 sites and their habitats and species in particular. A key protection mechanism is the requirement to consider the possible nature conservation implications of any plan or project on the Natura 2000 site network before any decision is made to allow that plan or project to proceed. Not only is every new plan or project captured by this requirement but each plan or project, when being considered for approval at any stage, must take into consideration the possible effects it may have in combination with other plans and projects when going through the process known as Appropriate Assessment (AA).

The obligation to undertake Appropriate Assessment (AA) derives from Article 6(3) and 6(4) of the Habitats Directive, and both involve a number of steps and tests that need to be applied in sequential order. Article 6(3) is concerned with the strict protection of sites, while Article 6(4) is the procedure for allowing derogation from this strict protection in certain restricted circumstances. As set out in Section 177U of the Planning and Development Act 2000 as amended, a screening for appropriate assessment of an application for consent for the proposed development must be carried out by the competent authority to assess, in view of best scientific knowledge, if the proposed development, individually or in combination with another plan or project is likely to have a significant effect on any European site. Each step in the assessment process precedes and provides a basis for other steps. The results at each step must be documented and recorded carefully so there is full traceability and transparency of the decisions made.

1.2 Aim of the report

The purpose of this report is to inform the AA process as required under the Habitats Directive (92/43/EEC) in instances where a plan or project may give rise to significant impacts on a Natura 2000 site. This report aims to inform the Appropriate Assessment process in determining whether the development, both alone and in combination with other plans or projects, are likely to have a significant impact on the Natura 2000 sites in the study area, in the context of their conservation objectives and specifically on the habitats and species for which the sites have been designated.

This report has been prepared with regard to the following guidance documents, where relevant.

- *Managing Natura 2000 Sites: The Provision of Article 6 of the Habitats Directive 92/43/EEC (European Commission (EC), 2018);*
- *Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodical Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission (EC), 2021);*
- *Guidance Document on Article 6(4) of the Habitats Directive 92/43/EEC (European Commission, (EC) 2007);*
- *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (Department of Environment, Heritage and Local Government, 2010 revision);*
- *Appropriate Assessment under Article 6 of the Habitats Directive; Guidance for Planning Authorities. Circular NPW 1/10 and PSSP 2/10 (Department of Environment, Heritage and Local Government, 2010);*
- *Guidelines for Good Practice Appropriate Assessment of Plans under Article 6(3) Habitats Directive (International Workshop on Assessment of Plans under the Habitats Directive, 2011);*
- *Commission notice Guidance document on wind energy developments and EU nature legislation, (EC 2020);*
- *Communication from the Commission on the precautionary principle. European Commission (2000)*
- *Assessment of plans & projects in relation to N2K sites – Methodological Guidance (EC 2021) and*
- *Guidance document on the strict protection of animal species of Community interest under the Habitats Directive (EC 2021).*

1.3 Authors of the Report

This chapter was prepared by Carl Dixon MSc (Ecological Monitoring) and Dr. Sorcha Sheehy PhD (Ecology/ornithology). Site surveys were completed by Carl Dixon, Sorcha Sheehy and Mark Donnelly BSc (Forestry).

Carl Dixon holds an Honours Degree (BSc) in Ecology and a Masters (MSc) in Ecological Monitoring from UCC. He is a senior ecologist who has over 25 years' experience in ecological assessment. Prior to setting up DixonBrosnan Environmental Consultants in 2000, Carl set up and ran Core Environmental Services which included REPS planning for landowners and

ecological assessments. Carl has particular experience in freshwater ecology, including electrofishing fish stock assessments and water quality assessments. He also has considerable experience in habitat mapping and mammal ecology including survey work and reporting in relation to Badgers and bats. Other competencies include surveys for invasive species and bird surveys. Carl has extensive experience with regards to EIAR and NIS mitigation and impact assessment. He has experience in large-scale industrial developments with extensive experience in complex assessments as part of multi-disciplinary teams. Such projects include gas pipelines, incinerators, electrical cable routes, oil refineries and quarries.

Carl Dixon has considerable experience in bat survey and bat mitigation measures/roost design. Carl was the primary coordinator and surveyor for a heritage council-funded project serving all the river bridges in County Waterford for bats. He has designed bat roosts for Lesser horseshoe in conjunction with the NPWS for sites in West Cork. Carl has completed specialized training courses relating to bats in Ireland and the UK and has considerable experience in using a variety of bat survey equipment and subsequent software analysis of data.

Dr. Sorcha Sheehy PhD (ecology/ornithology) is an experienced ecological consultant specialising in bird behaviour. Sorcha received a BSc in Applied Ecology from UCC and subsequently went on to receive a PhD in behavioural ornithology at UCC. During her PhD research, Sorcha studied bird-aircraft collision with a particular focus on bird behaviour. Sorcha has worked for over 15 years in a professional ecology role and specialises in the coordination of ecology projects and assessments. She has coordinated and contributed to Habitats Directive Assessments (AA screenings and NIS) and Environmental Impact Assessment Reports (EIAR) for a range of small and large-scale projects with particular expertise in assessing impacts on birds. Notable projects include Arklow Bank Wind Park, Shannon Technology and Energy Park and Waste to Energy Facility Ringaskiddy.

Mark Donnelly (Forestry) holds a BSc. Hons in Forestry from Bangor University, Wales, and is a member of the Institute of Chartered Foresters. He worked as an arboricultural consultant for the National Trust in Wales for 22 years and was a lecturer in Forest Ecology at Bangor University. In Ireland, he has completed landscape assessments for a range of projects including wind farms, quarries, local authorities, housing developments, roads and pipelines.

2. Regulatory Context and Appropriate Assessment Procedure

2.1 Regulatory Context

The Habitats Directive (Council Directive 92/43/EEC on the *Conservation of Natural Habitats and of Wild Fauna and Flora*) aims to maintain or restore the favourable conservation status of habitats and species of community interest across Europe. The requirements of these directives are transposed into Irish law through the European Communities (Birds and Natural Habitats Regulations 2012-2022).

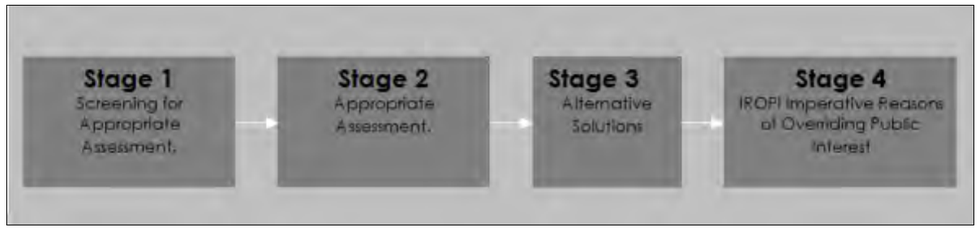
Under the Directive a network of sites of nature conservation importance have been identified by each Member State as containing specified habitats or species requiring to be maintained or returned to favourable conservation status. In Ireland the network consists of SACs and SPAs, and also candidate sites, which form the Natura 2000 network.

Article 6(3) of Council Directive 92/43/EEC of 21 May 1992 on the *Conservation of Natural Habitats and of Wild Fauna and Flora* (as amended) (hereafter 'the Habitats Directive') requires that, any plan or project not directly connected with or necessary to the management of a designated site, but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. A competent authority (e.g. the EPA or Local Authority) can only agree to a plan or project after having determined that it will not adversely affect the integrity of the site concerned.

The possibility of a significant effect on a designated or "European" site has generated the need for an appropriate assessment to be carried out by the competent authority for the purposes of Article 6(3). A Stage Two Appropriate Assessment is required if it cannot be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site. The first (Screening) Stage for appropriate assessment operates merely to determine whether a (Stage Two) Appropriate Assessment must be undertaken on the implications of the plan or project for the conservation objectives of relevant European sites.

2.2 Appropriate Assessment Procedure

The assessment requirements of Article 6(3) establish a stage-by-stage approach. This assessment follows the stages outlined in the 2001 European Commission publications "Assessment of plans and projects significantly affecting Natura 2000 sites: methodological guidance on the provisions of Articles 6(3) and 6(4) of the Habitats Directive 92/43/EEC" (2001) and Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC Office for Official Publications of the European Communities, Luxembourg (EC, 2015);



The stages are as follows:

Stage One: Screening — the process which identifies any appreciable impacts upon a Natura 2000 site of a project or plan, either alone or in combination with other projects or plans, and considers whether these impacts are likely to be significant;

Stage Two: Appropriate assessment — the consideration of the impact on the integrity of the Natura 2000 site of the project or plan, either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts;

Stage Three: Assessment of alternative solutions: The process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the

integrity of the Natura 2000 site. It is confirmed that no reliance is placed by the developer on Stage Three in the context of this application for development consent;

Stage Four: Assessment where no alternative solutions exist and where adverse impacts remain — an assessment of compensatory measures where, in the light of an assessment of imperative reasons of overriding public interest (IROPI), it is deemed that the project or plan should proceed (it is important to note that this guidance does not deal with the assessment of imperative reasons of overriding public interest). Again, for the avoidance of doubt, it is confirmed that no reliance is placed by the developer on Stage Four in the context of this application for development consent.

It is the responsibility of the competent authority to make a decision on whether or not the proposed development should be approved, taking into consideration any potential impact upon any Natura 2000 site within its zone of influence.

3. Receiving Environment

3.1 Existing site

The proposed development is located on the southern side of Ballincollig town approximately 8km southwest of Cork City (**Figure 1**). The Ballincollig Link Road is located c.375m north of the site and the National route N22 is located approximately 375m east of the site. The existing Limeworth and Heathfield estate which is currently under construction run along the site's northern edge. Lands to the south, east and west are largely agricultural.

The topography of the site gently slopes from the north to a low point on the south-eastern boundary which is approximately +15.87m AOD. The elevation height along the perimeter from the north, west and southern side varies from +22.21m to +15.87m AOD. The Maglin North River runs along the western boundary of the site.

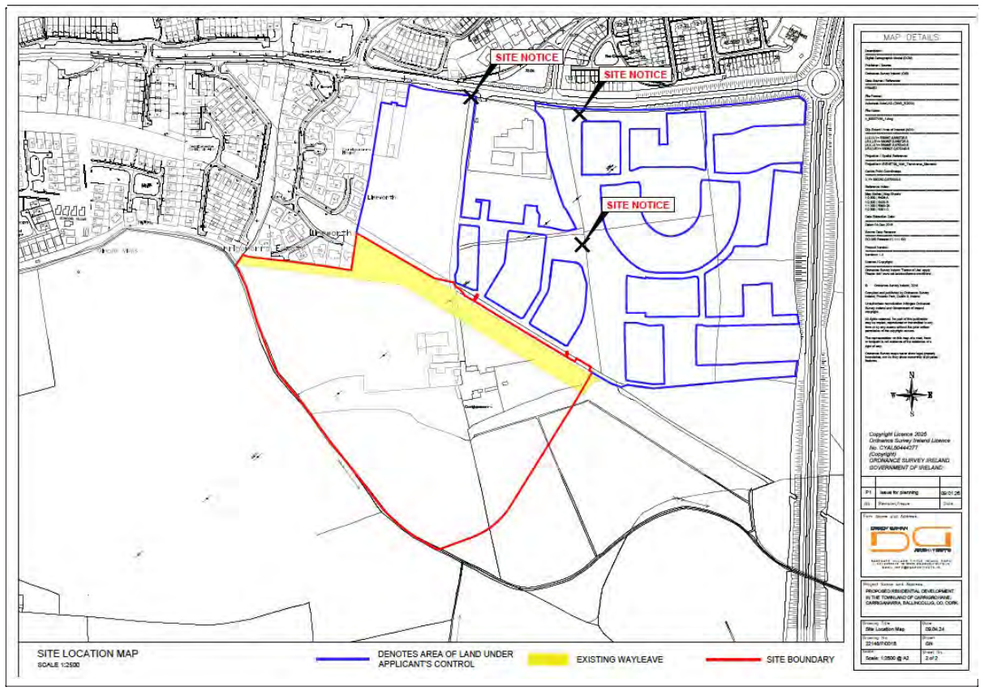


Figure 1. Proposed development site location | DG Architects



Figure 2. Proposed Site Layout | Source DG Architects

3.2 Proposed Development

The development will consist of the demolition of existing agricultural building and the construction of a residential development of 300 no. residential units consisting of 128 no. dwellings houses, 172 no. apartment/duplex units, a two storey creche facility and all ancillary site development works. The proposed 128 no. dwelling houses will include 42 no. bedroom detached/semi-detached dwelling houses and 84 no. 3 bedroom semi-detached/townhouse dwelling houses. The proposed development also provides for the restoration of an existing vernacular farm building on site which will accommodate 2 no. 2 bedroom semi-detached units.

The proposed 172 no. apartment/duplex units will include 18 no. 3 bedroom units, 109 no. 2 bedroom units and 45 no. 1 bedroom units, to be provided in 20 no. apartment/duplex buildings ranging in height from 3-4 storeys over basement level.

Vehicular access to the proposed development will be provided via the existing junction from the Killumney road serving the Heathfield residential development and existing sections of the Maglin Sustainable Access Corridor to the north. The proposed development provides for the extension of Maglin Sustainable Access Corridor and the provision of 4 no. pedestrian/cycle connections to the Heathfield residential development to the north which is under construction.

Ancillary site works include the raising of existing ground levels on site, the provision of bicycle parking and bin storage facilities serving the proposed apartment/duplex and creche buildings, the delivery of active travel infrastructure, landscaping and servicing proposals including a

temporary pumping station, and the undergrounding/diversion of an existing 38KV overhead ESB line which traverses the site.

An overview of the proposed development is shown in **Figure 2**. Site drawings are included in **Appendix 2.**

3.3 Surface Water Drainage

The existing topography produces one catchment area. Groundwater flow direction is interpreted to be from the north to a low point on the south-eastern boundary. Discharge from the site will be along the western boundary to the existing Maglin North watercourse.

In order to reduce the effects of the surface runoff on potential flooding, a Stormwater Management Plan will be applied to surface water discharges into adjacent watercourses. The Stormwater Management Plan can be applied to control the rate of runoff from new development. The maximum permitted surface water outflow from the new development is to be restricted to less than that of the existing Greenfield site by the usage of attenuation storage. Control of runoff by attenuation methods requires a hydraulic control to restrict the magnitude of flows passing downstream, together with an upstream storage capacity to contain the volume of runoff held back by the hydraulic control. The flows are proposed to be attenuated in the surface water system by adopting a flood storage attenuation tank along with restricted outlets as the control devise. The storage volume required has been designed using the computer aided design package Windes 10.4.

Storm water from the proposed development shall discharge into the existing watercourse ‘Maglin North’ located to the south-western boundary of the site via a hydro brake manhole, which will limit the amount of water discharging to the network. The amount of water discharged from the hydro brake manhole will be determined by using the allowable Greenfield Runoff rate for the developable area of the site. It is to be noted that all on site storm water storage facilities have been sized to cater for all storm water generated within the site boundary of the development. The discharge will be onto an area of stone riprap setback approximately 10m from the watercourse. This will dissipate energy and avoid bank erosion / scouring in the streambed

The stormwater management plan adopted for the particular development involves using interlinked attenuation tanks located in the green areas of the site. All surface water runoff arising from the paved development will be drained away from the site. The attenuation tanks will be designed for a 100-year storm event. The maximum discharge from the tanks will be limited to calculated permissible runoff (QBAR) for the catchment area. Attenuation Tank Sizes and Petrol Interceptor Sizing/Specifications have been included as part of the Stormwater Network Design in this report. The nature-based SuDS principles proposed will have a positive impact from a sustainable impact.

A contingency has been built in by providing SuDS measures and not including their volumetric benefits in the attenuation calculations, namely

- Filter drains along public paths

- Raingarden/Bioretention Tree Pits along access road and greens areas within the development
- Tree-pit infiltration and storage
- Infiltration basins in public green areas/open spaces

It should be noted that climate change has been accounted for in the design. As per volume 5 of the GDSDS a factor of 20% has been incorporated into the design.

The allowable runoff utilising a Q1 of 21.800 l/second for the entire catchment area for the site of 7.751 hectares. The allowable runoff equates to 2.813 l/second/hectare.

Surface water drawings are included in **Appendix 2** of this report.

3.4 Foul Drainage

A Pre-Connection Enquiry was submitted to Uisce Eireann. The Uisce Eireann Reference Number for this enquiry is CDS25007329. The response to this Enquiry was issued by Uisce Eireann on 21st October 2025. This confirmed that, subject to a valid connection agreement being put in place, the proposed connection to the Uisce Eireann network could be facilitated. The Statement of Design Acceptance as received from Uisce Éireann is included in Appendix 3 of this report.

The foul sewer has been designed using the System 1 and Simulation Modules of the Micro-drainage package. The foul network design addresses present day design issues and can view velocities at Full Bore, Proportional Depth and 1/3 flow.

A model of the proposed foul drainage network was built using the micro-drainage software applications. The model was analysed and amended until the results met with the design criteria specified.

The network has been designed to achieve self-cleansing velocities at 1/3 flow whilst maintaining minimum gradients.

Development Breakdown

300 No. Dwellings

Section 3.6 of The Irish Water Code of Practice Wastewater Infrastructure states that for the gravity sewers shall be designed to carry a minimum wastewater volume of 6 times the dry weather flow (6DWF) which is to be taken as 446 litres per dwelling

Loading = (300) (446) / (24) (60) (60) = 1.548 litres/second

6DWF = 9.288 litres/secondCrèche

24 No Staff & 182 No. Children

From the EPA Code of Practice for Small Communities, Business, Leisure Centres and Hotels

Loading = 60 L/Person/day

Loading = (152) (60) / (24) (60) (60) = 0.106 litres/second

6DWF =0.630 litres/second

The overall quantity of wastewater for the proposed development is estimated at 146.0 m³ per day. This is based on the unit schedule submitted by the architect. The foul waste within the development will be collected via an internal gravity network and will discharge to the public foul sewer via a gravity connection.

All works will be in accordance with Uisce Eireann Code of Practice for Wastewater Supply & the Wastewater Infrastructure Standard Details Document Number: IW-CDS-5030-01.

The foul water network model was built and analysed using the Micro-drainage Software application and was assessed to ensure velocities maintained a self-cleansing velocity. The system will consist of an internal gravity network discharging to the existing Uisce Eireann asset via a new pumping station and rising main.

Foul water drawings are included in **Appendix 2** of this report.

4. Stage 1 - Screening for Appropriate Assessment

4.1 Introduction

This section contains the information required for the competent authority to undertake screening for AA for the proposed development.

The aims of this section are to:

- Determine whether the proposed development is directly connected with, or necessary to, the conservation management of any Natura 2000 sites;
- Provide information on, and assess the potential for the proposed development to significant effects on Natura 2000 Sites (also known as European sites); and
- Determine whether the proposed development, alone or in combination with other projects, is likely to have significant effects on Natura 2000 sites in view of their conservation objectives.

The proposed development is not directly connected with, or necessary to the conservation management of any Natura 2000 sites.

4.2 Zone of influence

The Zone of Influence (ZoI) comprises the area within which the proposed development may potentially affect the conservation objectives (or qualifying interests) of a Natura 2000 site. There is no recommended zone of influence, and guidance from the National Parks and Wildlife Service (NPWS) recommends that the distance should be evaluated on a case-by-case basis with reference to the nature, size and location of the project, the sensitivities of the ecological receptors, and the potential for in-combination effects (cumulative).

In ecological and environmental impact assessment, for an effect to occur there must be a risk enabled by having a source (e.g. construction works at a proposed development site), a ‘receptor’ (e.g. SAC or other ecologically sensitive feature), and a pathway between the source and the receptor (e.g. a watercourse which connects the proposed development site to the

SAC, *ex situ* foraging habitat for SCI birds). A 'receptor' is defined as the Special Conservation Interest (SCI) of SPAs or Qualifying Interest (QI) of SACs for which conservation objectives have been set for the European sites being screened.

Consideration is therefore given to the source-pathway-receptor linkage and associated risks between the proposed development and Natura 2000 sites. For a significant effect to occur there needs to be an identified risk whereby a source (e.g. contaminant or pollutant arising from construction activities) affects a particular receptor (i.e. Natura 2000 site) through a particular pathway (e.g. a watercourse which connects the proposed development with the Natura 2000 site).

The identification of risk does not automatically mean that an effect will occur, nor that it will be significant. The identification of these risks means that there is a possibility of environmental or ecological damage occurring. The level and significance of the effect depends upon the nature of the consequence, likelihood of the risk and characteristics of the receptor.

The precautionary principle is applied for the purposes of screening to ensure that consideration and pre-emptive action is undertaken where there is a lack of scientific evidence. It is noted that mitigation measures are not taken into account in the AA screening assessment process.

4.3 Field Study

Field surveys were carried out at the proposed development site between January 2024 to January 2026. Surveys relevant to this appropriate assessment are described below. These surveys included an assessment of the potential for all Qualifying Interests (QIs)/ Special Conservation Interests (SCIs) of European sites and third schedule invasive species to occur within the proposed site. Additional surveys for volant and non-volant mammals, invasive species and floral surveys were also completed. As these are not QI/SCI species, the details of these surveys are not relevant to this appropriate assessment. Details of these other surveys are included in the Environmental Impact Assessment Report (EIAR), which accompanies this planning application.

4.3.1 Habitat/invasive species

Habitats were mapped according to the classification scheme outlined in the Heritage Council publication *A Guide to Habitats in Ireland* (Fossitt 2000) and following the guidelines contained in *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011). Habitats were cross referenced with Habitats Directive Annex I habitats. Surveys were completed on the 14th May 2024, 22nd August 2024, 11th September 2025, 17th December 2025, 30th January 2026. During these surveys, the site was also surveyed for invasive species and rare floral species (Wyse *et al*., 2016; Stace 2019). It is noted that a considerable number of site visits were carried during the overall assessment process including winter bird surveys, bat surveys and breeding birds. Observations in relation to habitats made during these site visits are included in the habitat descriptions where relevant.

4.3.2 Breeding birds

The breeding bird survey was carried out on 14th May 2024 and 16th June 2024. and based on the BTO Common Bird Census (CBC) methodology (Bibby *et al.,* 2000 and Gilbert , 1998) which aims to capture a snapshot of breeding bird activity within the study area.

The study area focused on terrestrial habitats within the proposed development site. The aim of the breeding bird surveys was to identify any valuable bird habitats within the Site boundary and to identify birds present within the proposed development site and surrounding landscape. This survey area encompassed terrestrial habitats along the survey route including hedgerows, treelines and agricultural fields.

During breeding bird surveys the site was walked so that all habitats within 50m of potential nesting features were surveyed. The ornithological surveyor slowly walked through the Site, stopping at regular intervals to scan with binoculars and to listen for bird calls or song. Birds were identified by sight and song, and observations were plotted on a map. Survey visits were made in the early morning to coincide with the peak period of bird activity and all species seen or heard in the study area and immediate environs were recorded including those in flight. Visits were made during favourable weather conditions.

All species encountered during the survey were mapped and coded using standard BTO species codes and activity recorded using the BTO status codes for breeding evidence. In an effort to minimise potential disturbance, no attempts were made to locate nests as such behaviours are generally sufficient to determine probable or confirmed breeding.

4.3.3 Wintering Birds

Winter bird surveys were carried out on the 29th January 2024, 12th February 2024, 27th February 2024, 22nd January 2025, 7th February 2025, 27th February 2025, 27th October 2025, 3rd November 2025 and 12th December 2025. These surveys focused on grassland habitats within the proposed development site as well as grassland habitats on the boundary of the site which could provide potential foraging or roosting habitats for wintering waterbirds and waders.

The survey methodology was based on that used by the British Trust for Ornithology (BTO), Wetland Bird Survey (WeBS) and also that for the Irish Wetland Bird Survey (I-WeBS), as outlined in Gilbert *et al.* (1998). The winter bird survey was undertaken using 8.5×45 binoculars and a Hawke Endurance Ed Spotting Scope 15-45×60 spotting scope, using a combination of transect and vantage point counts.

4.3.4 Aquatic Survey

Aquatic surveys were undertaken on the 25th September 2025. Biological sampling was carried out at each station using the kick-sampling technique as per Environmental Protection Authority (EPA) methodology (Feeley et al., 2020). This biotic index is used by the EPA and allows river quality to be compared under standardized guidelines.

The kick-sampling technique involved using a 'D' shaped hand net (mesh size 0.5 mm; 350 mm diameter). Sweeps through the sediment and deep sediment was carried out. The substrate immediately upstream of the net was kicked for two minutes to dislodge invertebrates. Stone washings were not carried out as there was no suitable substrate within the survey area. Samples are transferred to plastic containers and preserved using 70%

alcohol. Samples are subsequently sieved and sorted using a white sorting tray. Identification was undertaken in the laboratory using a high-powered binocular microscope and using standard identification keys.

It is noted that the Maglin North is generally considered as unsuitable for biological monitoring using EPA methodology as it is a depositing watercourse i.e. deep fine sediment, minimal flows with an absence of riffle habitat and dense detritus which clogs the channel. An assessment was also made of the fisheries value of the watercourse and macrophytes were recorded.

4.4 Source-Pathway-Receptor Model

The likely effects of the development on any European site have been assessed using a source-pathway-receptor model, where:

- A 'source' is defined as the individual element of the proposed works that has the potential to impact on a European site, its qualifying features and its conservation objectives.
- A 'pathway' is defined as the means or route by which a source can affect the ecological receptor.
- A 'receptor' is defined as the SCI of SPAs or QI of SACs for which conservation objectives have been set for the European sites being screened.

A source-pathway-receptor model is a standard tool used in environmental assessment. In order for an effect to be likely, all three elements of this mechanism must be in place. The absence or removal of one of the elements of the mechanism results in no likelihood for the effect to occur. The source-pathway-receptor model was used to identify a list of European sites, and their QIs/SCIs, with potential links to European sites. These are termed as 'relevant' European sites/QIs/SCIs throughout this report.

4.5 Likely Significant Effect

The threshold for a Likely Significant Effect (LSE) is treated in the screening exercise as being above a de minimis level. The opinion of the Advocate General in CJEU case C-258/11 outlines:

"the requirement that the effect in question be 'significant' exists in order to lay down a de minimis threshold. Plans or projects that have no appreciable effect on a European site are thereby excluded.

If all plans or projects capable of having any effect whatsoever on the site were to be caught by Article 6(3), activities on or near the site would risk being impossible by reason of legislative overkill."

In this report, therefore, 'relevant' European sites are those within the potential ZoI of activities associated with the construction and operation of the development, where LSE pathways to European sites were identified through the source-pathway-receptor model. It is noted that the precautionary principle has been applied for the purposes of screening to ensure that consideration and pre-emptive action is undertaken where there is a lack of scientific evidence.

It is noted that mitigation measures are not taken into account in the AA screening assessment process.

4.6 Screening Process

The Screening for Appropriate Assessment will incorporate the following steps:

Definition of the likely zone of impact for the proposed works;

- Identification of the European sites that are situated (in their entirety or partially or downstream) within the likely zone of impact of the proposed works;
- Identification of the most up-to-date QIs and SCIs for each European site within the likely zone of impact;
- Identification of the environmental conditions that maintain the QIs/SCIs at the desired target of Favourable Conservation Status;
- Identification of the threats/impacts – actual or potential that could negatively impact the environmental conditions of the QIs/SCIs within the European sites;
- Highlighting the activities of the proposed works that could give rise to significant negative impacts; and
- Identification of other plans or projects, for which in-combination impacts would likely have significant effects.

4.7 Desktop Review

A desktop review facilitates the identification of the baseline ecological conditions and key ecological issues relating to Natura 2000 sites and facilitates an evaluation assessment of potential in-combination impacts. Sources of information used for this report include reports prepared for the Ballincollig area and information from statutory and non-statutory bodies. The following sources of information and relevant documentation were utilised:

- National Parks & Wildlife Service (NPWS) - www.npws.ie
- Environmental Protection Agency (EPA) – www.epa.ie
- National Biodiversity Data Centre (NBDC) – www.biodiversityireland.ie
- EPA Catchments Data https://www.catchments.ie
- Birdwatch Ireland - http://www.birdwatchireland.ie/
- Invasive Species Ireland - http://www.invasivespeciesireland.com/
- *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011)
- *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (National Roads Authority, 2009)

- *Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU)* European Union, 2017
- Cork City Heritage and Biodiversity Plan (2021-2026) and
- Cork City Development Plan 2022-2028 (Cork City Council 2022).

4.8 European sites

4.8.1 European Sites within Zone of Influence

Special Areas of Conservation (SACs) and candidate SACs (cSACs) are protected under the Habitats Directive 92/43/EEC and the European Communities (Birds and Natural Habitats) Regulations 2011, as amended. Special Protection Areas (SPAs) are protected under the Birds Directive 2009/147/EC and European Communities (Birds and Natural Habitats) Regulations 2011, as amended. Collectively, these sites are referred to as Natura 2000 or European sites.

In accordance with the European Commission Methodological Guidance (EC 2018), a list of Natura 2000 sites that can be potentially affected by the proposed project has been compiled. The proposed development does not overlap with any European site. European sites within the likely zone of impact of the proposed development site are listed in **Table 1** and illustrated in **Figure 3**.

Cork Harbour SPA is located 9.8km east of the proposed development site. The Maglin North stream (EPA name Grange Hill; River waterbody code IE_SW_19C120740), a tributary of Curraheen Stream, runs along the western boundary of the proposed development site. The surface water catchments and drainage networks are shown on **Figure 4**. The Maglin North Stream meets the Curraheen Stream c.1.5km downstream of the proposed development site. The Curraheen Stream meets the Lee Estuary c.9.9km downstream of this confluence. The Lee Estuary forms part of the Cork Harbour SPA c.4.1km downstream of this point.

During operation, the proposed surface water drainage network will discharge to the Maglin North stream. Cork Harbour SPA is located 15.5km downstream of the proposed Carriganarra LRD discharge point. Therefore surface water run-off/discharges during the construction or operational phases could potentially impact on water quality within the Cork Harbour SPA via the Maglin North Stream.

Wastewater from the site will ultimately discharge into River Lee via the Ballincollig Wastewater treatment plant (WWTP) approximately 14.6km upstream of Cork Harbour SPA. This could potentially impact on water quality within the Cork Harbour SPA.

Therefore, surface water water run-off during the construction or discharges during the operational phases as well as wastewater discharges from the proposed development could potentially impact on Cork Harbour SPA via the Maglin North Stream and River Lee. Habitats within or near the proposed development area could also potentially provide *ex-situ* foraging grounds for SCI species outside the Cork Harbour SPA.

Therefore, a potential source-receptor link has been identified between the source (proposed development) and the receptor (Cork Harbour SPA) via a potential pathway (surface water runoff, the spread of invasive species and disturbance to/ loss of *ex-situ* habitats during construction and surface water and wastewater discharges during operation). Further information on the Cork Harbour SPA is provided below and a full site synopsis included **Appendix 1**.

Given the distances involved and the lack of hydrological connection, no potential pathway for impact has been identified between the proposed development and any other European site.

Table 1. European sites within the zone of influence of the proposed development site

European sites name and code	Distance from site boundary (at closest point) and potential source-pathway-receptor link	Qualifying interests (QI)/ Special Conservation Interests (SCI)
Special Protection Area (SPA)		
Cork Harbour SPA (site code 004030)	9.8km (15.5km downstream). Cork Harbour SPA is located 9.8km east of the proposed development site. The Maglin North stream (EPA name Grange Hill; River waterbody code IE_SW_19C120740), a tributary of Curraheen Stream, runs along the western boundary of the proposed development site. The surface water catchments and drainage networks are shown on Figure 4. The Maglin North Stream meets the Curraheen Stream c.1.5km downstream of the proposed development site. The Curraheen Stream meets the Lee Estuary c.9.9km downstream of this confluence. The Lee Estuary forms part of the Cork Harbour SPA c.4.1km downstream of this point. During operation, the proposed surface water drainage network will discharge to the Maglin North stream. Cork Harbour SPA is located 15.5km downstream of the proposed Carriganarra LRD discharge point. Therefore surface water run-off/discharges during the construction or operational phases could potentially impact on water quality within the Cork Harbour SPA via the Maglin North Stream. Wastewater from the site will ultimately discharge into River Lee via the Ballincollig Wastewater treatment plant (WWTP) approximately 14.6km upstream of Cork Harbour SPA. This could potentially impact on water quality within the Cork Harbour SPA. Surface water run-off/discharges during the construction or operational phases as well as wastewater discharges from the proposed development could potentially impact on Cork Harbour SPA via the Maglin North stream. Habitats within or near the proposed development area could also potentially provide ex-situ foraging grounds for SCI species outside the Cork Harbour SPA.	Birds A193 Common Tern (*Sterna hirundo*) A028 Grey Heron (*Ardea cinerea*) A130 Oystercatcher (*Haematopus ostralegus*) A140 Golden Plover (*Pluvialis apricaria*) A157 Bar-tailed Godwit (*Limosa lapponica*) A056 Shoveler (*Anas clypeata*) A156 Black-tailed Godwit (*Limosa limosa*) A052 Teal (*Anas crecca)* A183 Lesser Black-backed Gull (*Larus fuscus)* A054 Pintail (*Anas acuta*) A149 Dunlin (*Calidris alpina*) A017 Cormorant (*Phalacrocorax carbo*) A162 Redshank (*Tringa totanus*) A004 Little Grebe (*Tachybaptus ruficollis*) A050 Wigeon (*Anas penelope*) A160 Curlew (*Numenius arquata*)

European sites name and code	Distance from site boundary (at closest point) and potential source-pathway-receptor link	Qualifying interests (QI)/ Special Conservation Interests (SCI)
		A005 Great Crested Grebe (*Podiceps cristatus*) A069 Red-breasted Merganser (*Mergus serrator*) A048 Shelduck (*Tadorna tadorna*) A142 Lapwing (*Vanellus vanellus*) A179 Black-headed Gull (*Chroicocephalus ridibundus*) A182 Common Gull (*Larus canus*) A141 Grey Plover (*Pluvialis squatarola*) Habitats Wetlands

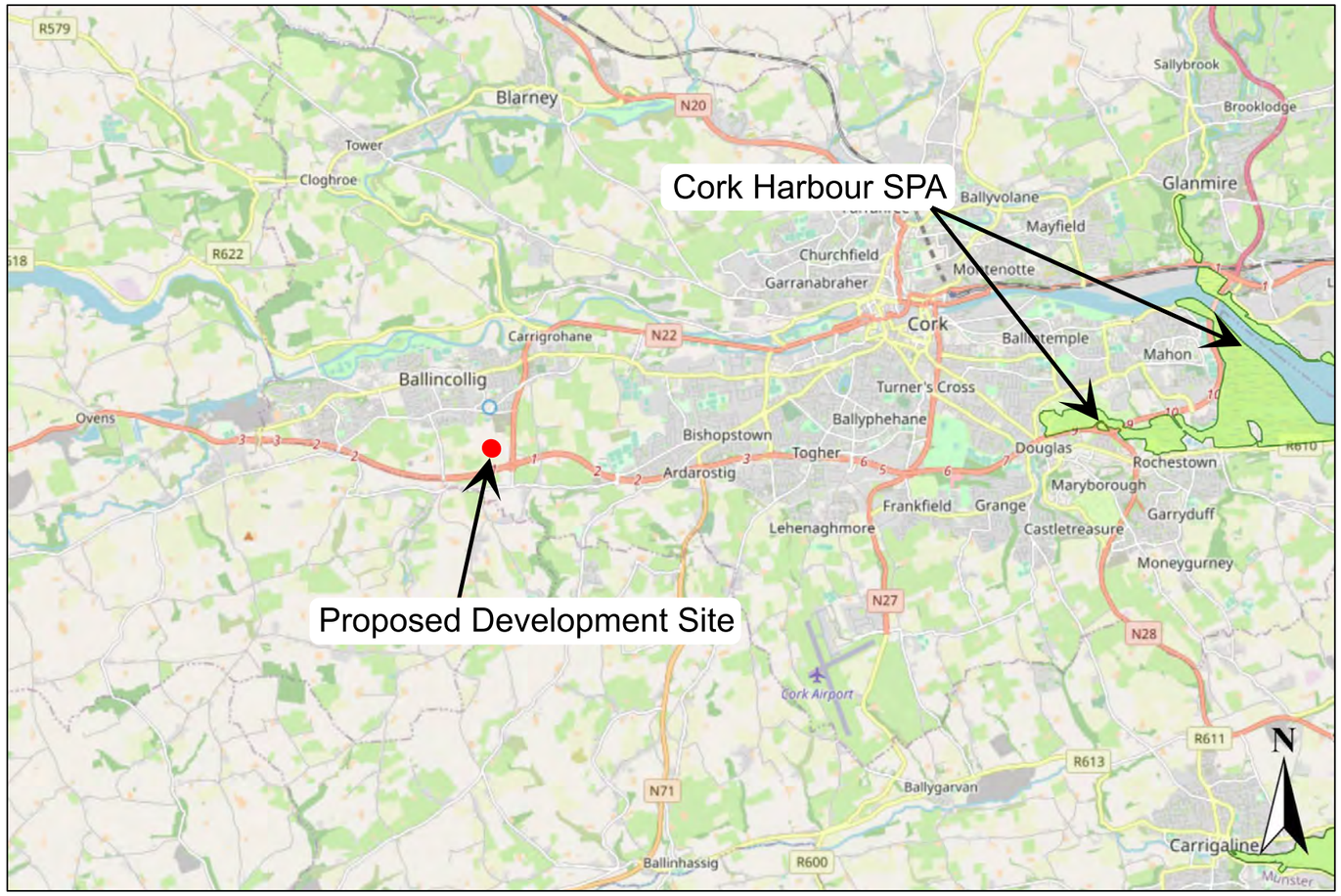


Figure 3. European sites within likely zone of impact of proposed development site | Source EPA Envision mapping | Not to scale

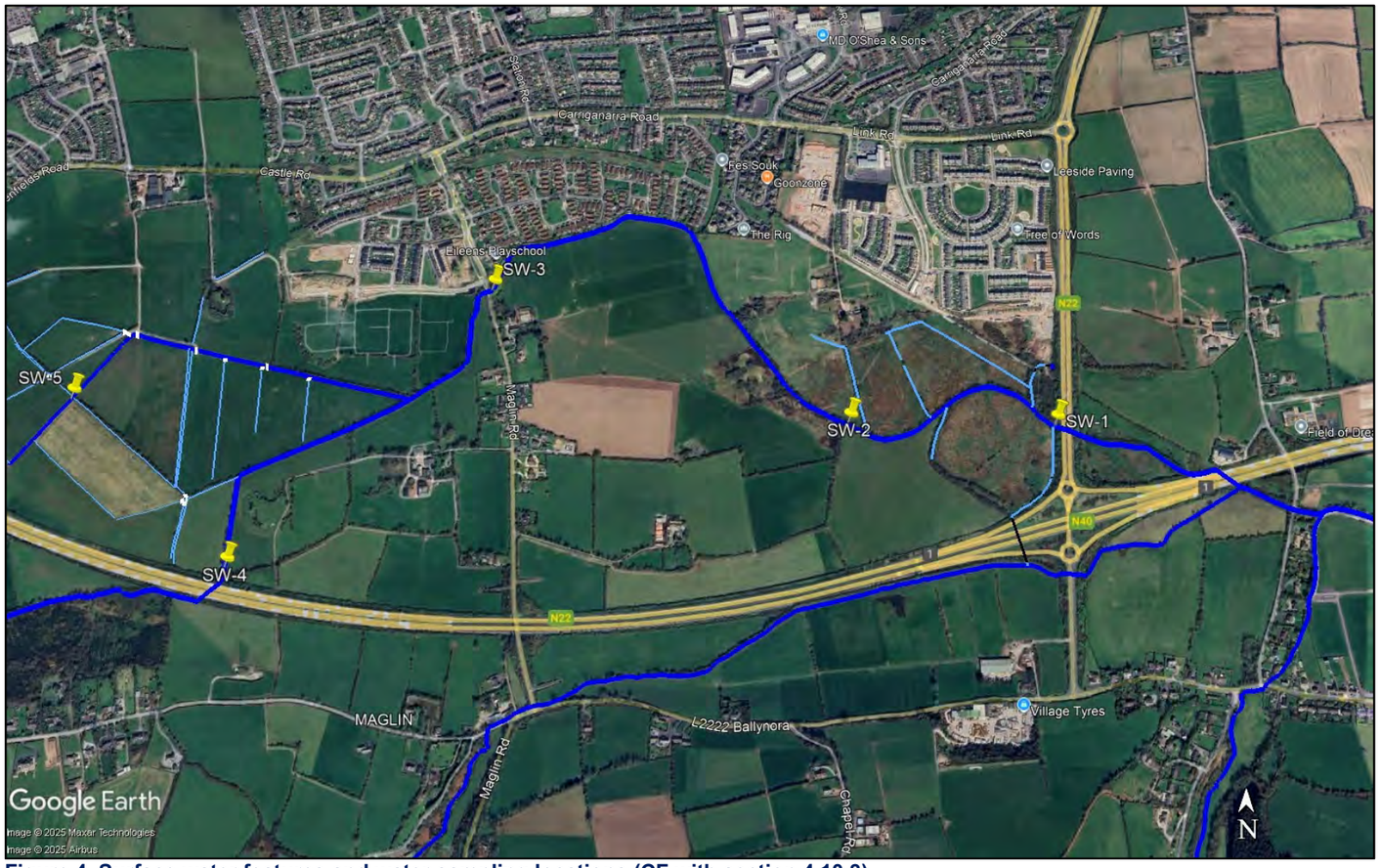


Figure 4. Surface water features and water sampling locations (CF with section 4.10.3)

4.8.2 Cork Harbour SPA (site code 004030) Site Synopses

Cork Harbour is a large, sheltered bay system, with several river estuaries - principally those of the Rivers Lee, Douglas, Owenboy and Owennacurra. The SPA site comprises most of the main intertidal areas of Cork Harbour, including all of the North Channel, the Douglas River Estuary, inner Lough Mahon, Monkstown Creek, Lough Beg, the Owenboy River Estuary, Whitegate Bay, Ringabella Creek and the Rostellan and Poulnabibe inlets.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Little Grebe, Great Crested Grebe, Cormorant, Grey Heron, Shelduck, Wigeon, Teal, Mallard, Pintail, Shoveler, Redbreasted Merganser, Oystercatcher, Golden Plover, Grey Plover, Lapwing, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Greenshank, Blackheaded Gull, Common Gull, Lesser Black-backed Gull and Common Tern. The site is also of special conservation interest for holding an assemblage of over 20,000 wintering waterbirds. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

Cork Harbour has a nationally important breeding colony of Common Tern (102 pairs in 1995). The birds have nested in Cork Harbour since about 1970, and since 1983 on various artificial structures, notably derelict steel barges and the roof of a Martello Tower (NPWS 2014).

A full site synopsis for the Cork Harbour SPA is included as **Appendix 1** of this report.

4.8.3 European sites – Features of interests and conservation objectives.

The EU Habitats Directive contains a list of habitats (Annex I) and species (Annex II) for which SACs must be established by Member States. Similarly, the EU Birds Directive contains lists of important bird species (Annex I) and other migratory bird species for which SPAs must be established. Those that are known to occur at a site are referred to as ‘qualifying interests’ and are listed in the Natura 2000 forms which are lodged with the EU Commission by each Member State. A ‘qualifying interest (QI)’ (or ‘special conservation interest (SCI)’ in the case of SPAs) is one of the factors (such as the species or habitat that is present) for which the site merits designation. The National Parks and Wildlife Service (NPWS) are responsible for the designation of SACs and SPAs in Ireland.

The conservation objectives for Cork Harbour SPA site are detailed in: NPWS (2014) *Conservation Objectives: Cork Harbour SPA 004030. Version 1.* National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and SACs and SPAs are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network. European and national legislation places a collective obligation on Ireland and its citizens to maintain at favourable conservation status sites designated as SACs and SPAs. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

The maintenance of habitats and species within European sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those

habitats and species at a national level. Favourable conservation status of a habitat is achieved when its natural range, and area it covers within that range, is stable or increasing, and the ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable. The species and habitats listed as SCIs for the Cork Harbour SPA and specific conservation objectives are included in **Table 2**.

Table 2. Special Conservation Interests (SCIs) for Cork Harbour SPA

Species code	Species		Conservation objective
A056	Shoveler	*Anas clypeata*	Maintain
A149	Dunlin	*Calidris alpina*	Maintain
A140	Golden Plover	*Pluvialis apricaria*	Maintain
A050	Wigeon	*Anas penelope*	Maintain
A028	Grey Heron	*Ardea cinerea*	Maintain
A069	Red- breasted merganser	*Mergus serrator*	Maintain
A142	*Lapwing*	*Vanellus vanellus*	Maintain
A130	O*ystercatcher*	*Haematopus ostralegus*	Maintain
A141	Grey plover	*Pluvialis squatarola*	Maintain
A052	Teal	*Anas crecca*	Maintain
A054	Pintail	*Anas acuta*	Maintain
A157	Bar-tailed Godwit	*Limosa lapponica*	Maintain
A162	Redshank	*Tringa totanus*	Maintain
A183	Lesser Black-backed gull	*Larus fuscus*	Maintain
A179	Black-headed Gull	*Chroicocephalus ridibundus*	Maintain
A004	Little Grebe	*Tachybaptus ruficollis*	Maintain
A160	Curlew	*Numenius arquata*	Maintain
A182	Common Gull	*Larus canus*	Maintain
A048	Shelduck	*Tadorna tadorna*	Maintain
A017	Cormorant	*Phalacrocorax carbo*	Maintain
A193	Common Tern	*Sterna hirundo*	Maintain
A005	Great crested grebe	*Podiceps cristatus*	Maintain
A156	Black-tailed Godwit	*Limosa limosa*	Maintain
A999	Wetlands and waterbirds		Maintain

Restore = Restore favourable conservation condition, Maintain = Maintain favourable conservation condition

To acknowledge the importance of Ireland's wetlands to wintering waterbirds, “Wetland and Waterbirds” may be included as a Special Conservation Interest for some SPAs that have been designated for wintering waterbirds and that contain a wetland site of significant importance to one or more of the species of Special Conservation Interest. Thus, a further objective is to maintain or restore the favourable conservation condition of the wetland habitat within the Cork Harbour SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.

4.9 Baseline Data

The ecological baseline for the proposed development site was based on a desktop review and direct surveys of the proposed development site and areas proximate to same. This focused on habitats and species that are listed as Qualifying Interests (QI) (in the case of SACs) and Special Conservation Interests (SCI) (in the case of SPAs) in the designations for

the European sites. Surveys for habitats, mammals, birds and invasive species were undertaken within the study area.

4.9.1 Habitats

Habitat mapping was carried out in line with the methodology outlined in the Heritage Council Publication, Best Practice Guidance for Habitat Survey and Mapping (Heritage Council, 2011). The terrestrial and aquatic habitats within or adjacent to the proposed development site was classified using the classification scheme outlined in the Heritage council publication A Guide to Habitats in Ireland (Fossitt, 2000) and cross referenced with Annex I Habitats where required.

An overview of habitats recorded within the site is shown in **Figure 5** and the habitats recorded on site are described in **Table 3**. Photographs of the site are also included below.

Table 3. Habitats recorded within the proposed development site boundary and their ecological value

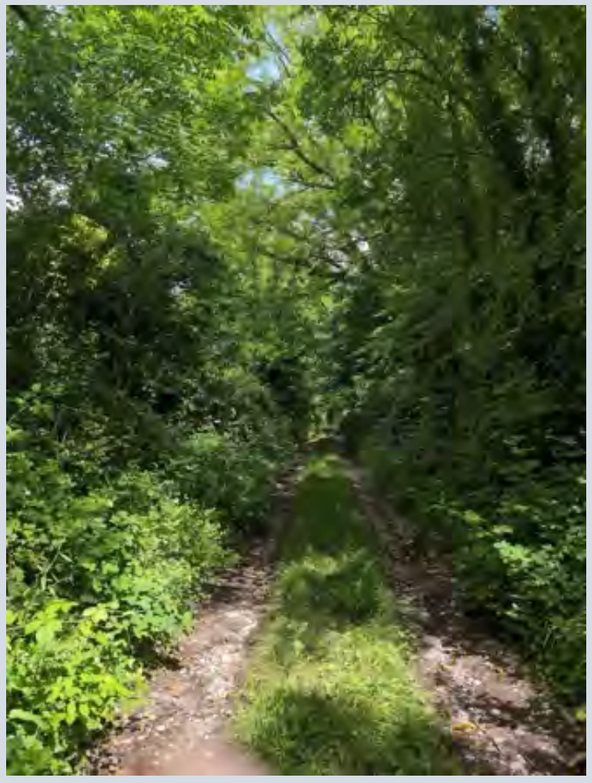
Habitats	Comments
Improved agricultural grassland GA1	All of the grassland within the proposed development site has been improved in the past. However, these are extensively managed with lower intensively grazing and fertiliser input than typical intensively farmed lands. This habitat is dominated by typical grass species including Perennial ryegrass, Meadow grass and Common bent. Herbaceous species include Curled dock, Ribwort plantain, Dandelion, Creeping buttercup and Sorrell.  Plate 1. Improved agricultural grassland at northeast of the site
Improved agricultural grassland GA1/Dry calcareous and neutral grassland GS1	This grassland is located on dryer areas at the north of the site. It has poor species diversity. Species present include Plantain, Red bartsia, Yarrow, Clovers, Poa sp., Timothy and Crested dogstail. Calcareous grasslands with either high numbers or diversity of orchids correspond to the priority habitat, 'semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometea) (*important orchid sites) (6210)'. The low diversity grassland within the proposed development site is not an Annex I habitat.  Plate 2. Semi-natural grassland adjoining woodland/scrub habitat (looking south)
Improved agricultural grassland GA1/Wet grassland GS4	Poorly drained agricultural grassland at the southeast of the site has allowed areas of Rush to develop. This habitat has poor species diversity. Rushes dominate this habitat with Sharp flowered rush and Soft rush. Broadleaved herbaceous species include Marsh foxtail, Meadowsweet, Angelica and Creeping buttercup are also present. Wet grassland has links with the Annex I: Wet grassland may contain examples of the annexed habitat, 'Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (6410)'. The wet/agricultural grassland at the proposed development site has low diversity is not representative of Annex I habitat.

Habitats	Comments
	 Plate 3. Wet/agricultural grassland mosaic
Dry meadows and grassy verges GS2/Scrub WS1	Semi-natural grassland has developed along the field boundaries where grazing has been reduced or prevented by electric fencing. This is developing into scrub (dominated by Bramble) in some areas. Cocksfoot and Sweet meadow grass are the dominant species as well as Hogweed, Nettle, Bush vetch, Knapweed and Great willowherb. Mullein was recorded in the vicinity of the Lime kiln. Several areas of scrub have developed along hedgerows where field margins have been abandoned. This habitat is dominated by Blackthorn, Willow, Gorse and Bramble. Wild clematis and Buddleia were recorded around the farmyard. At the south-west of the site, near the woodland and stream, scrub is developing into immature woodland WS2. This habitat classification includes naturally regenerated Ash, Alder, Willow and Sycamore which has developed from scrub on the margins of field boundaries. GS2 corresponds to the annexed habitat, 'lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) (6510)'. However, the grassland mosaic within the proposed development site is not an example of the is Annex I habitat.  Plate 4. Dry meadows and grassy verge along field boundary

Habitats	Comments
	 Plate 5. Dry meadows and grassy verge around farm house  Plate 6. Scrub/grassy verge adjoining woodland (and lime kiln) at west of site
Dry meadows and grassy verges GS2/ Recolonising bare ground ED3	Around the farm buildings at the southeast of the site, an area of what appears to have been formerly bare earth/spoil has been recolonised by a mixture of dry meadows/grassy verge. Species recorded include Spear thistle, Creeping buttercup, Hogweed, Curled dock, Bramble, Cocksfoot, Herb Robert, Buddleia, and False oat grass GS2 corresponds to the annexed habitat, 'lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) (6510)'. However, the grassland mosaic within the proposed development site is not an example of the is Annex I habitat.

Habitats	Comments
	 Plate 7. Recolonising bare ground/dry meadows developing around the southeast farm buildings.
Mixed broadleaved woodland WD1	A small area of woodland is located adjacent to the lime kiln, to the east of the Maglin North Stream. This area, which was previously associated with a quarry facility, now comprises of mature and semi-mature Ash, Sycamore, Beech, with low growing Alder, Hawthorn, Willow, Blackthorn and Elder. Ground flora included Ivy and Remote sedge. Understorey species include Hart's tongue fern, Nettle, Bramble, Ground ivy, Soft shield fern, Remote sedge, Cleavers. Although this habitat adjoins the Maglin North Stream, there is no evidence of flooding of this habitat. The remainder of the area has old Hawthorn scrub with some semi-mature trees scattered throughout. There are thickets of Elder and Bramble. However, there is no evidence that this area has been continuously wooded. A review of the historical mapping indicates some areas of trees along the access track are mature, as well as an area of woodland/scrub around the lime kiln (dating back to 1st edition 1829 to 1834). However, the 25" edition mapping (1987-1913) shows a smaller area of woodland/scrub alongside marginal grassland suggesting that this area had been largely cleared for the historical quarry operations onsite. A review of flood extents (OPW) found that this woodland is located outside the flood extents of the Maglin North Stream. No evidence of regular flooding or permanent waterlogging which would be consistent with wet woodland (or riparian woodland) was recorded within this habitat. While Alder and Willow are present, this woodland lacks the characteristics of wet woodland (and alluvial woodland) habitat.

Habitats	Comments
	 Plate 8. Woodland habitat at west of site
Hedgerows WL1/ Treelines WL2	Planted Hawthorn hedgerows in the vicinity of the farmyard and field boundaries, have become colonised with other species including Blackthorn and Willow. Larger tree species have also established including Ash, Sycamore and Alder, where they have developed into treelines. Hedgerows are largely along earth banks with old stone wall in some areas . Ivy is in the understorey common as well as Cow parsley. Note that an assessment of the hedgerows/treelines based on the Heritage Council Appraisal System (Foulkes) is included in the GeoTree Arboricultural assessment (Tree Report). With the exception of the mature treeline along the entrance track (H1 and H2), the hedgerow and treelines within the site are not mature, although they are locally valuable. A review of the historical mapping indicates some areas of trees along the access track are mature (H1 and H2) (dating back to 1st edition 1829 to 1834). A number of the hedgerows/treelines at the west of the site (along the Maglin North stream) and at the south of the site are visible on the 1st edition mapping, indicating that these are mature habitats. Treelines run along both sides of the access road (H1 and H2 in arboricultural assessment). This is patchy with several mature and semi-mature trees including one large mature Ash as well as mature Hawthorn, Elder and Semi-mature Ash. Local importance (Higher value) Lower growing hedgerows, with occasional mature trees, run along the north-western boundary of the site (H3, H4, H6). These are dominated by Hawthorn and Blackthorn with occasional Ash. These have developed over an old stone wall with limited understorey. Local importance (Higher value). A short section of Griselinia hedgerow runs along the north-western boundary of the site (H5). This is a low value non-native hedgerow Local importance (Lower value). Along the western boundary and adjoining stream, a treeline/hedgerow mosaic has developed along overgrown hedgerow which is dominated by Hawthorn (H6 and H7 in arboricultural assessment). Trees are generally low growing and dominated by mature Hawthorn, Blackthorn, Willow and Elder. The understorey is shaded and dominated by mixed ferns including Soft shield fern and Bracken. Local importance (Higher value) Moving south along this treeline, with several mature and semi-mature Alder, as well as mature and semi-mature Sycamore, Willow, Ash and Elder (G7 and G8 in arboricultural assessment). Local importance (Higher value)

Habitats	Comments
	At the southeast of the site, adjoining the derelict farm buildings, a treeline runs east to west with mature Ash and Hawthorn (H12 and H13). This is gappy along its western extent, becoming more dense moving east. Areas of dead wood area also present where trees have fallen over. The understorey includes deadwood, Willow, immature Elm, Mixed ferns (Hart's tongue, Soft shield), Ivy, Herb Robert. Local importance (Higher value) Mature Hawthorn and Blackthorn hedgerow runs along the centre of the site, south of the farm buildings (H9 and H10). This is a dense good quality native hedgerow. Understory species include Bramble and Yellow flag. It adjoins a drainage ditch which connects to the Maglin North. Local importance (Higher value) A short section of patchy hedgerow is located at the centre of the site (H11). This is dominated by Hawthorn, with occasional dead trees. Local importance (Lower value)  Plate 9. Central treeline along access road (H1/H2)

Habitats	Comments
	 Plate 10. Treeline along Maglin stream (G7/G8)  Plate 11. Short section of treeline at north-western corner of site (H6)

Habitats	Comments
	 Plate 12. Treeline at south-east of site (H13)  Plate 13. Hedgerow/treeline along southern drain (H10)
Mixed broadleaved woodland WD1/Scrub WS1	An area at the southeast of the site has developed into a mosaic of the mature woodland and scrub (dominated by bramble). This habitat is of relatively recent origin. The trees, which are largely semi-mature and immature, include Hawthorn Willow and occasional mature Ash. Understorey species include Ivy, Creeping buttercup, Nettle, Hogweed and Elder. Areas of waterlogged ground have allowed Remote sedge to establish. While Alder and Willow are present and seasonal waterlogging occurs, the habitat lacks the hydrological regime, floristic mix/structural complexity and flood dependency characteristic of Annex I alluvial woodland (91E0). The woodland is episodically waterlogged rather than flood-driven .

Habitats	Comments
	 Plate 14. Area of woodland scrub at southeast of site
Recolonising bare ground ED3	Includes areas around former farmyard where abandoned bare ground is developing into semi-natural grassland and low growing scrub.
Stone walls and other stonework BL1/Buildings and artificial surfaces BL3	Derelict farm buildings as well as the old lime kiln are included in this classification. The walls in some areas support Herb Robert, Ivy, Hart's tongue fern, Sow thistle. The former farmyard and farm buildings are derelict and in an advanced state of disrepair. The farmhouse is located to the west of the access track and corresponds to a footprint shown on the 1841 OS. More modern buildings are located to the south of the old farmhouse. Older outbuildings (dating from c.1903) are located at the southeast of the site, alongside some sections of old stone wall (largely beneath trees). There is a partially intact lime kiln to the west of the farmyard on the edge of an area of woodland. Tracks runs through the site providing access to farm buildings.  Plate 15. Derelict farm buildings at centre of the site

Habitats	Comments
	 Plate 16. Derelict farm buildings and scrub at southeast  Plate 17. Derelict farm buildings at centre of the site

Habitats	Comments
	 Plate 18. Sections of old stone wall at southeast of site
Lowland depositing river (FW2)	The Maglin North Stream runs along the western boundary of the site. This stream is heavily channelised with a straightened channel, soft mud substrate and large volumes of woody detritus. Flow is generally laminar with no significant riffle glide sequences or deep pools. The high earth banks are lined, predominantly with Alder but Willow is also common. Shade levels are generally high, which suppresses macrophyte growth and as a consequence there is no significant aquatic vegetation. Some Fools watercress is present where light levels are higher. There is sufficient flow within this stream to support permanent fish populations. Species such as Stickleback and European eel likely to occur. Brown Trout is also likely to occur, although there is an absence of spawning gravels and high value nursery habitat. Plate 19. Maglin North Stream along western boundary
Drainage ditch FW4	There are a number of small land drains within the site. The most prominent drainage ditch is located at the south of the site. This drainage ditch runs south from the centre of the site meeting the Maglin North Stream just south of the site boundary. This drainage ditch is shaded and channelized with Blackthorn and Hawthorn along its length. Standing

Habitats	Comments
	water and rush are present in some areas of the drain, which is likely to dry up during the summer months. The drain is heavily clogged with leaf litter. A smaller drainage ditch is located at the southeast of the site. This is heavily overgrown with grasses and less distinct that the main drainage ditch.  Plate 20. Drainage ditch at south of site  Plate 21. Smaller drainage ditch at south-east of site

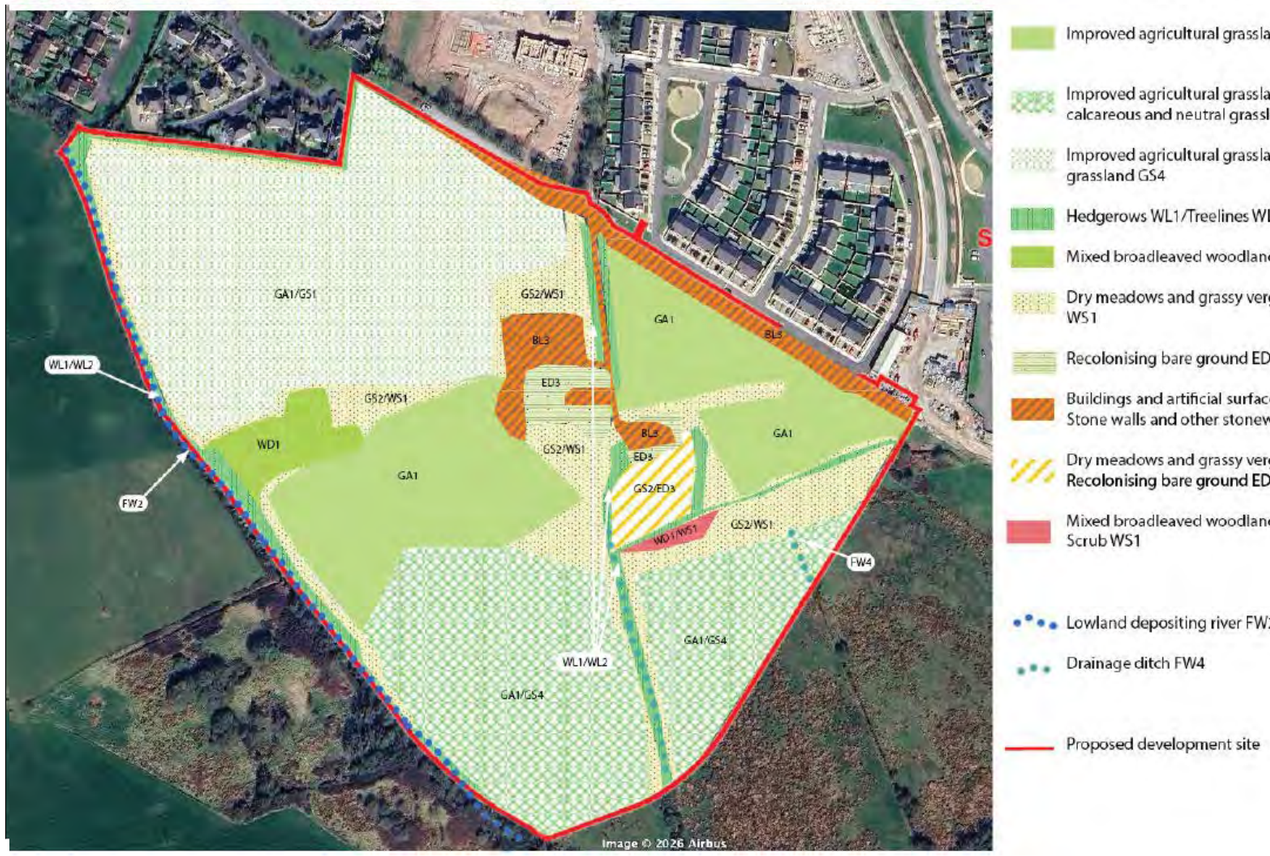


Figure 5. Habitats recorded within proposed development site boundary

4.9.2 Birds

Breeding birds

The site of the proposed development lies within Ordnance Survey National Grid 10km square W66. The National Biodiversity Data Centre's (NBDC) online database provides data on the distribution of species within 10km grid squares.

The National Biodiversity Centre online data base lists 123 species of bird recorded within grid square W66. Of these 123 species, 12 of which are listed under Annex I of the Birds Directive, namely, Bar-tailed Godwit (*Limosa lapponica*), Chough (*Pyrrhocorax pyrrhocorax*), Golden Plover (*Pluvialis apricaria*), Hen Harrier (*Circus cyaneus*), Kingfisher (*Alcedo atthis*), Little Egret (*Egretta garzetta*), Mediterranean Gull (*Ichthyaetus melanocephalus*), Merlin (*Falco columbarius*), Nightjar (*Caprimulgus europaeus*), Peregrine (*Falco peregrinus*), Red Kite (*Milvus milvus*) and Ruff (*Calidris pugnax*). There is no suitable breeding habitat for these Annex I species within the proposed development site boundary.

Breeding bird surveys were carried out in May and June 2024 based on the Common Bird Census (CBC) methodology (Balmer *et al.* 2013 and Gilbert *et al.,* 1998). The results of the breeding bird survey are shown in **Table 4**.

Table 4. Bird Species recorded during breeding bird surveys

Species		Breeding Status	Highest evidence of breeding	Estimated number of territories	Conservation Status: Annex I of Birds Directive or Red/Amber List*
Blackbird	*Turdus merula*	Possible	Singing male	3	
Blackcap	*Sylvia atricapilla*	Probable	Pair observed	2	
Blue tit	*Cyanistes caeruleus*	Possible	Singing male	2	
Bullfinch	*Pyrrhula pyrrhula*	Probable	Pair observed	1	
Buzzard	*Buteo buteo*	Non-breeding	Flying over		
Chaffinch	*Fringilla coelebs*	Possible	Singing male	2	
Chiffchaff	*Phylloscopus collybita*	Possible	Singing male	2	
Dunnock	*Prunella modularis*	Possible	Singing male	2	
Feral pigeon	*Columba livia domestica*	Non-breeding	Flying over		
Goldfinch	*Carduelis carduelis*	Probable	Pair observed	1	
Great tit	*Parus major*	Possible	Singing male	1	
House martin	*Delichon urbicum*	Non-breeding	Flying over		Amber List
House sparrow	*Passer domesticus*	Possible	Singing male	1	Amber List
Jackdaw	*Corvus monedula*	Probable	Pair observed	1	
Linnet	*Linaria cannabina*	Non-breeding	Overflying		Amber List
Magpie	*Pica pica*	Possible	Singing male	1	
Pheasant	*Phasianus colchicus*	Probable	Pair observed in suitable nesting habitat in breeding season	1	
Robin	*Erithacus rubecula*	Possible	Singing male	1	
Rook	*Corvus frugilegus*	Non-breeding	Flying over	NA	
Spotted flycatcher	*Musciapa striata*				
Starling	*Sturnus vulgaris*	Non-breeding	Overflying	1	Amber List
Swallow	*Hirundo rustica*	Confirmed	Nesting within farm building	1	Amber list
Treecreeper	*Certhia familiaris*	Possible	Species observed in breeding season in suitable nesting Habitat	1	
Woodpigeon	*Columba palumbus*	Possible	Singing male		
Wren	*Troglodytes troglodytes*	Possible	Singing male	2	

No Annex I bird species were recorded during the site survey. A total of 25 species were recorded during the breeding bird surveys. The majority of birds recorded as considered common, woodland edge species which will nest in the mature treelines and hedgerow onsite. However, the mix of habitats onsite provides locally valuable habitats for a range of breeding birds. The proposed development site is dominated by grassland with patchy treelines/hedgerow. Native hedgerow provide valuable feeding/nesting resources for birds i.e. Hawthorn, Elder, Blackthorn, Willow. The grassland within the proposed development size is managed conventionally for cattle grazing. This is a low diversity habitat which does not provide significant resources for breeding birds. Although there is some ponded surface water on grassland and in scrub/woodland during peak rainfall events, these ephemeral habitats do not provide significant breeding resources for birds. There are also heavily channelised drains within the proposed development site boundary, but likewise they do not provide high value breeding resources for local bird populations.

Five species of conservation concern (Amber list) were recorded during the breeding birds surveys i.e. House martin *Delichon urbicum*, House sparrow *Passer domesticus*, Linnet *Linaria cannabina*, Starling *Sturnus vulgaris* and Swallow *Hirundo rustica*. A Swallow nest was recorded within one of the old farm buildings.

During the survey period, which extended between 2024 and 2026, the management of grassland varied between longer, unmanaged grassland and shorter, managed grassland.

However, with the exception of Pheasant, no grassland nesting species were recorded during the site survey.

Wintering birds

Winter Bird surveys were carried out in the period in 2024 and 2025. The primary purpose of the study was to assess usage of pasture land within the proposed development site by birds listed as SCI species for the Cork Harbour SPA.

The lands within the proposed development site are used by grazing cattle. But this grassland is not intensively grazed and/or enriched with fertiliser input. The grassland management has varied through the field surveys. The site slopes gently to the south, but there is distinct higher ground that is dry (at the north of the site) and lower lying wet/agricultural grassland areas to the south. While the shorter grassland within the site could potentially provide habitat for wading birds or waterfowl, no such birds were recorded during any of the site surveys.

Birds recorded during winter bird surveys are listed in **Table 5**. Most species recorded during the winter bird surveys were common, Green List (Gilbert *et al.* 2021), passerine species such as Wren, Robin, Blackbird, etc. These species were recorded within the grassland and hedgerow/treelines within the proposed development site.

A number of BOCC species were recorded during the winter surveys including Snipe, Meadow Pipit and Starling. Snipe, a red list BOCCI species, was recorded within wet/agricultural grassland habitat at the south of the site. Small-scale ongoing drainage and reclamation of marginal farmland and bog habitats likely to be a key factor in their continued decline of this species. Meadow pipit (a Red list BOCCI species), was recorded within grassland. The main cause of declines is thought to be agricultural intensification. Starling (an Amber list BOCCI species). were recorded foraging within grassland habitats.

No SCI species were recorded during the winter surveys.

Table 5. Birds recorded during winter bird survey

Species		SCI Species Cork Harbour SPA	Birds Directive Annex	BOCCI	
			I	Red List	Amber List
Blackbird	*Turdus merula*				
Blue Tit	*Cyanistes caeruleus*				
Hooded Crow	*Corvus cornix*				
Jackdaw	*Corvus monedula*				
Meadow pipit	*Anthus pratensis*			x	
Pheasant	*Phasianus colchicus*				
Robin	*Erithacus rubecula*				
Rook	*Corvus frugilegus*				
Snipe	*Gallinago gallinago*			x	
Starling	*Sturnus vulgaris*				x

4.9.3 Invasive Species

Non-native plants are defined as those plants which have been introduced outside of their native range by humans and their activities, either purposefully or accidentally. Invasive non-native species are so-called as they typically display one or more of the following characteristics or features: (1) prolific reproduction through seed dispersal and/or re-growth from plant fragments; (2) rapid growth patterns; and, (3) resistance to standard weed control methods.

Where a non-native species displays invasive qualities and is not managed it can potentially: (1) out compete native vegetation, affecting plant community structure and habitat for wildlife; (2) cause damage to infrastructure including road carriageways, footpaths, walls and foundations; and, (3) have an adverse effects on landscape quality.

The Birds and Natural Habitats Regulations 2011 (SI 477 of 2011), Section 49(2) prohibits the introduction and dispersal of species listed in the Third Schedule, which includes Japanese Knotweed and Himalayan Balsam, as follows: “any *person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow [….] shall be guilty of an offence*.”

No third invasive schedule species were recorded within the proposed development site. Two other invasive non-native species Buddleia *Buddleia davidii* and Wild clematis *Clematis vitalba* were recorded within the proposed development site. These species were recorded largely within scrub and recolonising areas within the site. Both are listed as medium impact species by the NBDC. These species are not listed in SI 477 of 2011 and therefore there is no statutory obligation to remove them. Both have been included in the TII Guidelines on the Management of Noxious Weeds and Non-native Species on National Roads (TII, 2010) as they have been shown to have an adverse impact on landscape quality, native biodiversity or infrastructure; and are likely to be encountered during road schemes.

4.10 Water Quality

4.10.1 River Basin Management Plan for Ireland 2022-2027 (3rd Cycle)

The Water Framework Directive (WFD) sets out the environmental objectives which are required to be met through the process of river basin planning and implementation of those plans. Specific objectives are set out for surface water, groundwater and protected areas. The challenges that must be overcome in order to achieve those objectives are very significant. Therefore, a key purpose of the River Basin Management Plan (RBMP) is to set out priorities and ensure that implementation is guided by these priorities.

The EPA has published an updated draft Catchment Assessment for each of our 46 catchments. These assessments provide an overview of the situation in the catchment, draw comparison between Cycle 2 and Cycle 3, and will help support the draft River Basin

Management Plan 2022-2027 public consultation process. The third cycle RBMP, which was published in July 2022, aims to build on the progress made during the second cycle. Key measures during the first cycle included the licensing of urban waste-water discharges (with an associated investment in urban waste-water treatment) and the implementation of the Nitrates Action Programme (Good Agricultural Practice Regulations). The former measure has resulted in significant progress in terms both of compliance levels and of the impact of urban wastewater on water quality. The latter provides a considerable environmental baseline which all Irish farmers must achieve and has resulted in improving trends in the level of nitrates and phosphates in rivers and groundwater. It is acknowledged, however, that sufficient progress has not been made in developing and implementing supporting measures during the first and second cycles.

Overall, RBMP assesses the quality of water in Ireland and presents detailed scientific characterisation of our water bodies. The characterisation process also takes into account wider water quality considerations, such as the special water-quality requirements of protected areas. The characterisation process identifies those water bodies that are *At Risk* of not meeting the objectives of the WFD, and the process also identifies the significant pressures causing this risk. Based on an assessment of risk and pressures, a programme of measures has been developed to address the identified pressures and work towards achieving the required objectives for water quality and protected areas. Data relating to the watercourses in the vicinity of the proposed development site are provided in **Table 6** and the location of these shown in **Figure 6.**

Table 6. WFD Status

Catchment: Lee, Cork Harbour and Youghal Bay (Code 19)				
This catchment includes the area drained by the River Lee and all streams entering tidal water in Cork Harbour and Youghal Bay and between Knockaverry and Templebreedy Battery, Co. Cork, draining a total area of 2,153km². The largest urban centre in the catchment is Cork City. The other main urban centres in this catchment are Ballincollig, Macroom, Carrigaline, Crosshaven, Blarney, Glanmire, Midleton, Carrigtohill, Cobh, Passage West and Belvelly. The total population of the catchment is approximately 328,854 with a population density of 153 people per km². Several small coastal rivers drain the area to the southeast of Cork Harbour and the area at the eastern extreme of the catchment is drained by the Womanagh River which flows into the sea on the western side of Youghal Bay. The Lee-Cork Harbour catchment comprises 18 sub-catchments with 92 river water bodies, three lakes, 13 transitional, six coastal water bodies and 16 groundwater bodies. There are five heavily modified and no artificial water bodies in the catchment. The proposed development site is located within the Glasheen[Corkcity]_SC_010 sub catchment. All four water bodies in this sub catchment are unassigned but AT RISK due to elevated phosphate concentrations. Further investigation is required to determine what is impacting nutrient conditions.				
Waterbodies relevant to the proposed project				
Waterbody	**WFD Risk**	**WFD Status (2016-2021)**	**Significant Pressure**	**Pressure Category**
Catchment: Lee, Cork Harbour and Youghal Bay (Code 19)				
CURRAGHEEN (Cork City)_010	At risk	Moderate	Yes	Anthropogenic pressures
GLASHEEN (Cork City)_010	At risk	Poor	Yes	Anthropogenic pressures
Lee Cork Estuary_Upper	At risk	Moderate	Yes	Urban runoff, urban wastewater
Lee Cork Estuary_Lower	At risk	Moderate	Yes	Urban runoff, urban wastewater
Lough Mahon	At risk	Moderate	Yes	Urban runoff, urban wastewater

Source: EPA envision mapping and www.catchments.ie



Figure 6. WFD waterbodies in the vicinity of the proposed development WFD Status Green=Good, Yellow=Moderate; Orange=Poor | Source: EPA Envision mapping https://gis.epa.ie/EPAMaps/) | not to scale

4.10.2 Urban Wastewater Treatment Directive

The Wastewater Discharge (Authorisation) Regulations 2007 (S.I. 684 of 2007) gives effect to the requirements of the Urban Wastewater Treatment Directive (Directive 91/271/EEC) and the Water Framework Directive (2000/60/EC) in Ireland. The Urban Wastewater Treatment Directive (UWWTD) lays down the requirements for the collection, treatment and discharge of urban wastewater and specifies the quality standards which must be met — based on agglomeration size — before treated wastewater is released into the environment.

The priority objective for this river basin planning cycle is to secure compliance with the Urban Wastewater Treatment Directive and to contribute to the improvement and protection of waters in keeping with the water-quality objectives established by this Plan. Achieving this objective entails addressing waste-water discharges and overflows where protected areas (i.e., designated bathing waters, shellfish waters and Freshwater Pearl-Mussel sites) or high-status waters are at risk from urban waste-water pressures.

As part of the proposed development wastewater discharging from the proposed development will be conveyed to the Ballincollig WWTP (D0049-01) for treatment prior to discharging into the River Lee.

4.10.3 Aquatic surveys

The Maglin North Stream is heavily channelised with a straightened channel, a soft mud substrate and large volumes of woody detritus. Flow is generally laminar, with no significant riffle glide sequences or deep pools. The high earth banks are lined, predominantly with Alder. Willow also common. Shade levels are generally high, which suppresses macrophyte growth and as a consequence there is no significant instream aquatic vegetation. Some Fools watercress was recorded where light levels are higher. There is sufficient flow within the stream to support permanent fish populations. Species such as Stickleback and European eel are likely to occur. Brown trout is also likely to occur, although there is an absence of spawning gravels or high value nursery habitat. In general the stream provides sub-optimal habitat for Brown trout with populations likely to be sparse and localised.

Aquatic surveys were completed at three sites within and downstream of the proposed development site. In general the watercourse has a deep silt substrate and the EPA methodology for ascribing Q values is considered inappropriate. A number of invertebrate species were recorded namely *Tipulidae*, *Lymnea* sp, *Chironomidae, Oligocheate, Asellus sp*. and limited numbers of *Gammerus* sp.

A number of drainage ditches connect to this stream. One prominent drainage ditch runs through the proposed development site, meeting the Maglin North Stream c.60m downstream of the proposed development site. This drainage ditch is shaded and channelized with Willow and Alder along its length. Standing water and rush are present in some areas of the drain, which is likely to dry up during the summer months. This drainage ditch (and other drainage ditches onsite) is unlikely to support permanent fish populations.

The EPA monitors water quality in the rivers and streams across the country – refer to https://gis.epa.ie/EPAMaps/ for most recent data. However, there are no water quality (Q-value) monitoring points on the Maglin North River or rivers further downstream of the site. There are National Water Monitoring Stations downstream of the site on the Curraheen River. The closest to the site are on the Model Farm Road at Inchagaggin (Carrigrohane Bridge).

The river waterbody WFD status 2016 – 2021 and 2019 – 2024 for the Maglin North River, Curraheen River and all streams draining this WFD River sub-basin is Moderate. This is based on ‘expert judgement’ (i.e., in the absence of water quality data). All waterbodies in this WFD River sub-basin are assigned ‘At Risk’. It is noted that the Curraheen River is coming under anthropogenic pressures. There is one EPA licenced facility (W0214) in the Curraheen (Cork City)_010 WFD River sub-basin, located in Waterfall. This is a privately-operated waste transfer station located near the upper reaches of the Curraheen River – it has no surface water discharges. There are three Section 4 discharge licences in the sub-basin. All three (Ballyburden Meat Processors Ltd, Norwood Grange Nursing Home and the WWTP for a housing estate) are in Waterfall and effectively downstream of the Carriganarra site.

The wastewater treatment plant (WWTP) for the area, operated by Uisce Éireann, is located in Ballincollig near the GAA grounds. The treated water is discharged to the River Lee. This stretch of the River Lee (Lee (Cork)_090) was assigned Good WFD river waterbody status for 2016-2021 but has now been assigned Moderate for 2019 – 2024, reverting to the 2013-2018 WFD river waterbody status. It is assigned ‘Not At Risk’. The latest (2023) Q-values upstream (Inniscarra Bridge) and downstream (Leemount Bridge) of the WWTP discharge point is Q4, indicating Good status.

Five surface water samples (SW1 to SW5) were collected by Keohane Geological & Environmental Consultancy (KGEC) from the Maglin North stream along the valley. Samples were collected on 14th February 2024, 7th May and 9th September 2025. The sample locations are shown on **Figure 4** and results of monitoring included in **Table 7**.

Table 7. Surface water monitoring results on the Maglin North Stream | Source Keohane Geological & Environmental Consultancy (KGEC).

Parameter	Units	SW1			SW2			SW3			SW4			SW5		
		14/02/24	07/06/25	09/09/2025	14/02/24	07/06/25	09/09/25	14/02/24	07/06/25	09/09/25	14/02/24	07/06/25	09/09/25	14/02/24	07/06/25	09/09/25
Total Alkalinity	mg $CaCO_3$/l	144	145	63	145	135	62	131	123	92	112	103	90	275	235	226
Total Nitrogen	mg N/l	4.95	5.964	1.014	5.12	6.479	1.544	5.15	6.193	3.222	5.58	6.221	3.777	4.56	6.539	4.566
Nitrate	mg N/l	3.987	5.429	0.557	4.155	5.674	1.083	4.309	5.639	2.53	4.75	5.863	3.058	3.899	6.110	3.892
Nitrite	mg N/l	0.031	0.013	0.007	0.029	0.012	0.012	0.023	0.009	0.017	0.02	0.006	0.01	0.008	0.008	0.202
Total Ammonia	mg N/l	0.097	0.038	0.03	0.09	0.020	0.035	0.078	0.027	0.096	0.077	0.021	0.04	0.033	0.034	0.045
Unionised Ammonia	mg N/l	0.004	<0.001	0.001	0.003	<0.001	0.001	0.003	<0.001	0.003	0.002	<0.001	0.002	0.001	0.001	0.001
Ortho-Phosphate	mg P/l	0.055	0.034	0.043	0.054	0.032	0.064	0.05	0.033	0.142	0.054	0.040	0.104	0.02	0.014	0.026
Total Phosphorus	mg P/l	0.139	0.055	0.074	0.127	0.055	0.099	0.118	0.045	0.189	0.106	0.049	0.153	0.042	0.023	0.063
BOD	mg O_2/l	1.7	0.8	1.7	1.3	0.8	1.8	1.0	0.6	3.2	1.2	0.8	2.4	0.3	1.2	3.4
COD	mg O_2/l	24.4	9.2	13.6	21.8	11.8	19.2	22.2	9.2	28.3	19.2	7.9	30.9	15.3	8.8	16.6

Parameter	Units	SW1			SW2			SW3			SW4			SW5		
		14/02/24	07/06/25	09/09/2025	14/02/24	07/06/25	09/09/25	14/02/24	07/06/25	09/09/25	14/02/24	07/06/25	09/09/25	14/02/24	07/06/25	09/09/25
Chloride	mg Cl/l	20.0	20.7	7.8	20.2	21.0	12.1	20.5	21.0	22.1	21.1	20.2	24.4	26.5	24.7	26.1
Suspended Solids	mg/l	13.3	6.0	3.2	11.8	8.0	4.0	11.5	2.5	4.5	9.8	2.8	5.0	3.8	12.3	16.8
Conductivity @ 25°C	µS/cm	394	415	166	397	395	185	377	378	3.1	364	342	318	656	587	566
Turbidity	NTU	14.83	6.67	6.44	13.63	7.99	6.8	13.19	3.82	8.29	9.93	2.79	9.14	3.89	7.82	17.06

The results indicate varying water quality along the channel, but with no consistent pattern:

- BOD concentrations range from 0.3 to 3.4mg/l. BOD concentrations ≤1.5 mg/l indicate good status and concentrations ≤1.3mg/l indicate high status. BOD exceeded 1.5 mg/l on several occasions and at all sampling locations in the September 2025 sampling event. Flows were low during this sampling event.
- Total ammonia concentrations ranged from 0.02 to 0.097mg/l. Total ammonia concentrations ≤0.065mg/l indicate good status and concentrations ≤0.040mg/l indicate high status. The concentrations in SW-1 to SW-4 were all above 0.065mg/l in February 2024, so the waters didn't achieve good status for this parameter. However, the total ammonia results for May and September 2025 were (apart from SW3 in September 2025) all below 0.065mg/l indicating good status.
- Total phosphorus concentrations ranged from 0.023 to 0.189mg/l. Total phosphorus concentrations ≤0.025mg/l indicate good status and concentrations ≤0.010mg/l indicate high status. The concentrations were all above 0.025mg/l for all sampling events at most locations, indicating that the waters didn't achieve good status for this parameter. The only result less than 0.25mg/l occurred at SW-5 in May 2025.
- Turbidity and TSS concentrations are low in all samples.

The EPA Phosphorus Pollution Impact Potential[1] at the site is ranked 6 and 7. The EPA Nitrate Pollution Impact Potential[2] at the site is ranked 2 and 3.

4.10.4 Flood Risk Assessment

A review of the available flood risk assessment carried out by Keohane Geological & Environmental Consultancy (KGEC) in the Ballincollig area include:

The OPW CFRAM river flood extents mapping shows that the southern-most fringes of the site floods. Flooding occurs to the west of the site along the channel of the Maglin North River. The CFRAM river flood extents mid-range future scenario is shown on Figure 7. Low probability (AEP of 0.1%), medium probability (AEP of 1%) and high probability (AEP of 10%) are shown.

The OPW CFRAM coastal flood extents mid-range future scenario shows a similar flooding pattern along the Maglin North River. The CFRAM coastal flood extents mid-range future scenario is shown on Figure 8.

As the site is modelled as part of the CFRAM project, it is not covered by the OPW National Indicative Fluvial Mapping (NIFM). NIFM maps show flooding to occur to the southwest of the site associated with the Maglin North and Maglin South rivers – refer to Figure 8.

[1] Pollutant Impact Potential for Phosphorus has 7 rankings from PIP-P-1 to PIP-P-7. PIP-P-1 is the highest ranking - i.e., highest potential to cause pollution.
[2] Pollutant Impact Potential for Nitrates has 5 rankings from PIP-N-1 to PIP-N-5. PIP-N-1 is the highest ranking - i.e., highest potential to cause pollution.

The Ballincollig drainage study indicates that the 0.1% AEP high end future scenario flooding will extend into the southern periphery of the site – see Figure 7.9. This flood extents maps indicates that the flooding extends slightly further north than the CFRAM map.

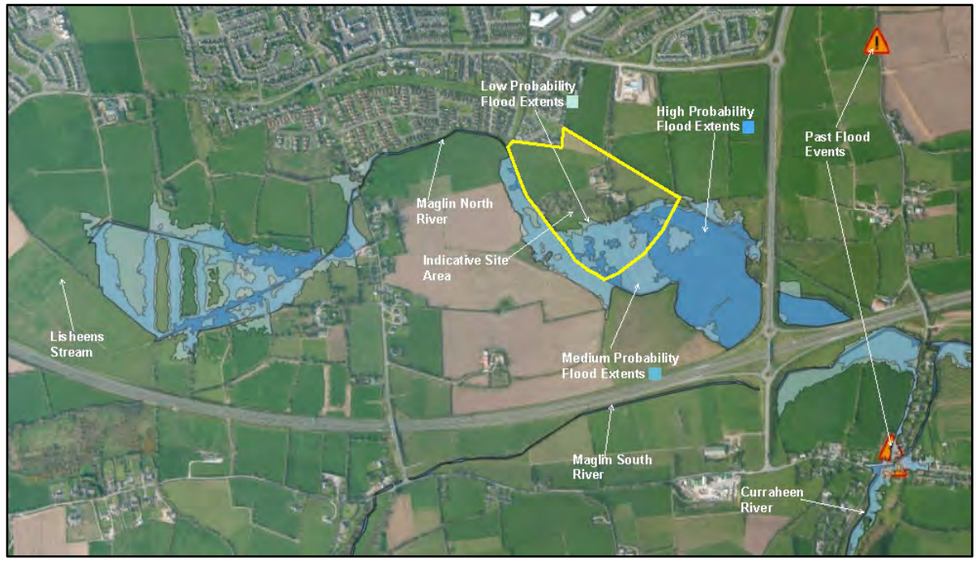


Figure 7. OPW CFRAM River Flood Extents



Figure 8. OPW NIFM River Flood Extent

As there is a risk of flooding affecting the project site, a Site-Specific Flood Risk Assessment (FRA) was carried out by Malachy Walsh & Partners Consulting Engineers (MWP) in accordance with the OPW's Guidelines.

The conclusions of the MWP FRA are that:

A hydraulic model was created to predict the flood zones and flood levels at the site. This demonstrated that the majority of the proposed residential development is located in Flood Zone C and therefore has a low probability of flooding. The southern area of the site which includes a small portion of the proposed residential area and the proposed sustainable access corridor is located in Flood Zone A/B and therefore has a high/moderate probability of flooding.

The source of potential flooding at the Carriganarra site is the Maglin North River, which bounds the western side of the site. Pluvial flooding is not considered an issue at the site.

A Justification Test is required for the proposed residential development, as it encroaches into Flood Zone A and B, and the proposed sustainable access corridor. A Justification Test was carried out which demonstrates that the proposed development of the sustainable access corridor is compliant with Department Guidelines and the Objectives of Cork City Development Plan 2022 – 2028.

To ensure that there is no unacceptable flood risk, the following mitigation measures are recommended:

- The finished floor level (FFL) of all buildings should be set above the 1% AEP flood level for the medium range future scenario plus 500mm freeboard. On this basis, the design flood level ranges from 16.50mOD to 17.09mOD at the downstream and upstream end of the site respectively. The proposed minimum FFL of the residential units ranges from 17.25mOD to 22.50mOD, and any proposed FFL is over 500mm above the adjacent design flood level.
- The land within the site will be raised to a minimum ground level of 17.00mOD which places it above the design flood level.
- The sustainable access corridor will be raised to a level ranging from 17.0mOD at the southwestern end of the road to 20.00mOD at the northeastern end of the road which places it above the design flood level.
- It was also concluded that, once these mitigation measures are implemented, the proposed development would not have an adverse impact on flooding on third party lands downstream of the sustainable access corridor when compared to the South Ballincollig Drainage Study SFRA.
- It was demonstrated that the risk to occupants of the site would be low.

Residual risks associated with the development were also assessed and are considered to be acceptable.

4.11 Potential effects of proposed development on European sites

Potential effects relate to habitat loss, changes to water quality (during construction and operation), the spread of invasive species and disturbance effects during the proposed works. Based on the *Managing Natura 2000 Sites: The Provision of Article 6 of the Habitats Directive 92/43/EEC* (European Commission (EC), 2018 and CIEEM guidelines '*Guidelines for Ecological Impact Assessment'* (CIEEM, 2019) impacts are listed as significant using a combination of professional judgement and criteria or standards where available, if impacts have the potential to have a significant impact on the ecological integrity on the habitats and species for which the site is designated.

The potential effects associated with the proposed works are discussed in the following sections with respect to their likelihood to have significant impacts on European sites.

As part of the assessment direct, indirect and in-combination impacts on all relevant QIs/SCIs were considered. Direct impacts refer to habitat loss or fragmentation arising from land-take requirements for development. Indirect and secondary impacts do not have a straight-line route between cause and effect, and it is potentially more challenging to ensure that all the possible indirect impacts of the project/plan - in combination with other plans and projects have been established.

Potential effects could arise from the following:

- Potential effects from loss of habitat
- Potential effects from noise and disturbance
- Potential effects on from surface water runoff/discharges
- Potential effects from wastewater discharges
- Potential effects from spread of invasive species
- In-combination effects.

4.11.1 Loss of habitat

The proposed development site is located 9.8km from Cork Harbour SPA at its closest point. An ecological appraisal of the site indicates that it supports common habitats which are not of high value in the context of European designations. The habitats recorded within the proposed development site do not correspond to habitats listed on Annex I of the Habitats Directive.

The proposed development site is located within managed grassland on the edge of an urban landscape. there are no permanent wetland which could provide valuable foraging or roosting habitat for wading birds within or in immediate proximity to the proposed site boundary. The periodically waterlogged grassland (and other grassland) habitats within the site could potentially provide roosting or foraging habitat for wading birds and waterfowl. However, winter bird surveys over 2024 and 2025 found no SCI birds within or in the vicinity of the proposed development site.

In a study around Cork Harbour (NIS for the M28 Cork to Ringaskiddy Project (RPS 2017)) a detailed study was carried out on grasslands in the vicinity of Cork Harbour to determine the value of these habitats for roosting and foraging SCI birds. This study found that while SCI birds occasionally used fields, they found that these grassland areas are not routinely used as a feeding habitat for the SCI species associated with Cork Harbour SPA. In addition, this study concluded that there is, effectively, an unlimited supply of potentially suitable grassland habitat in the vicinity of Cork Harbour, although there may be variations in habitat quality.

In the absence of any specific European or Irish guidance in relation to establishing ecological connectivity to SPAs NatureScot (SNH, 2016) was consulted. This document provides

guidance in relation to the identification of ecological connectivity between development sites and SPAs. The guidance takes into consideration the distances species may travel beyond the boundary of relevant SPAs and provides information on dispersal and foraging ranges of bird species which are frequently encountered when considering plans and projects. It goes on to state that "*in most cases the core range should be used when determining whether there is connectivity between the proposal and the qualifying Interests*". Where SPAs are at greater distance from the site than the core foraging distances for their listed Special Conservation Interest (SCI) species, there is no likely ecological connectivity to the development and so the SPAs are outside the likely Zone of Impact.

Core ranges are not available for all SCI species of Cork Harbour SPA. However the following may be indicative or core range for other wading birds. According to NatureScot guidance (SNH, 2016), the core foraging distances of Dunlin is 500m (max 3km), Curlew 1km (max 2km) and Golden Plover 2km (max 11km). Given there are no wetland features of significance of the site, ducks and diving SCI species will not forage at the site e.g. Cormorant, Little Grebe, Great Crested Grebe, Common Tern. Based on the above, the proposed development site is essentially outside the core range for SCI birds of Cork Harbour SPA.

Given the results of the field surveys and the distance from the SPA boundary it is concluded that the grassland onsite do not represent critical foraging or roosting habitat for the SCI birds of Cork Harbour SPA. No signs of SCI birds were recorded here, or in the fields surrounding the proposed development site during the site survey. Given the availability of large areas of similar habitat in the immediate vicinity and wider area, there will be no impact on SCI from loss of foraging or roosting habitat. Considering its distance from the SPA, the core ranges of SCI birds and the absence of permanent wetland habitats in the vicinity, this site does not provide critical roosting or foraging habitat for SCI birds. The proposed development will not result in any significant loss of *ex situ* foraging or roosting habitat for SCI birds for the Cork Harbour SPA.

Considering the above no likely significant effects on European sites from loss of habitat due to the proposed development have been identified.

4.11.2 Noise and disturbance

Potentially increased noise and disturbance associated with the site works could cause disturbance/displacement of fauna. If of sufficient severity, there could be impacts on reproductive success. Disturbance can cause sensitive species, such as birds, to deviate from their normal, preferred behaviour, resulting in stress, increased energy expenditure and, in some cases, species mortality.

The potential effects and impacts of disturbance have been widely recognised in wildlife conservation legislation, as has the need to develop conservation measures for birds whilst taking human activities into account. Article 4.4 of the Bird's Directive (79/409/EEC) requires member states to "*take appropriate steps to avoid… any disturbances affecting the birds, in so far as these would be significant having regard to the objectives of this Article*". This specifically relates to conservation measures concerning Annex I species.

The wintering birds listed as qualifying interests for the Cork Harbour SPA are strongly associated with estuarine shoreline areas or wetlands - habitat types absent from the proposed development area.

It is noted that the proposed development area is located 9.8km from the SPA boundary and is located adjacent to existing urban road networks and residential developments. As noted in **Section 8.1**, this area does not provide critical habitat for SCI birds. Given the absence of valuable habitats within and in the vicinity of the site, any increases in disturbance at the site during construction and operation will not impact on SCI birds.

No valuable habitat for SCI species was recorded within or adjacent to the proposed development area. The construction phase of the project will increase noise and disturbance, which may have short-term disturbance effects on local wildlife. However, given the lack of valuable habitat for SCI species on or near the proposed development area, no impact on birds listed as qualifying interests for the Cork Harbour SPA is predicted to occur. No likely significant effects on European sites from noise and disturbance due to the proposed development have been identified.

4.11.3 Surface water runoff/discharges

Potential impacts on aquatic habitats which can arise from surface water emissions associated with the construction phase of the proposed development include increased silt levels in surface water run-off, inadvertent spillages of hydrocarbons from fuel and hydraulic fluid and spillage of cementous materials.

The proposed development site is located c.15.5km upstream of Cork Harbour SPA. Silt-laden stormwater run-off during site preparation, site clearance, dewatering of excavations and construction of site access roads as well as spillages of fuel and oil and concrete / cement run-off could potentially impact on water quality within the Maglin North Stream and the Cork Harbour SPA downstream of the proposed development site.

During operation surface water from the site will discharges to the Maglin North Stream. In the absence of mitigation, hydrocarbons from the parking areas could be carried in the stormwater and increased volumes of stormwater as a result of increased areas of impermeable surfaces could also occur during operation. The southern margin of the site is within the flood extents area as mapped in the Ballincollig drainage study and as identified in the site-specific flood risk assessment. The sustainable access corridor to serve the development goes through the flood plain; the residential-zoned lands, to be raised, extend into the flood plain; and the open space between the proposed road and housing, to be filled, are in the flood plain. As such, the development will reduce / displace flood storage capacity, potentially increasing flood extents elsewhere.

Therefore, the conservation objectives of Cork Harbour SPA may be impacted by surface water runoff/discharges (as well as changes in flood extents) during construction and operation and likely significant effects from surface water emissions cannot be excluded in the absence of mitigation.

4.11.4 Wastewater discharges during operation

The proposed housing development could potentially result in an increase in nutrients discharging to Cork Harbour via the River Lee discharge for the Ballincollig Wastewater Treatment Plant (WWTP). Increased nutrients can potentially impact on estuarine habitats by changing baseline ecological conditions and increasing algal growth, which in turn could impact on feeding success for birds listed as qualifying interests for the Cork Harbour SPA.

Wastewater from the proposed development will be conveyed for treatment to Ballincollig WWTP. The Ballincollig agglomeration is served by a wastewater treatment plant with a Plant Capacity Population Equivalent (P.E.) of 33,000. The agglomeration consists of one primary discharge point which discharges to the River Lee, located approximately 14.6km upstream of the Cork Harbour SPA.

The WWTP obtained a discharge licence (Reg: D0049-01) from the EPA and has assigned emission limit values (ELV's) for a range of parameters to ensure a high degree of protection to the River Lee, the Lee Estuary and surrounding waters.

Treated effluent from the proposed development will discharge from the Ballincollig WWTP via the main treated effluent line. The discharge licence assigns ELV's for total phosphorous (Total P), chemical oxygen demand (COD), total suspended solids (TSS), biological oxygen demand (BOD), Ammonia, pH and orthophosphate. The ELVs are set based on the full design capacity (P.E. 33,000) and are aimed at providing a high degree of protection to the receiving water body and to ensure the receiving waterbody is capable of accommodating the proposed discharge without causing or exacerbating a breach in the relevant standards.

It is noted that the proposed occupancy of the housing development is approximately Total PE for the development can be taken as 870.8 PE (based on 2.7 persons per dwelling and 60.8 PE for creche). Based on the most recent EPA data (Source Envision mapping) the agglomeration PE for Ballincollig WWTP was 25,105 (AER 2024). The proposed development would increase the current WWTP P.E. from 25,105 to 25,975.80, which is well within the 33,000 P.E. design capacity.

The most recent AER (2024) notes that the final effluent from the Primary Discharge Point was non-compliant with the Emission Limit Values for Ammonia-Total (as N) mg/l Total Nitrogen mg/l which were linked to adverse weather events. The following was noted:

- *The WWTP discharge was not compliant with the ELV's set in the wastewater discharge licence for the following: Total Nitrogen mg/l, Ammonia-Total (as N) mg/l.*
- *The ambient monitoring results does meet the required EQS at the downstream monitoring location. The EQS relates to the Oxygenation and Nutrient*
- *Conditions set out in the Surface Water Regulations 2009.*
- *The discharge from the wastewater treatment plant does not have an observable impact on the water quality.*
- *The discharge from the wastewater treatment plant does not have an observable negative impact on the Water Framework Directive status.*

It is noted that the annual mean hydraulic loading is less than the peak Treatment Plant Capacity. The annual maximum hydraulic loading is less than the peak Treatment Plant Capacity.

A Pre-Connection Enquiry was submitted to Irish Water which confirmed that, subject to a valid connection agreement being put in place, the proposed connection to the Irish Water network could be facilitated (See **Appendix 3**).

The addition of the effluent discharge from the proposed Carriganarra LRD to the Ballincollig WWTP is well within its design capacity and will not comprise the operational capability of the WWTP to treat effluent to comply with emission limit values. Therefore, the no significant impacts are predicted from the proposed development given the current operating conditions at the WWTP. The WWTP discharge is located 14.6km upstream of Cork Harbour SPA. Minor increases in nutrient levels potentially discharged by the WWTP will not have a significant impact water quality within the River Lee and/or the Cork Harbour SPA. Therefore, no likely significant effects on water quality within European sites from wastewater discharges have been identified.

4.11.5 Spread of Invasive Species

No high-risk invasive species were recorded within the proposed development area. The other invasive species recorded within the proposed development site i.e. Buddleia and Wild clematis, do not have the potential to impact estuarine habitats over 15km downstream.

Therefore, there no likely significant effects on Cork Harbour SPA via impacts from the spread of invasive species have been identified.

4.11.6 In-combination Impacts

In-combination impacts refer to a series of individual impacts that may, in combination, produce a significant effect. The underlying intention of this in combination provision is to take account of in-combination impacts from existing or proposed plans and projects and these will often only occur over time.

Article 6(3) of the Habitats Directive requires that:

Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.

It is therefore required that the potential impacts of the proposed development are considered in-combination with any other relevant plans or projects.

As Cork Harbour SPA is adjacent to a major urban centre and a major industrial centre, water quality is variable, with the estuary of the River Lee and parts of the Inner Harbour being somewhat eutrophic. However, the polluted conditions may not be having significant impacts on the bird populations. The Natura 2000 Standard Data Form for Cork Harbour SPA notes that there are no serious imminent threats to the wintering birds even though the intertidal areas receive polluted water. Oil pollution from shipping in Cork Harbour is a general threat. Aquaculture occurs though it is not known if this has significant impacts on the birds. Recreational activities are high in some areas, including jet skiing which causes disturbance to roosting birds. Extensive areas of estuarine habitat have been reclaimed since about the 1950s for industrial, port-related and road projects, and further reclamation remains a threat.

An assessment of plans and projects with the potential for in-combination effects in association with the proposed development was undertaken. A search of planning applications in the vicinity of the proposed development was undertaken in January 2026 to examine projects with potential for in-combination effects (Source: Cork City Council, An Bord Pleanála,

EPA). Other projects or developments which could potentially cause in-combination impacts are listed in **Table 8**.

Table 8. Other projects or developments which could lead to potential in-combination impacts

Plans and Projects European Network	Key Policies/Issues/Objectives Directly Related to the Conservation of the	
River Basin Management Plan 2022-2027	The project should comply with the environmental objectives of the Irish RBMP which are to be achieved generally by 2027. • Ensure full compliance with relevant EU legislation • Prevent deterioration • Meeting the objectives for designated protected areas • Protect high status waters Implement targeted actions and pilot schemes in focus sub-catchments aimed at: targeting water bodies close to meeting their objective and addressing more complex issues which will build knowledge for the third cycle.	The implementation and compliance with key environmental policies, issues and objectives of this management plan will result in positive in-combination effects to European sites. The implementation of this plan will have a positive impact for the biodiversity. It will not contribute to in-combination impacts with the proposed development.
Inland Fisheries Ireland Corporate Plan 2021-2025	To ensure that Ireland's fish populations are managed and protected to ensure their conservation status remains favourable. That they provide a basis for a sustainable world class recreational angling product, and those pristine aquatic habitats are also enjoyed for other recreational uses. To develop and improve fish habitats and ensure that the conditions required for fish populations to thrive are sustained and protected. To grow the number of anglers and ensure the needs of IFI's other key stakeholders are being met in a sustainable conservation focused manner. EU (Quality of Salmonid Waters) Regulations 1988. All works during development and operation of the project must aim to conserve fish and other species of fauna and flora habitat; biodiversity of inland fisheries and ecosystems and protect spawning Salmon and trout.	The implementation and compliance with key environmental issues and objectives of this corporate plan will result in positive on-combination effects to European sites. The implementation of this corporate plan will have a positive impact for biodiversity of inland fisheries and ecosystems. It will not contribute to in-combination or cumulative impacts with the proposed development.
Irish Water Capital Investment Plan 2020-2024	Proposals to upgrade and secure water services and water treatment services countrywide.	Likely net positive impact due to water conservation and more effective treatment of water. It will not contribute to in-combination impacts with the proposed development.
Water Services Strategic Plan (WSSP, 2015)	Irish Water has prepared a Water Services Strategic Plan (WSSP, 2015), under Section 33 of the Water Service No. 2 Act of 2013 to address the delivery of strategic objectives which will contribute towards improved water quality and biodiversity requirements through reducing: • Habitat loss and disturbance from new / upgraded infrastructure; • Species disturbance; • Changes to water quality or quantity; and • Nutrient enrichment /eutrophication.	The WSSP forms the highest tier of asset management plans (Tier 1) which Irish Water prepare and it sets the overarching framework for subsequent detailed implementation plans (Tier 2) and water services projects (Tier 3). The WSSP sets out the challenges we face as a country in relation to the provision of water services and identifies strategic national priorities. It includes Irish Water's short, medium and long-term objectives and identifies strategies to achieve these objectives. As such, the plan provides the context for subsequent detailed implementation plans (Tier 2) which will document the approach to be used for key water service areas such as water resource management, wastewater compliance and sludge management. The WSSP also sets out the strategic objectives against which the Irish Water Capital Investment Programme is developed. The current version of the CAP outlines the proposals for capital expenditure in terms of upgrades and new builds within the Irish Water owned assets. The overarching strategy was subject to AA and highlighted the need for additional plan/project environmental assessments to be carried out at the tier 2 and tier 3 level. Therefore, significant in-combination effects can be ruled out.
WWTP discharges	Coachord, Dripsey, Macroom, Cloghduv	Discharges from municipal WWTPs are required to meet water quality standards. Irish Water Capital Investment Plan 2022-2024 proposes to upgrade water treatment services countrywide. Therefore, significant in-combination effects can be ruled out.

Plans and Projects European Network	Key Policies/Issues/Objectives Directly Related to the Conservation of the	
Other developments in the vicinity		
	Murnane and O'Shea Ltd. 25/44048. Large scale residential development (LRD) of 544 no. residential units, a two storey creche facility, commercial/retail unit and ancillary development at Greenfield, Ballincollig, Co. Cork. Located c.1.8km west. Cork Luas Emerging preferred routes Coleman Homes 24/43308 Creche. permitted 07/10/2024. c.830m west Coleman Home 23/42446 Large scale residential development (LRD) of 162 units, landscaping and all ancillary site works. Maglin Road, Ballincollig. Development permitted and under construction. c.830m west MOS Homes Limited 22/41644 Construction of 98 dwellings at Heathfield, Ballincollig. Development permitted and under construction. Along northern boundary. MOS Homes Limited 26/44475. Construction of 11 no. dwellings at Heathfield, Ballincollig. Along northern boundary. O'Flynn construction 25/44222. LRD for the construction of 1,150 no. residential units, 1 no. creche, 3 no. retail units at Maglin, Ballincollig. C.700 west	As noted above, no likely significant effects from noise or disturbance have been identified with the project and therefore, no potential in-combination effects have been identified for noise and disturbance. In the absence of mitigation, the potential for significant in-combination effects on Cork Harbour SPA with other projects from emissions to water during construction and operation cannot be ruled out. No other significant in-combination impacts have been identified. There are no projects which could have a potential significant in-combination effect along with the proposed development.

As noted in **Section 4.7.4**, the proposed development will connect Ballincollig WWTP which currently has capacity for this discharge (based on most recent EPA data). The Ballincollig WWTP has considerable headroom available for the current and other permitted/proposed developments in the Ballincollig agglomeration. The WWTP is currently not having an observable negative effect on water quality or on the Water Framework Directive status within the River Lee/Lee Estuary downstream and no effects of cumulative wastewater loading for the proposed development have been identified. Therefore, no likely significant in-combination impacts due to foul effluent discharges from the proposed development have been identified.

In the absence of mitigation, the potential for significant in-combination effects on Cork Harbour SPA with certain projects identified in **Table 8** from emissions to water during construction and operation cannot be ruled out.

4.12 Stage One Appropriate Assessment Conclusions

4.12.1 Screening of Relevant Natura 2000 Sites and Qualifying Interests/Special Conservation Interests

Potential significant effects on Cork Harbour SPA cannot be ruled out. Screening conclusions with regards to the qualifying species and habitats for relevant European sites are provided in **Table 9**. No significant effects on the conservation objectives of other European sites will occur. Sites/QIs/SCIs that are screened in for further assessment are highlighted in bold.

Table 9. Screening of relevant European sites

Natura 2000 Site	Qualifying Interest	Potential Impacts	Screened In/Out
Cork Harbour SPA (Site code 004030)	▪ **A056 Shoveler *Anas clypeata*** ▪ **A149 Dunlin *Calidris alpina*** ▪ **A140 Golden Plover *Pluvialis apricaria*** ▪ **A050 Wigeon *Anas penelope*** ▪ **A028 Grey Heron *Ardea cinerea*** ▪ **A069 Red- breasted merganser *Mergus serrator*** ▪ **A142 Lapwing *Vanellus vanellus*** ▪ **A130 Oystercatcher *Haematopus ostralegus*** ▪ **A141 Grey plover *Pluvialis squatarola*** ▪ **A052 Teal *Anas crecca*** ▪ **A05 Pintail *Anas acuta*** ▪ **A157 Bar-tailed Godwit *Limosa lapponica*** ▪ **A162 Redshank *Tringa totanus*** ▪ **A183 Lesser Black-backed gull *Larus fuscus*** ▪ **A179 Black-headed Gull *Chroicocephalus ridibundus*** ▪ **A004 Little Grebe *Tachybaptus ruficollis*** ▪ **A160 Curlew *Numenius arquata*** ▪ **A182 Common Gull *Larus canus*** ▪ **A048 Shelduck *Tadorna tadorna*** ▪ **A017 Cormorant *Phalacrocorax carbo*** ▪ **A193 Common Tern *Sterna hirundo*** ▪ **A005 Great crested grebe *Podiceps cristatus*** ▪ **A156 Black-tailed Godwit *Limosa limosa*** ▪ **A999 Wetlands and waterbirds**	Given the potential impacts from surface water runoff/discharges and potential changes in flood extents during construction/operation and the hydrological connection of the proposed development site to the SPA, significant effects cannot be ruled out due to impacts on water quality during the construction and operational phase. The proposed development site does not provide habitat that is relied upon by SCI Birds. Given the distance from valuable roosting and foraging habitats within the SPA, the absence of valuable foraging/roosting habitats within the proposed development site, and the existing noise/disturbance environment, significant adverse effects on Cork Harbour SPA from noise and disturbance on *ex-situ* habitats can be excluded. In the absence of mitigation, the potential for significant adverse in-combination effects on Cork Harbour SPA from emissions to water during construction and operation cannot be ruled out. No other significant in-combination impacts have been identified. No significant impacts from loss of habitat, foul water discharges, emissions to air or the spread of invasive species have been identified.	Screened in (surface water)

4.12.2 Screening conclusion

The aims of this screening section of this report were as follows:

- Determine whether the proposed development, alone or in combination with other projects, is likely to have significant effects on Natura 2000 sites in view of their conservation objectives.
- Provide information on and assess the potential for the proposed development to significantly impact on Natura 2000 Sites (also known as European sites).
- Determine whether the proposed development is directly connected with, or necessary to the conservation management of any Natura 2000 sites.

It has been objectively concluded that:

- The proposed development is not directly connected with, or necessary to the conservation management of any Natura 2000 sites.
- On the basis of objective information, the possibility of significant effects from the proposed development on European sites cannot be excluded. There is potential for the proposed development to significantly impact the Cork Harbour SPA via impacts on water quality during construction and operation (surface water).
- The proposed development, alone or in combination with other projects could potentially impact on the conservation objectives of Cork Harbour SPA.

On the basis of objective information and in view of best scientific knowledge, the possibility of significant effects from the proposed development on the Cork Harbour SPA, cannot be ruled out and therefore an Appropriate Assessment is required.

The NIS (below) has been prepared to inform and assist Cork City Council, to assess, in view of best scientific knowledge, if the proposed development, individually or in combination with another plan or project is likely to have a significant effects on Cork Harbour SPA.

5. Stage 2 – Natura Impact Statement

5.1 Introduction

The main objective of this stage (Stage 2, Natura Impact Statement) in the Appropriate Assessment process is to determine whether the proposed LRD at Greenfield, Ballincollig, Co. Cork (either alone or in combination with other plans, programmes and projects) will result in significant adverse impacts to the integrity of the Natura 2000 sites identified in the previous section i.e., Cork Harbour SPA with respect to the site's structure, function and/or conservation objectives. This stage also outlines the mitigation measures that should be taken in order to avoid any negative impacts associated with the proposed development.

5.2 Status of qualifying interests for the Cork Harbour SPA

Cork Harbour SPA is a large, sheltered bay system that is an internationally important wetland site, regularly supporting in excess of 20,000 wintering waterfowl, for which it is amongst the top ten sites in the country. Owing to the sheltered conditions, the intertidal flats are often muddy in character but described principally as 'mixed sediment to sandy mud with polychaetes and oligochaetes'. These muds support a range of macro-invertebrates, notably *Macoma balthica, Scrobicularia plana, Peringia (Hydrobia) ulvae, Nepthys hombergi, Nereis diversicolor* and *Corophium volutator*, all of which provide a food source for many wintering waterbird species. Salt marshes are scattered through the site and these provide high tide roosts for waterbirds (NPWS 2014b).

The specific conservation objectives for the species listed as conservation interests for the Cork Harbour SPA (**Table 10**) are to maintain a favourable conservation condition of the non-breeding/breeding waterbirds and to maintain the favourable conservation condition of the wetland habitat at Cork Harbour SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.

Table 10. SCI species for which a potential impact has been identified – specific targets

Species/Habitats	Attribute	Measure	Target
Little Grebe Great Crested Grebe Cormorant Grey Heron Shelduck Wigeon Teal Pintail Shoveler Red-breasted Merganser Oystercatcher Golden Plover Grey Plover Lapwing Dunlin Black-tailed Godwit Bar-tailed Godwit Curlew	Population trend	Percentage change	Long term population trend stable or increasing
	Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by each species, other than that occurring from natural patterns of variation

Species/Habitats	Attribute	Measure	Target
Redshank Black-headed Gull Common Gull Lesser Black-backed Gull			
Common Tern	Breeding population abundance: apparently occupied nests (AONs)	Number	No significant decline
	Productivity rate: fledged young per breeding pair	Mean number	No significant decline
	Distribution: breeding colonies	Number; location; area (hectares)	No significant decline
	Prey biomass available	Kilogrammes	No significant decline
	Barriers to connectivity	Number; location; shape; area (hectares)	No significant increase
	Disturbance at the breeding site	Level of impact	Human activities should occur at levels that do not adversely affect the breeding common tern population
Wetlands	Habitat area	Hectares	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 2,587 hectares, other than that occurring from natural patterns of variation

The Conservation Objectives Supporting document for Cork Harbour SPA (NPWS, 2014c) provides a review of the site conservation condition and population trends for Cork Harbour SPA with regard to species' all-Ireland and international trends. All-Ireland trends follow I-WeBS data 1994-2015 (Birdwatch Ireland 2022) while International trends follow Wetlands International (2012). The conservation status of Cork Harbour SPA's SCI birds are included in **Table 11**.

Table 11. Conservation Status of SCI species within Cork Harbour

Special Conservation Interests	BoCCI Category [1]	Site conservation condition[2]	Current All-Ireland Trend[3]	Current International Trend[4]
Shelduck	Amber	Unfavourable	Declining	Increasing
Wigeon	Amber	Unfavourable	Declining	Stable
Teal	Amber	Intermediate (Unfavourable)	Stable	Increasing
Pintail	Amber	Highly unfavourable	Stable	Increasing
Shoveler	Red	Highly unfavourable	Stable	Increasing
Red-breasted Merganser	Amber	Highly unfavourable	Stable	n/c
Little Grebe	Green	Favourable	Increasing	Increasing
Great Crested Grebe	Amber	Unfavourable	Stable	Declining?
Cormorant	Amber	Highly unfavourable	Stable	Increasing
Grey Heron	Green	Intermediate	Stable	Increasing
Oystercatcher	Red	Intermediate (unfavourable)	Stable	Declining
Golden Plover	Red	Favourable	Declining	Declining
Grey Plover	Red	Highly unfavourable	Declining	Declining?
Lapwing	Red	Highly unfavourable	Declining	Stable
Dunlin	Red	Unfavourable	Declining	Stable
Black-tailed Godwit	Red	Favourable	Increasing	Increasing
Bar-tailed Godwit	Red	Favourable	Stable	Increasing
Curlew	Red	Unfavourable	Declining	Declining
Redshank	Red	Unfavourable	Stable	Stable/increasing
Black-headed Gull	Amber	Highly unfavourable	n/c	n/c
Common Gull	Amber	Highly unfavourable	n/c	n/c
Lesser Black-backed Gull	Amber	Highly unfavourable	n/c	n/c

1. Gilbert et al. 2021. 2. NPWS, 2014c, 3. Birdwatch Ireland I-WeBS 1994-2015, 4. Wetlands International (2012)

6. Assessment of Likely Significant Effects

All likely significant effects relate to surface water runoff/discharges during construction and operation. Based on the *Managing Natura 2000 Sites: The Provision of Article 6 of the Habitats Directive 92/43/EEC* (European Commission (EC), 2018 and CIEEM guidelines '*Guidelines for Ecological Impact Assessment*' (CIEEM, 2019) impacts are listed as significant using a combination of professional judgement and criteria or standards where available, if impacts have the potential to have a significant impact on the ecological integrity on the habitats and species for which the site is designated.

The potential impacts associated with the proposed development are discussed in the following section with respect to their likelihood to have significant impacts on European sites.

As part of the assessment direct, indirect and in-combination impacts were considered. Direct impacts refer to habitat loss or fragmentation arising from land-take requirements for development. Indirect and secondary impacts do not have a straight-line route between cause and effect, and it is potentially more challenging to ensure that all the possible indirect impacts of the project/plan - in combination with other plans and projects have been established.

Likely significant effects were identified as follows:

- Surface water runoff during construction
- Surface water discharges during operation
- In-combination impacts

6.1 Surface water runoff during construction

Potential impacts on aquatic habitats which can arise from this type of development include increased silt levels in surface water run-off, silt from dewatering of excavations, concrete spillage and hydrocarbon spillage. In the absence of appropriate design and mitigation, high levels of silt in surface water run-off from construction works, could theoretically impact on fish species. If of sufficient severity, adult fish could theoretically be affected by increased silt levels as gills may become damaged by exposure to elevated suspended solids levels. Excessive siltation can cause eggs and fry to be smothered. In particular impacts on spawning lamprey and salmonids can be significant. If of sufficient severity, aquatic invertebrates may be smothered by excessive deposits of silt from suspended solids. In areas of stony substrate, silt deposits may result in a change in the macro-invertebrate species composition, favouring less diverse assemblages and impacting on sensitive species. Aquatic plant communities may also be affected by increased siltation. Submerged plants may be stunted and photosynthesis may be reduced.

Inadvertent spillages of hydrocarbons during construction could introduce toxic chemicals into the aquatic environment via surface water run-off or groundwater contamination and have a direct toxicological impact on habitats and fauna.

The Maglin North Stream (EPA name Grange Hill; River waterbody code IE_SW_19C120740), a tributary of Curraheen Stream, runs along the western boundary of the proposed development site. Cork Harbour SPA is located 15.5km downstream of this point. Therefore surface water run-off during the construction could potentially flow into the Cork Harbour SPA via the Maglin North Stream (15.5km downstream).

Given the proximity of the Maglin North Stream to the construction works area, a range of mitigation measures have been specified to prevent impacts on water quality. **Section 7** of this report (as well as in the Construction, Environmental, Management Plan (CEMP)) include a range of site specific measures to prevent adverse effects on local water quality. The infilling of the lands between the sustainable access corridor and the residential units will also be set back 10m from the riverbank. Hydrocarbon, cement and silt control measures will be implemented throughout construction works. Ongoing monitoring of the Maglin North Stream will be conducted during construction works. The proposed single-span bridge across the Maglin North Stream will not require instream works.

Given the surface water mitigation measures will ensure there are no adverse effects on local water quality, there will be no adverse effects on the conservation objectives of the Cork Harbour SPA from construction surface water runoff during construction works.

6.2 Surface water discharges during operation

During operation, the proposed surface water management system is designed, as much as is feasible, in accordance with the principles of Sustainable Drainage Systems (SuDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS). The runoff from the site will be controlled and managed using a suite of SuDS and engineering controls designed for a 1:100-year storm event plus a 20% allowance for climate change. These will include rainwater harvesting (water butts – to be retrofitted by homeowners), infiltration basins, filter drains, tree pits, raingarden / bioretention tree pits, blue / green roofs, and attenuation tanks fitted with flow control devices. Hydrocarbon interceptors will also be installed upstream of each attenuation tank. SuDS features to management runoff from the sustainable access corridor and filled areas include filter strips, filter drains and bioretention strips. The filled areas will be graded to direct overland flow to the filter drains to bring surface water to the west. The overall management will limit discharge from the site to greenfield rates – 21.8 l/sec for the residential area (outfall No.1) and 2.9 l/sec for the sustainable access corridor (outfall No.2).

With the potential for oil spills and leaks from cars parked in the development, hydrocarbon interceptors and grit traps are included in the drainage design to protect the water quality in the Maglin North River. The hydrocarbon interceptors will be cleaned and maintained by the management company.

The SuDS infrastructure proposed has regard to the underlying karst limestone bedrock. Infiltration to the subsurface has been minimised. Engineering solutions are proposed to manage stormwater runoff – 6 No. tanks are proposed. Discharge from the site will be to 2 No. areas of stone riprap at the head of constructed open drains with setbacks of approximately 10m from the river. These will dissipate energy and avoid bank erosion / scouring in the drains and riverbed.

MWP has carried out a Site-Specific Flood Risk Assessment (SSFRA) for the proposed development.. The SSFRA had regard to findings of the Ballincollig drainage study, which identified flooding extending into the southern portion of the site for a 1:100-year rainstorm event. The conclusion of the SSFRA is that, with the recommended mitigation (refer to **Section 4.10.4**), the development is at low risk of flooding for the design event and that it will result in only slight changes to the flood levels in adjoining lands. It concluded that there will be higher flood levels upstream of the sustainable access corridor of up 360mm extending approximately 350m upstream. Downstream of the sustainable access corridor increases of up to 50mm extending for 250m would be experienced. These increase flood levels occur in areas already identified as being at risk of flooding, with only a slight increase in extents on the upstream side of the sustainable access corridor. No increased flood risk has been identified to sites further downstream i.e. Lee Estuary and/or Cork Harbour SPA.

The operational surface water design measures will ensure there are no significant impact on local water quality, rates of runoff to local watercourse and flood risk to sites downstream.

Therefore, there will be no adverse effects on the conservation objectives of the Cork Harbour SPA from operational surface water discharges.

7. Mitigation Measures

The mitigation measures have been drawn up in line with current best practice and include an avoidance of sensitive habitats at the design stage and mitigation measures will function effectively in preventing significant ecological impacts. The following mitigation measures will be implemented:

A Construction Environmental Management Plan (CEMP) has been prepared (by DOSA Consulting Engineers) for the proposed development and this contains construction mitigation measures, which are also set out in this report.

7.1 Stripping & Earthworks

In parallel with access road construction the main earthmoving works will be undertaken on the site. As the plant required for this phase will remain on site and not leave until the work is complete and the materials input is minimal, it is considered that the site access outlined will be adequate to cater for the construction works.

Level platforms will be excavated for each residential building and there will be a requirement to import stone material for the access roads and to the front of each dwelling. Measures will be in place to contain dust and/or to ensure that mud and other debris are kept off the public roadways. Existing on-site material will be reprofiled where suitable. External material will be imported from licensed and regulated quarries.

If during the course of development external suitable material becomes available the process of importing same under an Article 27 agreement will be explored and implemented. Article 27 of the European Communities (Waste Directive) Regulations, 2011, allows an “economic operator” to decide, under certain circumstances, that a material is a by-product and not a waste.

All works will be carried out in accordance with Departmental guidelines and procedure.

7.2 Bulk Earthworks

The proposed topography on site has been estimates using Kubla Cubed volumetric analysis software. This software utilises earthworks TIN (Triangulated Irregular Networks) prism volume calculation engine to estimate volumes. A TIN is a network of interconnected triangles that represent the surface of the land. The software then uses these TINs to calculate the volume of the earth moved by creating prisms between the existing and proposed ground surfaces. Each prism is essentially a three-dimensional shape with a triangular base and a height representing the difference in elevation between the existing and proposed ground. By summing the volumes of all these prisms, the software can accurately estimate the cut and fill volumes for the project.

The duration that subsoils layers are exposed to the effects of weather shall be minimised. Disturbed subsoil layers will be stabilised as soon as practicable (e.g., backfill of service trenches, construction of road capping layers, construction of building foundations and completion of landscaping). Similar to comments regarding stripped topsoil, stockpiles of excavated subsoil material shall be protected for the duration of the works. Stockpiles of subsoil material shall be located separately from topsoil stockpiles. These stockpiles will be monitored throughout the construction phase. Monitoring of ground conditions and stability of excavations will be monitored on an on-going basis. Once the earthworks and landscaping are completed, the risk of sediment loading of water courses is significantly reduced.

The proposed mitigation measures for both the construction and operational phases include:

- Careful selection of stockpile locations to-avoid, as far as practical, double handling of materials; avoid steep slopes; avoid natural overland flow paths of stormwater runoff; provide shelter from the prevailing wind direction.
- Blading off the vegetative layer (for separate storage). Vegetation will not be incorporated in the stripped topsoil.
- Avoid stripping in inclement wet weather conditions. Wet soils are more difficult to work and handle and it is more likely to damage soil structure in wet conditions.
- Avoid extending topsoil stripping into the mineral soil layer. Limiting height of stockpiles to avoid anaerobic conditions occurring.
- Profiling of stockpiles to promote rainwater runoff.
- Check dams and / or straw bales will be installed along the alignment of roadside drainage to slow flows and remove silt. These will be constructed using clean stone and geotextile spanning across the drainage channel
- Placement of silt fencing downgradient of stockpiles to catch any fines carried by stormwater runoff.
- Stockpiles will be allowed vegetate naturally, which will reduce erosion by wind and water.
- A street sweeper will attend site regularly to clean the road when there are truck movements in and out of the site.
- Earthworks will be suspended during extreme weather conditions. An extreme rainfall event will be classified as an event that corresponds to the Met Éireann Orange–Weather Alert for Rainfall.
- Hard surface roads will be regularly swept to remove mud and aggregate materials from their surface.
- Public roads outside the site will be regularly inspected for cleanliness, and cleaned as necessary.
- Material handling systems and Site stockpiling of materials will be designed and laid out to minimise exposure to wind; and
- Water misting or sprays will be used on stockpiles as required if particularly dusty activities are necessary during dry or windy periods.

7.3 Storage and Use of Materials

Specific areas for storage, delivery and loading/unloading of materials will be designated, which will have appropriate containment/spill protection measures where required.

Handling and storage areas will be actively managed and fine, dry material will be stored inside enclosed shields/coverings or within central storage areas.

A regular review of weather forecasts of heavy rainfall will be conducted, and a contingency plan will be prepared before and after such events to minimise any potential nuisances.

Discharge water generated during the placement of concrete will be stored and removed off-Site for treatment and disposal.

Prolonged exposure of contaminated soils or groundwater to the atmosphere will be avoided where practical or unnecessary.

7.4 Demolition

The construction of the proposed development will involve the demolition of four buildings, removal of hard surfacing and existing services. Material is to be disposed of to a landfill or facility licensed to take that class of material.

7.5 Maintenance of Plant and Machinery

All plant and equipment will be regularly cleaned and properly maintained and there will be no washing out of any concrete trucks on site. Pumped concrete will be monitored to ensure there is no accidental discharge and will be carried out in dry weather and with impermeable pouring mats laid down where possible.

7.6 Storage and Use of Fuels, Oils, and Chemicals

Where possible, refuelling of vehicles and equipment will not be carried out on site to minimise the potential for spills or leaks to occur. However, some fuel, lubricants and hydraulic fluids will need to be stored on site during construction works for equipment such as excavators and generators.

Appropriate bunding, storage and signage arrangements for all deleterious substances (e.g., fuels, oils, and chemicals) will be used.

Fuels, lubricants, and hydraulic fluids for equipment used on the construction Site will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to best codes of practice (Enterprise Ireland BPGCS005).

Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the Site for disposal or recycling.

Diesel tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled.

Spillage and leaks of oil from cars parked in the development during the Construction Phase Share unavoidable. To reduce the potential impacts, oil interceptors will be incorporated into the Site drainage design.

Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the Site and properly disposed of.

Refuelling will be carried out from tanks or delivery vehicles on a designated impermeable surface and will not be left unattended.

Plant will not be left running when not in use (i.e., no idling) and plant with dust arrestment equipment will be used where practical.

The fuel storage area will be properly secured to prevent unauthorised access or vandalism and all triggers will be locked when not in use. Spill kits and drip trays will be used during refuelling to collect any potential spills or overfills. No vehicles or containers will be left unattended during refuelling.

Mobile fuel bowsers may be used for refuelling heavy equipment. Bowsers used will be double skinned and spill kit/drip tray equipment will be used during refuelling which will take place away from any nearby drains or watercourses and from any surface water drainage gulley's.

Spill/Environmental Response Procedures

Robust and appropriate Spill Response Plan and Site Environmental Emergency Plans (SEP) will be implemented for the duration of the works.

Identifying fuel storage and refuelling locations on designated areas within the compound, away from drainage ditches/waterbodies, and on substrate underlain with an impermeable liner to prevent contaminant leaching to groundwater;

Identifying spill kit locations (spill kits will be required for each piece of heavy equipment (e.g., excavators, loaders, trucks, etc.,) which will be at least 21L drum size each with spill pads, sorbent, small boom, plastic garbage bag and gloves;

A specially trained and dedicated Environmental and Emergency Spill Response team will be appointed before the commencement of works on Site.

Staff will be trained and experienced in using appropriate control measures and spill kits on-Site, and will be familiar with the location of all spill kit locations and the Site layout.

A register will be kept of all hazardous substances either used on Site or expected to be present. The register shall be always available and shall include as a minimum:

Valid safety sheets; Health & Safety, environmental controls to be implemented when storing, handling, using and in the event of spillage of materials;

Emergency response procedures/precautions for each material;

Personal Protective Equipment (PPE) is required when using the material.

7.7 Training and Awareness

All site staff will be required to complete an induction prior to commencement of works on the site. The details of the site induction will be provided by the main contractor in the Construction Health & Safety Plan.

As part of the site induction, all site staff will be made aware of the presence of the sensitive ecological areas in the vicinity of the site. Employees will also be informed about the risks associated with stormwater runoff on site and will be required to ensure no runoff or chemicals will enter the adjoining network once installed.

During the project works, the Site Manager or Project Environmental Manager will deliver strategic toolbox talks focused on potential environmental and safety risks associated with the works being carried out at that stage of the project.

7.8 Surface Water Drainage

The storm water system will involve a network of underground pipelines and manholes discharging to an existing adjoining watercourse via an attenuation system, which will be fitted with flow control devices to ensure no increase in peak flows and an oil interceptor and silt trap to remove any traces of oil and silt washed off road surfaces.

The services layout drawings included at planning stage show the proposed surface water drainage layout for the entire site.

The proposed mitigation measures for both the construction and operational phases include:

- Silt traps such as a combination of an earthen berm, silt-fencing and associated interception trenches will be installed along the extent of the southern boundary of the Site adjoining the existing spine road, such that no contaminated surface water run-off can leave the Site.
- Settlement ponds will be lined with cohesive material, with the addition of an engineered liner where a sealed drainage system is in use, and outlet by infiltration will not be permitted in order to protect the receiving groundwater at the Site.
- Under no circumstances will wastewater from equipment, wheel or surface cleaning be allowed to discharge into any drainage ditches, the ground or downslope.
- Debris and sediment captured by vehicle wheel washes will be collected and disposed of off-Site at a licensed facility.

In addition, the below-listed measures serve to work in tandem with and complement efforts to mitigate sedimentation/siltation and the release of pollutants on Site during the Construction Phase.

- Site Environment Plan (SEP) identifying fuel storage and refuelling locations will be developed and this plan will also identify the spill kit locations. Spill response kits will be required for each piece of heavy equipment (i.e. Excavators, Loaders, Trucks) which will be at least 21 litre drum size each with spill pads, sorbent, small boom, plastic garbage bag and gloves.
- Silt traps will be installed on surface water drains during the site development works.

- Constructing buildings and roads above the flood level to ensure that back flows through the surface water outfalls will not occur.
- All foul and other waste water will be discharged to the foul drainage system. The storm drainage system with associated hydrocarbon interceptors and silt collection will be cleaned and maintained on an on-going basis throughout its lifetime in a manner and frequency that is in line with guidelines. All bypass separators are required by legislation to be fitted with an oil level alarm system with recommendations that the alarm is installed, tested, commissioned, and regularly serviced by a qualified technician. The alarm indicates when the separator needs immediate maintenance in order for it to continue to work effectively. The Environmental Agency's PPG3 guidelines stipulate that every 6 months, and in accordance with manufacturer's instructions, experienced personnel should carry out maintenance to both the separator and alarm. It is proposed to enter into a maintenance agreement with the bypass separator supplier will be to provide a full technical and service package including separator and alarm installation, commissioning, oil and silt removal and route service contracts.

The following measures will be implemented for the storage and use of hydrocarbons on site:

- Diesel tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled.
- Refuelling will be carried out from these tanks or from delivery vehicles and will not be left unattended.
- Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to best codes of practice - (Enterprise Ireland BPGCS005).
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the site and properly disposed of.
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling.
- The development's road network will be finished with tarmac or asphalt surface which will discharge runoff to a piped drainage system.
- Proven engineering practice will apply during the hydraulic design process.
- Surface water drains will be installed in roads and streets and in pre-determined wayleaves adjacent to building structures.
- Spillage and leaks of oil from cars parked in the development during the operational phase is unavoidable. To reduce the potential impacts, oil interceptors will be incorporated into the site drainage design.

- The area is serviced by mains gas and this utility will be provided to the new development. The use of home heating oil is therefore eliminated so the risk has been removed.

- The proposed development is not anticipated to cause an adverse impact on the surface water regime given the remedial and reductive measures previously outlined. Normal proven construction reinstatement and backfilling procedures will follow pipe laying, jointing, and testing procedures.

7.9 Bridge

A Bridge is proposed to carry the access road and services over the existing watercourse (Maglin North Stream) and incorporates a deck, supported on piers and abutments which are in turn supported by foundations. Abutments are formed to support the ends of the deck; piers are formed.

The main Bridge elements can be steel or concrete or combinations of these. Concrete can be cast on site (in situ) or can include precast units which are transported to the site. The exact form and materials used on the Bridge is specific depending on the nature of the Bridge, the alignment of road it carries, the distances between the abutments (spans). In this case the Bridge will most likely be predominantly a precast structure delivered to site.

The road surface on the Bridge deck will be a bituminous bound pavement laid on a waterproofing coat. Bridge deck waterproofing can either be a spray applied or sheet membrane system. The spray applied system comprises a solvent free methyl methacrylate resin spray and a polymer modified bituminous based hot melt adhesive tack coat. The sheet membrane system comprises a non-woven polyester reinforced, styrene-butadene-styrene (SBS) polymer modified bitumen sheet with a solvent-based bituminous primer and blown (oxidised) bitumen bonding. A steel parapet is also fixed to the Bridge deck.

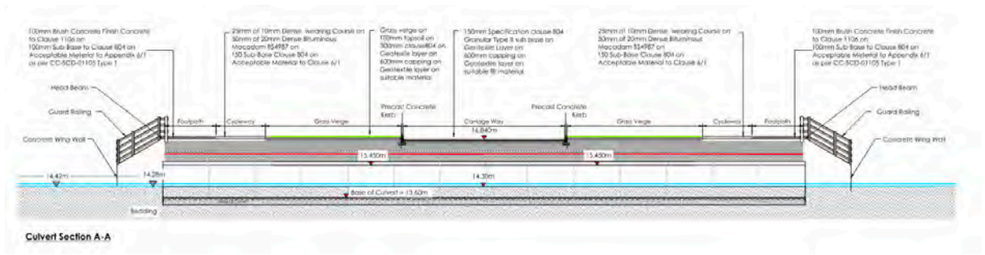


Figure 9. Bridge long section

7.9.1 Bridge Construction Sequence

Construction of the Bridge will commence when the earthworks embankments on the adjacent sections of road are at abutment level. Typical Bridge construction procedures may be summarised as follows:

Residential Development, Carriganarra, Ballincollig, Cork 226.4.1.1 Bridge Foundations Foundations are required for the abutments.Foundations can be either concrete pad or piled. Pad footings are generally constructed as follows:

• Excavation to a depth below formation level to a suitable founding soil strata.

• Laying a concrete layer, approximately 75 mm thick, at foundation formation level over the full extent of the rectangular foundation to produce a clean, flat plain surface, capable of containing the wet structural foundation concrete. The concrete layer is transported to the site in a concrete wagon.

• Fabricating cages of steel reinforcement, which is done on site, with bars protruding vertically for subsequent concrete pours.

• Placing formwork for the foundation slab. Formwork will be comprised of wooden or metal sheets supported by wooden stakes or other props.

• Transporting concrete to the site and pouring and compacting the concrete, by vibration, to required level, in formwork.

• Leaving the concrete for a period of time to enable it to cure before stripping the formwork to form foundation base.

• Steel reinforcement is fixed for the abutments followed by shutters for the pier.

• Placing concrete for the abutments, including vibration and finish to exposed top of concrete.

• Curing fresh concrete, stripping shutters, treating concrete surface and backfilling over excavations with acceptable material and compacting using a small machine operated compactor.

Piled foundations are generally constructed as follows:

• Carry out preliminary excavations at foundation positions.

• Install foundation piles to a suitable load bearing soil strata – this can either be by driving preconstructed concrete or steel to the required depth with a pile driver, or by using a boring machine to create the void for the pile, placing a casing in the void followed by lowering steel reinforcement and pouring concrete to form the pile.

• Complete excavations to the appropriate formation level.

• Trim projecting piles to required level using mechanical saws or cutting equipment.

• Construction of a reinforcement pile cap upon which piers and abutments will be constructed follows in a similar manner as the construction of the pad footing.

7.9.1 Bridge Abutments

• Abutments are concrete seats upon which the Bridge beams can be supported at each end of the Bridge. Construction of abutments is generally undertaken as follows:

• Fixing a grillage of steel reinforcement for abutment walls.

• Erecting vertical formwork for abutment walls.

• Erecting vertical formwork for abutment walls.

• Placing concrete in wall formwork and compacting by vibration.

• Removing shutters, curing concrete, treating exposed surfaces and applying waterproof membrane to faces retaining soil fill – the waterproof membrane can typically be a bitumen coating applied by brush or spray.

• A drain is laid behind the abutments comprising a small pipe with a granular surround.

• Placing and compacting granular fill, behind abutments and wing walls, to road formation level.

• Preparation of seatings for Bridge beams.

7.9.3 Bridge Deck

Bridge decks can be several different forms, as follows:

• Concrete deck cast on site (in situ deck).

• Beam and slab, with beams being precast concrete or steel, and the deck being concrete cast in situ.

• In situ decks are generally constructed as follows:

• Erecting formwork on staging to support the wet concrete forming the deck.

• Erecting a steel reinforcement cage within the formwork.

• Pumping concrete into the formwork and compacting by vibration.

• Preparing a finish to the top surface of the wet concrete by smoothing the concrete with a float.

• Leaving the concrete for a period of time to enable it to cure before removing the staging. Decks supported by beams are constructed as follows:

• Taking delivery of precast prestressed concrete or steel Bridge beams and erecting in position over temporary props at pier positions and abutments using cranes.

• Erecting soffit formwork, between and along outer edges of Bridge beams, and side forms for edge parapet beam and diaphragms / transverse beams.

• Fixing inserts for services and additional structural elements.

• Fixing grillage of steel reinforcement for in-situ concrete deck and parapet beam.

• Placing concrete for Bridge deck and in-situ edge beams. This is normally done as staged process. The first stage involves the concrete pour of the main deck sections, followed by the diaphragms / transverse beams and finally the edge beams.

• Curing deck concrete, stripping formwork, treating exposed surfaces.

• Waterproofing top of structural deck.

• Completing services.

• The deck is completed with construction of the verges/footways, and placement of the deck waterproofing system as described above. The final stages of Bridge construction include erecting metal parapet elements and applying pavement markings.

8. In-combination effects

Article 6(3) of the Habitats Directive requires that:

Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.

In-combination impacts refer to a series of individually modest impacts that may in combination produce a significant impact. The underlying intention of this in combination provision is to take account of in-combination impacts from existing or proposed plans and projects and these will often only occur over time.

High negative threats, pressures and activities identified for the Cork Harbour SPA include roads, motorways, port areas, industrial or commercial areas, urbanised areas, human habitation and marine and freshwater aquaculture. Other developments near the proposed development area and their potential in-combination impacts are listed in **Table 8**.

The other projects included in Table 8 will result in increasing the hard paved surfaces within the local catchment and so potentially increase runoff rates and volumes, and flood risk in the Maglin catchment. In reviewing the available documentation for these projects, it is stated that SuDS infrastructure will be installed and discharge from the sites will be limited to greenfield rates. Apart from a small section of the sustainable access corridor of the Greenfield LRD, these projects are located entirely outside the flood extents areas of the Maglin North River. For the Greenfield LRD, compensation has been included to maintain the current flood levels and extents, so no cumulative effects are predicted in this regard. The runoff from the Carriganarra site will be maintained at greenfield rates and increased flooding arising from this aspect of the development is not predicted. As such, no in-combination effect is predicted in terms of runoff rates and flood risk.

These projects will involve large-scale earthworks, which could result in silt-laden stormwater reaching watercourses. The housing development at Carriganarra (planning Ref. No. 22/41644) and its extension (planning Ref. No. 26/44475) have no on-site watercourses / drains and are distant from the Maglin North River. As such, the risk of silt-laden stormwater reaching the Maglin North is low. Visits to the Carriganarra site during construction works confirms that stormwater runoff is trapped on site by temporary berms, forming silt traps. In the CEMP of the housing development at Maglin LRD (being proposed by O'Flynn Construction - planning Ref. No. 25/44222), Greenfield (being proposed by Murnane & O'Shea Ltd - planning Ref. No. 25/44048) and Cois Caisleán (being proposed by Coleman New Homes Ltd - planning Ref. No. 23/42446) stormwater runoff controls are proposed, including silt traps and siltbusters. Coleman New Homes Ltd are also developing the creche (planning

Ref. No. 24/43308), so similar surface water management controls are assumed. As such, no in-combination effect is predicted with regard to water quality.

The potential cumulative impacts of the relevant plan for the area were assessed, which is considered to be the Cork City Development Plan 2022. The assessment of the potential impacts on the environment of the Cork City Development Plan 2022 was undertaken utilising the Strategic Environmental Objectives (SEOs) which are detailed in Table 5.1 of the CDP's Strategic Environmental Assessment. The potential cumulative impacts of the Plan were assessed having regard to these SEO's. Table 5.1 of the SEA identifies the SEO's for 'Water' as being to:

- Ensure that the status of water bodies is protected, maintained and improved in line with the requirements of the Water Framework Directive.
- Ensure water resources are sustainably managed to deliver proposed regional and City growth targets in the context of existing and projected water supply and wastewater capacity constraints ensuring the protection of receiving environments.
- Avoid inappropriate zoning and development in areas at risk of flooding and areas that are vulnerable to current and future erosion.
- Integrate sustainable water management solutions (such as SuDS, porous surfacing and green roofs) into development proposals.

Table 7.5 of the CDP's Strategic Environmental Assessment, 'Comparative Assessment of each of the Alternatives against Strategic Environmental Objectives' indicates that Alternative/Scenario 3 'Compact Liveable Growth', the 'Selected Scenario' has positive interactions with the status of the SEO's for 'Water'.

There are no significant in-combination effects predicted for surface water, hydrology or groundwater during the operational phase.

Following mitigation, no adverse impacts from changes in water quality during construction or operation were identified in the plans or projects described above. In summary, no measurable in-combination impacts are likely to Cork Harbour SPA from other developments.

9. Conclusions

The AA screening concluded, on the basis of objective information and in view of best scientific knowledge, the possibility of significant effects from the proposed project on European sites could not be ruled out and therefore an Appropriate Assessment was required. The AA screening concluded that there was potential for the proposed development to significantly impact the Cork Harbour SPA, via water quality impacts during construction and operation.

The NIS has been prepared to inform and assist the competent authority to assess, in view of best scientific knowledge, if the proposed development, individually or in combination with another plan or project is likely to have a significant effects on the European site, Cork Harbour SPA.

This NIS has examined and analysed, in light of the best scientific knowledge, with respect to Cork Harbour SPA within the potential likely zone of impact of the proposed development, the potential effect pathways, how these could impact on qualifying species and habitats and whether the predicted effects would adversely affect the integrity of Cork Harbour SPA.

Mitigation measures are set out in **Section 7** of the NIS and they ensure that any effects on the conservation objectives of Cork Harbour SPA will be avoided during the proposed development such that there will be no risk of adverse effects on the integrity of this European site.

It has been objectively concluded following an examination, analysis and evaluation of the relevant information, including in particular the nature of the predicted effects from the proposed development and with the implementation of the mitigation measures proposed, that the construction and operation of the proposed development will not adversely affect (either directly or indirectly) the integrity of any European site, either alone or in combination with other plans or projects. There is no reasonable scientific doubt in relation to this conclusion. The competent authority will make the final determination in this regard.

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Appendices

Appendix 1 – Site synopsis

Cork Harbour Special Protection Area (Site Code 004030)

Cork Harbour is a large, sheltered bay system, with several river estuaries - principally those of the Rivers Lee, Douglas, Owenboy and Owennacurra. The SPA site comprises most of the main intertidal areas of Cork Harbour, including all of the North Channel, the Douglas River Estuary, inner Lough Mahon, Monkstown Creek, Lough Beg, the Owenboy River Estuary, Whitegate Bay and the Rostellan and Poulnabibe inlets.

Owing to the sheltered conditions, the intertidal flats are often muddy in character. These muds support a range of macro-invertebrates, notably Macoma balthica, Scrobicularia plana, Hydrobia ulvae, Nepthys hombergi, Nereis diversicolor and Corophium volutator. Green algae species occur on the flats, especially Ulva lactua and Enteromorpha spp. Cordgrass (Spartina spp.) has colonised the intertidal flats in places, especially where good shelter exists, such as at Rossleague and Belvelly in the North Channel. Salt marshes are scattered through the site and these provide high tide roosts for the birds. Salt marsh species present include Sea Purslane (Halimione portulacoides), Sea Aster (Aster tripolium), Thrift (Armeria maritima), Common Saltmarsh-grass (Puccinellia maritima), Sea Plantain (Plantago maritima), Laxflowered Sea-lavender (Limonium humile) and Sea Arrowgrass (Triglochin maritima). Some shallow bay water is included in the site. Cork Harbour is adjacent to a major urban centre and a major industrial centre. Rostellan Lake is a small brackish lake that is used by swans throughout the winter. The site also includes some marginal wet grassland areas used by feeding and roosting birds.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Little Grebe, Great Crested Grebe, Cormorant, Grey Heron, Shelduck, Wigeon, Teal, Pintail, Shoveler, Red-breasted Merganser, Oystercatcher, Golden Plover, Grey Plover, Lapwing, Dunlin, Blacktailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Black-headed Gull, Common Gull, Lesser Black-backed Gull and Common Tern. The site is also of special conservation interest for holding an assemblage of over 20,000 wintering waterbirds. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

Cork Harbour is an internationally important wetland site, regularly supporting in excess of 20,000 wintering waterfowl, for which it is amongst the top five sites in the country. The two-year mean of summed annual peaks for the entire harbour complex was 55,401 for the period 1995/96 and 1996/97. Of particular note is that the site supports internationally important populations of Black-tailed Godwit (905) and Redshank (1,782) - all figures given are average winter means for the two winters 1995/96 and 1996/97. At least 18 other species have populations of national importance, as follows: Little Grebe (51), Great Crested Grebe (204), Cormorant (705), Grey Heron (63), Shelduck (2,093), Wigeon (1,852), Teal (922), Pintail (66), Shoveler (57), Red-breasted Merganser (88), Oystercatcher (1,404), Golden Plover (3,653), Grey Plover (84), Lapwing (7,688), Dunlin (10,373), Bartailed Godwit (417), Curlew (1,325) and Greenshank (26). The Shelduck population is the largest in the country (over 10% of national total). The site has regionally or locally important populations of a range of other species, including Whooper Swan (10), Pochard (145) and Turnstone (79). Other species using the site include Gadwall (13), Mallard (456), Tufted Duck (113), Goldeneye (31), Coot (53), Mute Swan (38), Ringed Plover (34) and Knot (38). Cork Harbour is a nationally important site for gulls in winter and autumn, especially Black-headed Gull (4,704), Common Gull (3,180) and Lesser Black-backed Gull (1,440).

A range of passage waders occurs regularly in autumn, including such species as Ruff (5-10), Spotted Redshank (1-5) and Green Sandpiper (1-5). Numbers vary between years and usually a few of each of these species over-winter.

The wintering birds in Cork Harbour have been monitored since the 1970s and are counted annually as part of the I-WeBS scheme.

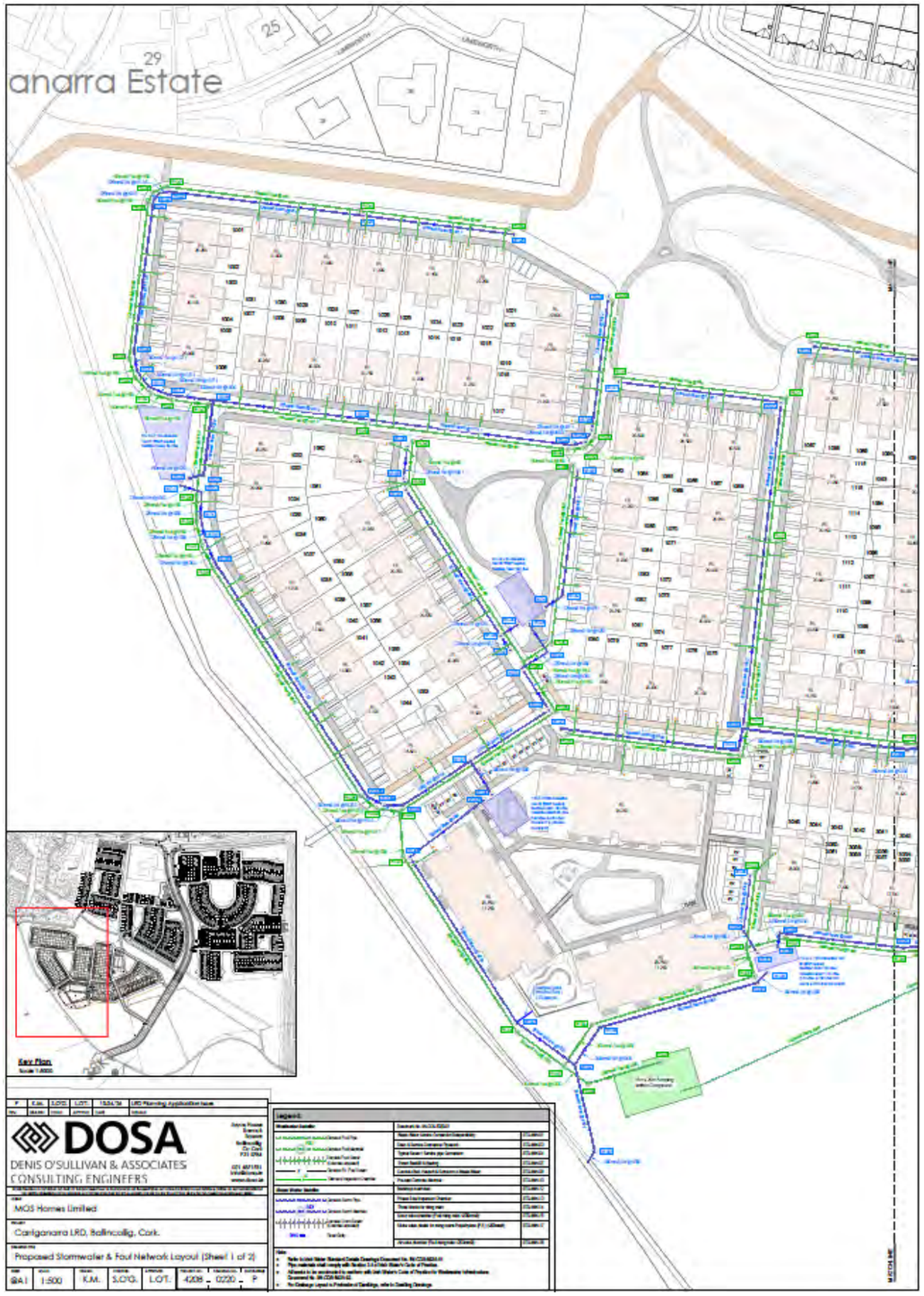
Cork Harbour has a nationally important breeding colony of Common Tern (3-year mean of 69 pairs for the period 1998-2000, with a maximum of 102 pairs in 1995). The birds have nested in Cork Harbour since about 1970, and since 1983 on various artificial structures, notably derelict steel barges and the roof of a Martello Tower. The birds are monitored annually and the chicks are ringed.

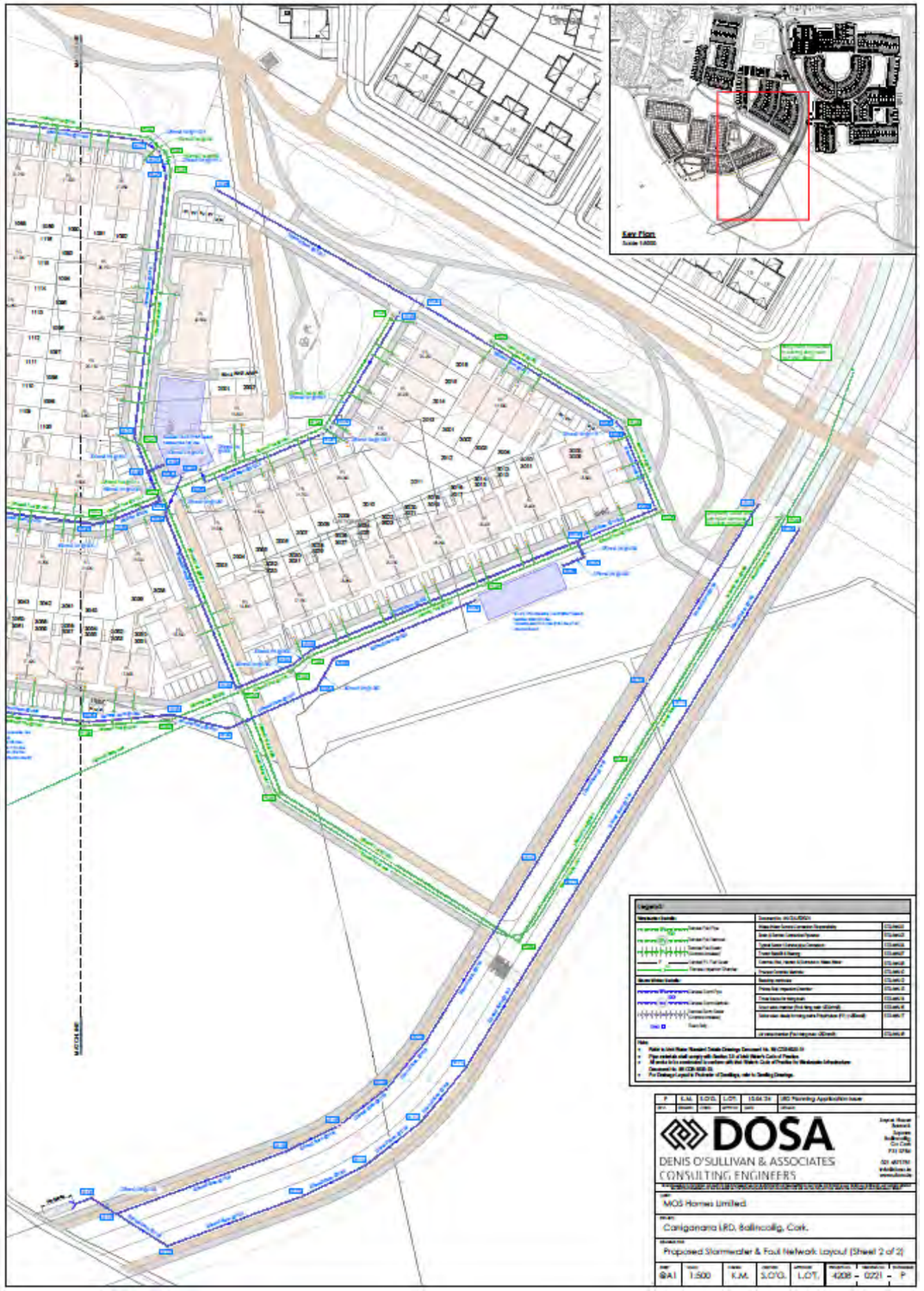
Extensive areas of estuarine habitat have been reclaimed since about the 1950s for industrial, port-related and road projects, and further reclamation remains a threat. As Cork Harbour is adjacent to a major urban centre and a major industrial centre,

water quality is variable, with the estuary of the River Lee and parts of the Inner Harbour being somewhat eutrophic. However, the polluted conditions may not be having significant impacts on the bird populations. Oil pollution from shipping in Cork Harbour is a general threat. Recreational activities are high in some areas of the harbour, including jet skiing which causes disturbance to roosting birds.

Cork Harbour is of major ornithological significance, being of international importance both for the total numbers of wintering birds (i.e. > 20,000) and also for its populations of Black-tailed Godwit and Redshank. In addition, there are at least 18 wintering species that have populations of national importance, as well as a nationally important breeding colony of Common Tern. Several of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Golden Plover, Bar-tailed Godwit, Ruff and Common Tern. The site provides both feeding and roosting sites for the various bird species that use it.

Appendix 2. Site drawings


anarra Estate
Key Plan
DOSA
DENIS O'SULLIVAN & ASSOCIATES
CONSULTING ENGINEERS
MOS Homes Limited
Carriganarra LRD, Ballincollig, Cork.
Proposed Stormwater & Foul Network Layout (Sheet 1 of 2)


Key Plan
DOSA
DENIS O'SULLIVAN & ASSOCIATES
CONSULTING ENGINEERS
MOS Homes Limited
Carriganarra LRD, Ballincollig, Cork.
Proposed Stormwater & Foul Network Layout (Sheet 2 of 2)

Appendix 3. Uisce Eireann

CONFIRMATION OF FEASIBILITY

Uisce Éireann
Irish Water

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

Stephen O'Grady

Joyce House
Barrack Square
Ballincollig
Cork
P31 KP84

21 October 2025

Our Ref: CDS25007329 Pre-Connection Enquiry
Carrignarra, Ballincollig, Co. Cork

Dear Applicant/Agent,

We have completed the review of the Pre-Connection Enquiry.

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 307 unit(s) at Carrignarra, Ballincollig, Co. Cork **(the Development)**.

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection** - Feasible without infrastructure upgrade by Uisce Éireann

  In order to provide the necessary capacity to facilitate the proposed Development, a connection to the watermain network is required approximately 260m north of the Development on Carriganarra Road. As this connection would traverse private lands, it will be the Applicants responsibility to obtain the relevant required wayleaves and permissions on any 3rd party lands for this connection between the private Development boundary and the connection point to public water infrastructure.

  Please note that based on Uisce Éireann's GIS records there is an existing watermain located within the Development boundary. The layout of the development must ensure that this pipe is protected and adequate separation distances are provided between Uisce Éireann infrastructure and any structures on site. If the proposed development requires the diversion of existing infrastructure, the customer will be required to enter into a diversion agreement and grant a deed of easement over the infrastructure to Uisce Éireann's diversions department (diversions@water.ie). To facilitate your

Stiúrthóirí / Directors: Niall Gleeson (POF / CEO), Jerry Grant (Cathaoirleach / Chairperson), Gerard Britchfield, Liz Joyce, Michael Nolan, Patricia King, Eileen Maher, Cathy Mannion, Paul Reid, Michael Walsh.
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin, Ireland D01NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Uisce Éireann is a designated activity company, limited by shares.
Cláraithe in Éirinn Uimh.: 530363 / Registered in Ireland No.: 530363.

UE / LH / OP448 / 0323

requirements and avoid delays the customer is advised to engage with Uisce Éireann as early as possible.

- **Wastewater Connection** - Feasible without infrastructure upgrade by Uisce Éireann:

  Please be advised that as part of any future connection application, it will be necessary to engage with Uisce Éireann to ensure that the gravity infrastructure to be provided within this Development is suitably sized and located to facilitate the decommissioning of the existing Heathfield / The Square WWPS. All flows (existing and proposed) through this Development shall discharge to the existing Maglin WWPS.

  Alternatively, if the Developer is to propose a connection via any adjacent third-party development lands, this will require agreement between the respective parties to ensure any potential infrastructure is designed accordingly.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

Where can you find more information?

- **Section A -** What is important to know?
- **Section B -** Details of Uisce Éireann's Network(s)

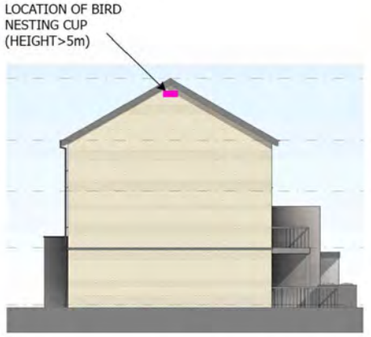
This letter is issued to provide information about the current feasibility of the proposed connection(s) to Uisce Éireann's network(s). This is not a connection offer and capacity in Uisce Éireann's network(s) may only be secured by entering into a connection agreement with Uisce Éireann.

For any further information, visit **www.water.ie/connections**, **email newconnections@water.ie** or contact 1800 278 278.

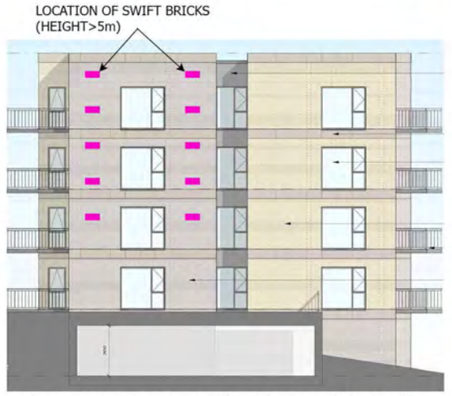
Yours sincerely,

APPENDIX 8-5 Proposed bird nesting locations plan - Deady Gahan Architects

DO NOT SCALE. WORK TO FIGURED DIMENSIONS ONLY.
ALL EXISTING DIMENSIONS TO BE CHECKED ON SITE.
DRAWN ON AUTOCAD R2004 AT DEADY GAHAN ARCHITECTS LTD
LAYERS ON THIS DRAWING COMPLY WITH BS 1192: PART 5



TYPICAL DUPLEX ELEVATION - NESTING CUP LOCATIONS



TYPICAL APARTMENT ELEVATION - SWIFT BRICK LOCATIONS

PEDESTRIAN CONNECTION TO NORTHERN DEVELOPMENT
PERMITTED DEVELOPMENT UNDER CONSTRUCTION BY APPLICANT PLANNING REF: 22/41644
PROVISION FOR FUTURE EXTENSION TO ACTIVE TRAVEL ROUTE TO WEST
PROPOSED ACTIVE TRAVEL ROUTE
PERMITTED ACTIVE TRAVEL ROUTE
PROPOSED EXTENSION TO PERMITTED ACTIVE TRAVEL ROUTE
PROPOSED PEDESTRIAN CONNECTION NORTH
COMPLETED HEATHFIELD DEVELOPM CONSTRUCTED BY APPLICANT PLANNING REF: 19/38923
EXISTING ESB LINES TO BE UNDERGROUNDED/ DIVERTED
PROPOSED PEDESTRI CONNECTION NORT
PROPOSED UNCONTROLLED RAISED CROSSING
EXISTING WAYLEAVE
SITE ENTRANCE
AGRICULTURAL LAND
PROPOSED EXTENSION TO SUSTAINABLE ACCESS CORRIDOR
PROVISION FOR FUTURE PEDESTRIAN CONNECTIVITY TO WEST
MAGLIN NORTH STREAM
PROPOSED TEMPORARY PUMPING STATION
AGRICULTURAL LAND
SITE ENTRANCE
PROPOSED UNCONTROLLED RAISED CROSSING
PROVISION FOR FUTURE EXTENSION TO SUSTAINABLE ACCESS CORRIDOR TO WEST

● 20 x SWIFT BRICKS



● 8 x SWALLOW NEST CUPS



● 8 x HOUSE MARTIN NEST CUPS



NORTH

date	rev	name	chk	note
22.01.26	P1	GN	EJG	ISSUE FOR PLANNING

DEADY GAHAN ARCHITECTS
EASTGATE VILLAGE, LITTLE ISLAND, CORK
T: 021 4355016 W:WWW.DGARCHITECTS.IE
EMAIL:INFO@DGARCHITECTS.IE

Project
PROPOSED RESIDENTIAL DEVELOPMENT
CARRIGANARRA, BALLINCOLLIG,
CO. CORK

Drawing title
PROPOSED BIRD NESTING LOCATIONS

Scale	Drawn	Checked	Date
1:2000 @ A3	GN	EJG	23.05.2025

Project No.	Drg. No.	Revision
22148	22148/P/013	P1

☐ Information \ Comments — Tender ☐
☐ Planning — Construction ☐

PROPOSED BIRD NESTING LOCATIONS
SCALE 1:2000 @ A3

APPENDIX 8-6 Invasive Species Management Plan - Dixon Brosnan Ecology



DixonBrosnan
environmental consultants

Project	**Outline Invasive Species Management Plan (ISMP) Proposed LRD at Carriganarra, Ballincollig**	
Client	HW Planning	
Project Ref.	26007	
Report No.	26007.01	
Client Ref.	-	
Date	**Revision**	**Prepared By**
10/02/26	Issue to client	Carl Dixon BSc MSc
		Sorcha Sheehy BSc PhD

DixonBrosnan Lios Ri Na hAoine, 1 Redemption Road, Cork.

Tel 086 851 1437| carl@dixonbrosnan.com | www.dixonbrosnan.com

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1. Introduction

DixonBrosnan Environmental Consultants were commissioned to develop an invasive species management plan (ISMP) at the site of a proposed large scale residential development (LRD) at Carriganarra, Ballincollig.

This report was prepared by Carl Dixon MSc (Ecological Monitoring). Carl Dixon MSc (Ecology) is a senior ecologist who has over 25 years' experience in ecological and water quality assessments. Carl Dixon holds an Honours Degree (BSc) in Ecology and a Masters (MSc) in Ecological Monitoring from UCC. He is a senior ecologist who has over 25 years' experience in ecological assessment. Prior to setting up DixonBrosnan Environmental Consultants in 2000, Carl set up and ran Core Environmental Services which included Rural Environmental Protection Scheme (REPS) planning for landowners and ecological assessments. Carl has particular experience in freshwater ecology including electrofishing fish stock assessments and water quality assessments. He also has considerable experience in habitat mapping and mammal ecology including survey work and reporting in relation to badgers and bats. Other competencies include surveys for invasive species and bird surveys. Carl has extensive experience with regards to EIAR and NIS mitigation and impact assessment. He has particular experience in large-scale industrial developments with extensive experience in complex assessments as part of multi-disciplinary teams. Such projects include gas pipelines, incinerators, electrical cable routes, oil refineries and quarries.

2. Invasive species within Proposed Development Site

2.1 Legislation

Non-native plants are defined as those plants which have been introduced outside of their native range by humans and their activities, either purposefully or accidentally. Invasive non-native species are so-called as they typically display one or more of the following characteristics or features: (1) prolific reproduction through seed dispersal and/or re-growth from plant fragments; (2) rapid growth patterns; and, (3) resistance to standard weed control methods.

Where a non-native species displays invasive qualities and is not managed it can potentially: (1) out compete native vegetation, affecting plant community structure and habitat for wildlife; (2) cause damage to infrastructure including road carriageways, footpaths, walls and foundations; and, (3) have an adverse effect on landscape quality.

The National Biodiversity Data Centre's (NBDC) online database provides data on the distribution of species within 10km grid squares. The site of the proposed development lies within 10km grid square (hectad) W66 of Ordnance Survey Ireland's National Grid System. The NBDC lists a number of high impact invasive species which have been recorded within hectad W66 (**Table 1**).

Table 1. NBDC list of high impact invasive species recorded in W66

Species group	Species name
Bird	Canada Goose (*Branta canadensis*)
Flatworm (Turbellaria)	New Zealand Flatworm (*Arthurdendyus triangulatus*)
Flowering plant	Canadian Waterweed (*Elodea canadensis*)
Flowering plant	Cherry Laurel (*Prunus laurocerasus*)
Flowering plant	Japanese Knotweed (*Fallopia japonica*)
Flowering plant	*Rhododendron ponticum*
Insect - beetle (Coleoptera)	Harlequin Ladybird (*Harmonia axyridis*)
Terrestrial mammal	American Mink (*Neovison vison*)
Terrestrial mammal	Brown Rat (*Rattus norvegicus*)
Terrestrial mammal	Coypu (*Myocastor coypus*)
Terrestrial mammal	Ferret (*Mustela putorius subsp. furo*)
Terrestrial mammal	Raccoon (*Procyon lotor*)
Terrestrial mammal	Sika Deer (*Cervus nippon*)

NBDC 06/01/25

The control of invasive species in Ireland comes under the Wildlife (Amendment) Act 2000, where it states that

'Any person who— [...] plants or otherwise causes to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora, ['refers only to exotic species thereof'][...] otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.'

The Birds and Natural Habitats Regulations 2011 (SI 477 of 2011), Section 49(2) prohibits the introduction and dispersal of species listed in the Third Schedule, which includes Japanese Knotweed, as follows: "any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow [….] shall be guilty of an offence."

2.2 Invasive Species within Proposed Development site

This assessment is based on surveys at the proposed development site. Site surveys were largely carried out between January 2024 and January 2026. During these site visits the site was surveyed for invasive species (Wyse *et al.,* 2016; Stace 2019).

The proposed development site is dominated by grassland habitats, with patchy mature and semi-mature treeline/hedgerows as well as areas of woodland, scrub and recolonizing bare ground. No third schedule species were recorded within the proposed development site. Two other invasive non-native species Buddleia *Buddleia davidii* and Wild clematis *Clematis vitalba* were recorded within the proposed development site. These species were recorded largely within scrub and recolonizing areas within the site (See **Figure 1**).

Buddleia was recorded in a scattered distribution within scrub, woodland and recolonising habitats around the farmyard. This is a deciduous shrub up to 5m tall with long arching branches and lilac flowers (though occasionally white or purple) in long pyramidal dense panicles. No precise studies have been done on the level of impact of *Buddleja davidii,* likely due to its long history of naturalisation but it is likely to displace native plants where it is present. An economic impact assessment of invasive species found "There are no negative effects known due to butterfly bush growth in Germany". Buddleia can colonise a wide range of habitats including grasslands scrub and woodland. Buddleia is listed as a medium impact listed species by the NBDC. Under the right ecological conditions these species may have an impact on the conservation goals of a European site or impact on a water body achieving good/high ecological status under the Water Framework Directive (Directive 2000/60/EC). Buddleia is also included in the NRA *Guidelines on the Management of Noxious Weeds and Non-native Species on National Roads* (NRA 2010) as this species has been shown to have an adverse impact on landscape quality, native biodiversity or infrastructure; and is likely to be encountered during road schemes.

Wild Clematis is recorded within scrub, treelines and woodland habitats. This is a deciduous climber can grow up to 30m in length, leaves pinnate & opposite, flowers in dense white clusters (and is hence known as old man's beard). Generally it appears to be more vigorous in its introduced range than in native regions. No impacts documented in Ireland but considered a serious pest in New Zealand and listed as a weed in North America. Described in Hill *et al.,* (2001) "*Vines can climb the tallest forest trees, forming a dense, light-absorbing canopy that suppresses all vegetation beneath it. C. vitalba can be so vigorous that the weight of foliage and stems breaks the supporting trees, reducing once-healthy forest to a low, long-lived thicket of vines scrambling over stumps and log".* The NBDC notes that under the right ecological conditions these species may have an impact on the conservation goals of a European site or impact on a water body achieving good/high ecological status under the Water Framework Directive (Directive 2000/60/EC). Wild Clematis is also included in the NRA *Guidelines on the Management of Noxious Weeds and Non-native Species on National Roads* (NRA 2010) as these species has been shown to have an adverse impact on landscape quality, native biodiversity or infrastructure; and is likely to be encountered during road schemes.

It is noted that DixonBrosnan have recorded the invasive water fern (*Azolla* sp.) along the Lisheens Stream (a tributary of the Maglin North Stream) upstream of the proposed development site. No signs of Azolla have been recorded on the Maglin North Stream where it adjoins the proposed development site. This species is a Third Schedule listed species under Regulations 49 & 50 in the European Communities (Birds and Natural Habitats) Regulations 2011. Azolla filiculoides is a heterosporous, floating fern up to 2.5 cm in diameter. The plants are dark green to reddish and float on the water surface, either individually or in mats, which can reach a thickness of up to 20 cm. Individual plants consist of two-lobed leaves and rhizomes. The lower lobes of the leaves are usually larger than the upper (reviewed in Hussner 2010). Two preliminary risk assessments were previously carried out for Ireland, as follows. A stage one and two risk assessment as part of Ireland's National Plant Conservation Strategy – Target 10 - Managing Invasive Alien Species (Botanic Gardens 2007); and a prioritisation risk assessment as part of the Risk Analysis and Prioritisation for Invasive and Non-native Species in Ireland and Northern Ireland (Kelly *et al.* 2013). The former identified Azolla

filiculoides as one of the thirteen “most significant invasive plants in Ireland” and the latter assessment designed the plant as a ‘high risk’ invasive species.



Figure 1. Location of invasive species within proposed development site (Scattered distribution)

3. Invasive species treatment/management

3.1 Site Hygiene

Good hygiene practices such as wheel and bucket washes, inspection of footwear, vehicles and machinery will be undertaken during eradication operations.

The contractor must appropriately dispose of any excavated invasive material in accordance with the NRA (2010) guidelines; where cut, pulled or mown non-native invasive plant material arises, its disposal will not lead to a risk of further spread of the plants.

Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds.

Material that contains flower heads or seeds will be disposed of either by burial at a depth of no less than 2m, or by incineration (having regard to relevant legislation, including: Section 32 of the Waste Management Act, 1996 to 2008; Section 4 of the Air Pollution Act, 1987; Regulations 49 (2) of S.I. No. 477/2011 European Communities (Birds and Natural Habitats) Regulations 2011; and relevant local authority bylaws) or disposal to licensed landfill in the case of non-native invasive species.

All disposals will be carried out in accordance with the Waste Management Acts.

Informing all site staff through toolbox talk as part of site inductions.

Any new sightings of the species will be relayed to construction staff and the developer via the project ecologist/ECoW. These areas will be treated following the same protocol as described above.

Reporting sighting(s) to the NPWS and NBDC and liaise with the NPWS.

3.2 Pre-construction Survey

Since invasive species spread quickly, prior to the commencement of treatment, a pre-construction survey will be carried out. The survey will be undertaken by a suitably qualified ecologist. This information will be utilised to update the ISMP.

In addition to the advance treatment works and pre-construction survey, when the works areas become available to the contractor for enabling works, areas identified as requiring specific invasive species treatment will be demarcated and the designated control measures implemented at the earliest possible stage to reduce the risk of spread along the proposed scheme or beyond the land take.

Those involved in the application of herbicides/pesticides will be competent to do so and, consequently, will have sufficient training, experience and knowledge in the area of herbicides/pesticides application.

All staff involved in the application of herbicides/pesticides will have received appropriate training, which may include achieving competency certification in the safe use of herbicides/pesticides through a National Proficiency Tests Council registered assessment centre or achieving an appropriate FETAC award in this area.

4. Buddleia

As noted in **Section 2** of this report, there is no statutory obligation to remove Buddleia. However, Buddleia will be removed as part of the pre-construction/construction works. In areas where Buddleia is located in habitats earmarked for retention e.g. hedgerow/treeline, Buddleia should be removed with great care. The following treatment methods are recommended.

Buddleia is straightforward to control using a mixture of mechanical removal and herbicide treatment.

Buddleia is a plant that favours disturbed sites, physical grubbing of plants can provide ideal conditions for the germination of seeds. Therefore, care needs to be taken to ensure re-vegetation of controlled areas is undertaken swiftly. The branches of Buddleia are capable of rooting as cuttings, so care should also be taken to ensure material is disposed of in a manner to avoid this risk.

As mature plants occur within the proposed works area, the preferred method of treatment is cutting back to a basal stump or grubbing out followed by chemical treatment. Herbicide applications will take into account sensitive receptors such the location of the Maglin North Stream and locally important habitats such as treelines/heddgerows and must only be applied in line with manufacturers recommendations.

Recommended practice for the application of herbicides requires cutting back of plants to a basal stump during active growth (late spring to early summer) which is then treated (brushed on) immediately with a systemic weed killer mix (Starr *et al*, 2003). Foliar application of triclopyr or glyphosate may be adequate for limited infestations of younger plants but should be followed up at 6 monthly interval until the supervising ecologist can certify that the plant is no longer extant within the works area.

5. Wild Clematis

As noted in **Section 2** of this report, there is no statutory obligation to remove Wild Clematis. It is noted that this plant is present on a number of mature and semi-mature trees earmarked for retention and removal of Wild Clematis within these areas will be made on a case-by-case basis with the aim of protecting mature and semi-mature trees. However, should it be concluded that Wild Clematis at the proposed development site should be removed, the following treatment methods will be used.

Wild Clematis is straightforward to control using a mixture of mechanical removal and herbicide treatment. Alternative methods of control are discussed below.

This species can be controlled by both mechanical control and herbicides, though typically its control relies on a combination of both i.e., cut-stump application.

Small seedlings can be readily pulled by hand. Larger stems have to be cut, the roots grubbed out and the material placed off the ground so it cannot take root again.

A number of chemicals have been used effectively against Wild Clematis in New Zealand, including glyphosate, though control invariably takes more than one year (New Zealand Department of Conservation 2005). Control should be undertaken during active growth. For mature plants, the vines should be cut back to ground level or waist height in winter or spring and the subsequent re- growth can be then foliar sprayed. This method will avoid impacting on the host plant the vine may be covering.

For larger specimens, the plant can be cut at the base with a straight horizontal cut. Herbicide is then applied immediately to the wound with a paint brush, eye dropper or small squeeze bottle. On larger stems it is only necessary to wipe herbicide around the outer rim of the cut. The plants should be left in situ until they are dead. Where plants are not killed in a single application, wait until re growth before re spraying.

Triclopyr can also be used as a foliar spray or as a spot treatment. This should be applied in summer during active growth before senescence, when it is not very hot or during drought. Following control, regular monitoring will be required with appropriate follow-up to deal with re- growth or new seedling germination over a period of 2–3 years.

6. Azolla

Azolla was not recorded within the proposed development site. However is has previously been recorded on the Lisheen Stream (a tributary of the Maglin North Stream). The following biosecurity measures should be followed to prevent this species spreading into the site.

All work adjoining the Maglin North Stream should be conducted with thoroughly dry or disinfected equipment.

Check and Clean all visible aquatic plants, animals, mud, and other organic material from equipment and gear at the sampling location. If a new occurrence of an invasive plant is identified the project ecologist/EcoW will be consulted.

When departing from site, drain all water from all equipment and gear that came in contact or held water. This should include tubs, buckets, boots, etc, and all other items that could serve as potential water holdings for aquatic species.

All PPE should be visually inspected and any attached vegetation or debris removed. Where appropriate, the gear should be wiped down with a cloth soaked in 1% solution of Virkon Aquatic or another proprietary disinfection product. Alternatively, a 5% solution (100 ml / 20 litre solution) of chlorine bleach should be used. Rubber gloves must be worn when undertaking this procedure. Alternatively, personal gear may be steam cleaned or dried thoroughly for five days after cleaning with soap and water.

Construction machinery and large equipment being used in the vicinity of the stream must be cleaned using high-pressure steam cleaning before and after use. If it is not possible to steam clean the equipment, a normal power hose must be used. After cleaning visually inspect the equipment to ensure that all adherent material and debris has been removed.

It is recommended to apply disinfectant to the undercarriage and wheels of the vehicle after steam cleaning or power hosing.

7. Conclusions

No third schedule invasive species have been recorded within the proposed development site. Two other non-native species were recorded i.e. Buddleia and Wild Clematis were recorded. The location of invasive species in proximity to semi-mature and mature treelines/hedgerows earmarked for retention means care should be taken in the use of herbicides. This issue will be taken into account when carrying out the outlined treatment programme in consultation with the nominated contractor. Vegetation removal of these other species should be kept to a minimum to retain the integrity of retained habitats within the site.

No impediment to the removal of these species as part of this outline invasive species management plan have been identified. However, care should be taken when removing invasive species from retained habitats onsite which are earmarked for retention i.e. treelines, hedgerows etc. Biosecurity measures to prevent the spread of aquatic invasive species have also been specified.

CHAPTER NINE

CULTURAL HERITAGE

APPENDIX 9-1 Geophysics Report – John Nicholls MSc
APPENDIX 9-2 Archaeological Testing Reports – Lane Purcell Archaeology
APPENDIX 9-3 Walkover Survey Photographs – Lane Purcell Archaeology
APPENDIX 9-4 Photographic and Drawn Survey of the limekiln - Lane Purcell Archaeology
APPENDIX 9-5 Typical detail for “Floating Road/Path” and Greenway Construction Methodology - Lane Purcell Archaeology
APPENDIX 9-6 Archaeological Testing Final Report March 2026 – Lane Purcell Archaeology

APPENDIX 9-1 Geophysics Report – John Nicholls MSc

Appendix 9.1

Geophysical Survey Report

Phase 2b proposed residential development in Carrigrohane townland, Ballincollig, County Cork

Client
Murnane & O'Shea Ltd.

Detection License
22R0331

TAG Project
2022IE31B

Date
November 2022

Author
John Nicholls MSc.

TARGET Archaeological Geophysics Ltd.

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200 Kimmage Road West, Dublin 12

TARGET GEOPHYSICAL SURVEY REPORT 2022IE31B, PHASE 2B PROPOSED RESIDENTIAL DEVELOPMENT IN CARRIGROHANE TOWNLAND, BALLINCOLLIG, CO. CORK

PROJECT BACKGROUND

Geophysical survey was undertaken in connection with the phase 2b proposed residential development in Carrigrohane townland, to the S of Ballincollig, in Co. Cork. Located c.0.5km NW of Junction 1 of the Cork South Ring Road (N22/N40), 0.2km SW of Gaelscoil Uí Riordáin, the site of the phase 2b proposed development encompasses 3 fields and a farmyard situated c.0.5 W of Maglin Road. A total 4.8ha of high-resolution recorded magnetometry was completed during the phase 2b survey, examining all lands suitable to geophysical survey within the site boundary.

A report relating to the geophysical survey undertaken in connection with the phase 2a proposed residential development, which is located immediately to the N of phase 2b, will be submitted separately.

This phase 2b survey was commissioned by Murnane & O'Shea Ltd. and forms part of a pre-planning archaeological assessment being undertaken in advance of proposed development. The geophysical survey was carried out under license (detection license 22R0331) from the National Monuments Service, Department of Housing, Local Government & Heritage, with the following aims:

- to identify geophysical anomalies of possible archaeological origin within the investigation areas
- accurately locate these anomalies and present the findings in graphical format
- describe the anomalies and discuss their likely provenance in a written report

ITM central coordinates: 560113 569882

Townland: Carrigrohane

County: Cork

Landuse: Grazed pasture land, poorly maintained pasture and disused farmyard

Landscape, soils, geology

The site of proposed development extends across undulating terrain occupied by coarse loamy drift of the Clashmore (1100h) soil association. Bedrock (100k) comprises of Little Island formation massive and crinoidal fine limestone (Irish National Soils Map, 1:250,000k, V1b, 2014; Geological Survey of Ireland Spatial Resources, Public Data Viewer Series).

Archaeology

The area of archaeological potential associated with recorded monument and place (RMP), standing stone CO073-103, lies within the boundary of the proposed development to the W, with 2 further RMPs, fulachta fia sites CO073-100 and CO073-101 situated c.40m beyond the site boundary SW-W. Further RMPs also lie within the wider landscape. The following extract from the National Monuments Service SMR database provides summary details of these RMPs, as well as further monuments situated within c.1km radius of the proposed development:

SMR No.	Class	Townland	East	North
CO073-063	Bridge	Ballynora, Maglin	559431	568921
CO073-064	Kiln - lime	Maglin	559792	569495
CO073-065	Fulacht fia	Maglin	560195	569271
CO073-066	Standing stone	Carrigrohane	561060	570414
CO073-074	Standing stone	Ballincollig (Muskerry	559060	570180
CO073-082	Ringfort - rath	Carrigrohane	560059	570629
CO073-082001	Souterrain	Carrigrohane	560059	570629
CO073-097	Country house	Maglin	559774	569301

CO073-100	Fulacht fia	Maglin	559894	569743
CO073-101	Fulacht fia	Maglin	559783	569952
CO073-103	Standing stone	Carrigrohane	559897	569918
CO073-104	Fulacht fia	Carrigrohane	560640	569823
CO073-130	Fulacht fia	Maglin	559879	569145
CO073-132	Excavation – misc.	Carrigrohane	560579	570285
CO073-134	Fulacht fia	Curraheen (Cork By.,	560681	569291
CO073-135	Fulacht fia	Curraheen (Cork By.,	560654	569532
CO073-136	Fulacht fia	Curraheen (Cork By.,	560666	569466
CO073-137	Burnt mound	Curraheen (Cork By.,	560815	569368
CO073-138	Excavation – misc.	Curraheen (Cork By.,	560830	569370
CO073-139	Fulacht fia	Curraheen (Cork By.,	560840	569391
CO073-140	Burnt mound	Curraheen (Cork By.,	560863	569385
CO073-141	Fulacht fia	Curraheen (Cork By.,	560881	569423
CO073-142	Fulacht fia	Curraheen (Cork By.,	560919	569421
CO073-143	Fulacht fia	Curraheen (Cork By.,	560844	569373
CO073-146	Habitation site	Curraheen (Cork By.,	560681	569291
CO073-150	Enclosure	Carrigrohane	560433	570092
CO073-161	Burnt spread	Ballincollig (Muskerry	559285	569850
CO085-136	Church	Ballynora	560110	568769
CO085-136001	Graveyard	Ballynora	560110	568769

Fieldwork	1st November 2022
Geophysical technique	High-resolution recorded magnetometry (fluxgate gradiometry)
Report issue	15th November 2022
Author	John Nicholls MSc.
Detection license no.	22R0331
Client	Murnane & O'Shea Ltd.
Archaeologists	Lane Purcell Archaeology

1 SURVEY METHODOLOGY

1.1 Methodology

1.1.1 Geophysical survey at the site of the phase 2b proposed residential development was conducted in 2 fields, completing a total 4.8ha of high-resolution recorded magnetometry in 2 areas (2b.1-2b.2), examining all lands available at the time of fieldwork.

1.1.2 The survey employed an advanced multichannel fluxgate gradiometer system combined with cm precision GPS, recording magnetometer (fluxgate gradiometer) and GPS data simultaneously at rates of 50Hz and 1Hz respectively. The geophysical data were acquired along parallel instrument traverses 3.64m in width, with the instrumentation installed in 'tow configuration' for use with an ATV.

1.2 Instrumentation

1.2.1 The following table provides a summary of the survey methodology and geophysical instrumentation employed during the course of this work:

Technique	Sensor spacing	Sample rate	Instrumentation	Sensitivity/precision	No. of data recorded
Magnetometry (fluxgate gradiometry)	0.28m	50Hz	Multi-channel fluxgate gradiometer	<75pT/√Hz @ 1Hz (650mm baseline)	204.613
GPS	3.92m	1Hz	Trimble R10 (VRS)	<0.1m	5,398

1.2.2 The instrumentation and software employed for this geophysical survey were configured to apply a spatial resolution of c.80-100 magnetometer measurements per $m.^2$ This spatial resolution meets with ease the 'Level 3 – Characterisation' EAC Guidelines for geophysical survey in archaeology (Schmidt et al, 2016).

1.3 Data processing

1.3.1 Post fieldwork the geophysical data were processed as follows:

Process	Description
i	Positioning of geophysical data based on real-time GPS measurements (WGS84 geodetic CRS).
ii	Zero median transect processing for multi-sensor magnetometer data collected along parallel transects.
iii	Transformation from WGS84 geodetic coordinate system to ITM (IRENET95) projected CRS.
iv	Gridding (ordinary kriging).
v	Export of greyscale images georeferenced in ITM (IRENET95) projected CRS.

1.3.2 To ensure integrity of the processed geophysical data, and maintain close correlation with the original raw on-site measurements, no further processing, filtering or 'smoothing' of the data was undertaken following processing steps i-v.

1.4 Data display

1.4.1 Figure 1 presents a site location diagram (scale 10,000), highlighting the location of the phase 2b proposed development, the boundary of the phase 2a proposed development to the N, and RMPs within a 1km radius.

1.4.2 Figure 2 presents a greyscale of the results from the phase 2b geophysical survey in areas 2b.1-2b.2 at a scale of 1:1000, and includes the results from the phase 2a geophysical survey to the N.

1.4.3 Figure 3 presents an interpretation of the results from the phase 2b geophysical survey in areas 2b.1-2b.2, at a scale of 1:1000, and includes also an interpretation of the results from the phase 2a geophysical survey to the N. Numbers included on figure 3 refer to notable anomalies recorded from this phase 2b geophysical survey, and these are discussed in the results section of this report.

2 GENERAL CONSIDERATIONS

2.1 Ground conditions, access & survey extent

2.1.1 The geophysical survey extended across mostly accessible grazed pasture land situated either side of a disused farm. Sections of poorly maintained pasture land and disturbance at the perimeter of the farm were avoided. All accessible lands suitable to geophysical survey were investigated within the boundary of the phase 2b proposed development.

2.1.2 The following table summarises the ground conditions, landuse and hectares of geophysical survey completed during this geophysical investigation:

Area	Description of terrain	Current landuse	Ha
2b.1	Mostly level irregular shaped field descending to the W-SW, bound by housing to the NW, and a disused farm with poor terrain to the S-SE.	Grazed pasture	3.8
2b.2	Generally level field descending to the E-SE, bound by metal fencing N-NE, a disused farm and poor terrain to the SW, with construction debris and machinery to the NW.	Grazed pasture	1

2.2 Modern interference

2.2.1 The results from the phase 2b geophysical survey highlight an abundance of small-scale ferrous throughout the data. These are a common occurrence in magnetometer survey, and relate mostly to modern metallic debris in the topsoil.

2.2.2 Broad ferrous responses also occur in the results, mostly at the perimeter of survey in proximity to temporary fencing, existing field boundaries and farm buildings. A band of strong magnetic response extending N-SE along the edges of phase 2b areas 2b.1-2b.2 corresponds to disturbance from the former Great Southern Railways railway line.

2.3 Recent landuse & cultivation

2.3.1 Remnants of at least 3 former field boundaries have been recorded traversing phase 2b survey area 2b.1 roughly N-S and E-W. Responses from past cultivation are also evident in the results, visible as closely spaced parallel linear anomalies oriented N-S and E-W.

2.4 Natural soil/geological variation

2.4.1 Responses from natural soil/geological variations are also apparent in the results from the phase 2b survey in area 2b.1, and these are characterized by groups of weakly magnetic linear/curvilinear response.

3 GEOPHYSICAL SURVEY RESULTS

3.1 General overview

3.1.1 The results from the phase 2b geophysical survey in areas 2b.1-2b.2 display the effects of recent landuse in the form of abundant small and large-scale ferrous, remnants of at least 3 former boundaries, and responses from past cultivation. Background magnetic variation is generally within the range of +/-1.5nT, although this is significantly distorted in proximity to disturbance from modern ferrous material.

3.1.2 A circular ditched enclosure with an E facing entrance has been recorded NE of survey centre in phase 2b area 2b.1. Responses of interest are also indicated in proximity to this enclosure, including a potential pit type feature to the SE, and traces of a possible early field system bordering the enclosure perimeter to the S and W. No further responses of clear archaeological significance/potential are indicated by the results from survey in phase 2b areas 2b.1-2b.2.

3.1.3 The survey data do, however, highlight an abundance of small-scale/poorly defined anomalies and weakly magnetic trends which are of uncertain origin. A possible archaeological explanation for some of these should not be ignored, most notably rectilinear/linear responses D to the W-NW in 2b.1; linear trends extending roughly W-E in 2b.1, and curvilinear trends F-G N of survey centre in 2b.1. The possibility that D-G represent plough-damaged features of archaeological significance should not be ignored. Response H in area 2b.2 may also be of interest.

3.1.4 Elsewhere, the results from survey in phase 2b areas 2b.1-2b.2 highlight a multitude or weakly magnetic linear/curvilinear trends and poorly defined positives, the majority of which are expected to derive from patterns of former landuse, natural soil/geological origin and/or modern ferrous debris.

3.2 Survey results (figures 2-3)

3.2.1 Notable anomalies recorded from geophysical survey in phase 2b areas 2b.1-2b.2 are referred to below:

Area	Anomaly(s)	Location	Description & likely provenance
2b.1	A	NE of survey centre	*Archaeology* Magnetically strong circular ditched enclosure c.16m in diameter with an E facing entrance. This enclosure is visible as a faint circular cropmark on recent google aerial imagery.
2b.1	B	E-NE of survey centre	*? Archaeology* Possible pit type feature. Interpretation is tentative given the proximity of modern ferrous debris, responses from former boundaries, past cultivation and natural soil/geological variation.
2b.1	C	NE of survey centre	*? Part of early field system* Weakly magnetic linear trends potentially forming part of a rectangle at the perimeter of enclosure A. Interpretation is tentative given the proximity and similar magnitude of former cultivation trends.
2b.1	D	W-NW	*?? Archaeology* Sub-rectangular positive potentially representing part of an enclosure extending beyond the site boundary. However, D lies on a steep W facing slope in proximity to patterns of former cultivation and natural sol/geological variation. A natural soil/geological and/or recent landuse explanation should also be considered.
2b.1	E	W-E	*Trend* Parallel linear trends of potential note c5-6m apart from one another, potentially representing remnants of a former trackway or road. Interpretation is tentative.

2b.1	F-G	N	*Trend* Weakly magnetic curvilinear trends bordering the limits of phase 2b.1. These are barely visible above the 'magnetic background', and located at the edge of an existing boundary. Interpretation is highly tentative. A recent landuse and/or natural soil/geological explanation should also be considered.
2b.2	H	SE	*?? Archaeology* Irregular positive responses. An archaeological or natural soil/geological explanation for H is equally plausible.

4 CONCLUSION

4.1 The results from survey in the phase 2b residential development in Carrigrohane townland have been successful in recording the location of a previously unknown circular ditched enclosure. This enclosure is located in phase 2b area 2b.1, measures c.16m in diameter, and has a well-defined entrance facing E. No further responses of definite archaeological character are indicated within the boundary of the phase 2b development by the results from this geophysical survey.

4.2 Anomalies of possible archaeological significance have been recorded. These are mostly situated in area 2b.1. and include a potential pit type response to the SE of the enclosure, and traces of a possible early field system to the S and W. Interpretation of these responses is tentative.

4.3 Responses associated with past cultivation regimes, disused land divisions and an abundance of small-scale ferrous are also evident in the results. Strong magnetic variation to the N-NE in areas 2b.1-2b.2 is associated with the former Great Southern Railway railway line.

4.4 Responses indicative of natural soil/geological variation are also evident throughout the results from this geophysical survey.

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Schmidt A, Linford P, Linford N, David A, Gaffney C, Sarris A, and Fassbinder J, (2016), EAC Guidelines for the Use of Geophysics in Archaeology.

QGIS Development Team, 2021, QGIS Geographic Information System, Open-Source Geospatial Foundation Project http://qgis.osgeo.org

ONLINE RESOURCES

Archaeological Survey of Ireland SMR Database: http://webgis.archaeology.ie/historicenvironment/

Bing Maps: https://www.bing.com/maps

Geological Survey of Ireland Spatial Resources, Public Data Viewer Series: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228

Google Maps: https://www.google.com/maps

Irish National Soils Map, 1:250,000k, V1b (2014). Teagasc, Cranfield University (jointly funded by the EPA STRIVE Research Programme 2007-2013 & Teagasc): http://gis.teagasc.ie/soils/map.php

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APPENDIX

Technical Information: magnetometry

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MAGNETOMETRY

Introduction

Magnetometry represents one of a suite of geophysical techniques employed in archaeological prospection to inform invasive work such as trial trenching and excavation.

Frequently used to determine the often non-visible boundaries of archaeological remains, magnetometer surveys enable archaeologists to identify the location, form and extent of a diverse array of archaeological features no longer visible at the surface.

Buried archaeological remains successfully identified using magnetometry include sites such as enclosure systems and deserted villages, hillforts and military encampments, henges and tumuli, villa/castle foundations, ecclesiastical settlements and formal gardens.

Background to application

The basis for use of magnetometry in archaeological prospection derives from the abundance of natural iron oxides in most soils, and our ability to measure subtle variations in the magnetic properties of these iron oxides caused by human activity. Discrete variations in soil magnetism associated with buried archaeological remains derive typically from in situ burning and organic enrichment of the soil, through activities such as cooking and heating; pottery manufacture and metal working; as well as use of fired building materials such as ceramic tiles and brick. These burnt, fired and organic rich deposits create subtle magnetic contrasts visible as discrete magnetic anomalies superimposed on the earth's geomagnetic field.



1. Magnetometer survey data in greyscale format highlighting pit remains SE of an enclosure and Roman villa.



2. Burnt-fired debris uncovered during excavation of the highlighted area SE of the same enclosure and Roman villa.

Magnetometer surveys conducted in both commercial and research archaeological investigations enable determination of the location, form and extent of buried archaeological remains. Data acquired from these surveys can be quickly generated into georeferenced images and interpretation layers to inform subsequent trial trenching and excavation.

Technology

TARGET provides precise mapping and characterization of buried archaeological remains by employing an array of highly stable and sensitive fluxgate gradiometers, combined with an advanced data logging system and cm precision GPS. This state-of-the-art geophysical instrumentation, which is capable of collecting extremely dense data sets, permits detailed high-resolution survey of archaeological sites from as small as 1ha in size, to larger scale investigation of sites up to 150ha or more.

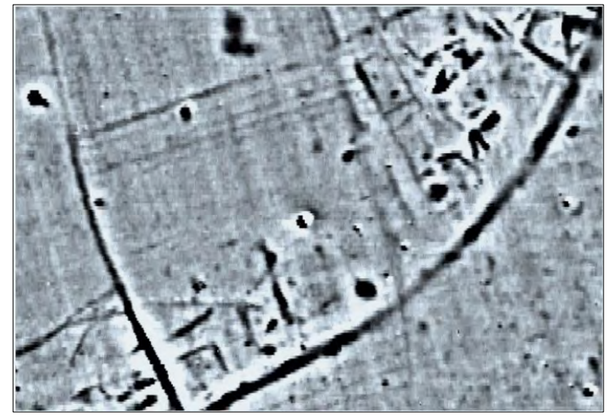
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High resolution magnetometer surveys are undertaken as standard, recording data at c.5cm intervals with probe separations of 0.3m for precise measurement and characterization of buried archaeological remains. This spatial resolution meets with ease the 'Level 3 – Characterisation' EAC Guidelines recommendation for geophysical survey in archaeology (Schmidt et al, 2016).

Instrumentation is used in combination with cm precision GPS and data collected along parallel traverses with the system installed in 'tow configuration' for use with an ATV or in push mode.

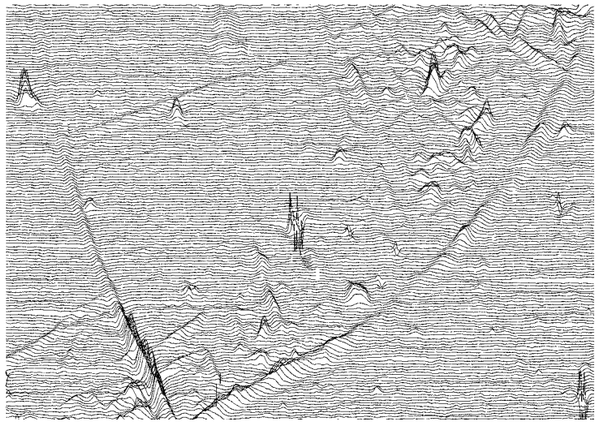
Data Display

Greyscale plots are the most common format for displaying magnetometer data. This display format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within a given data set. This display method also enables the identification of discrete responses barely visible above natural 'background' magnetic variation on site.



6. Greyscale from survey at the site of a deserted medieval village.

XY trace plots provide a near-perspective representation of measurements along individual lines of data recorded from each magnetometer sensor. The XY trace format is used as a conventional method for identifying responses of modern ferrous debris, and also as an aid in identifying locations of potential industrial features, such kilns and metal working.



7. XY trace from survey at the site of a deserted medieval village.

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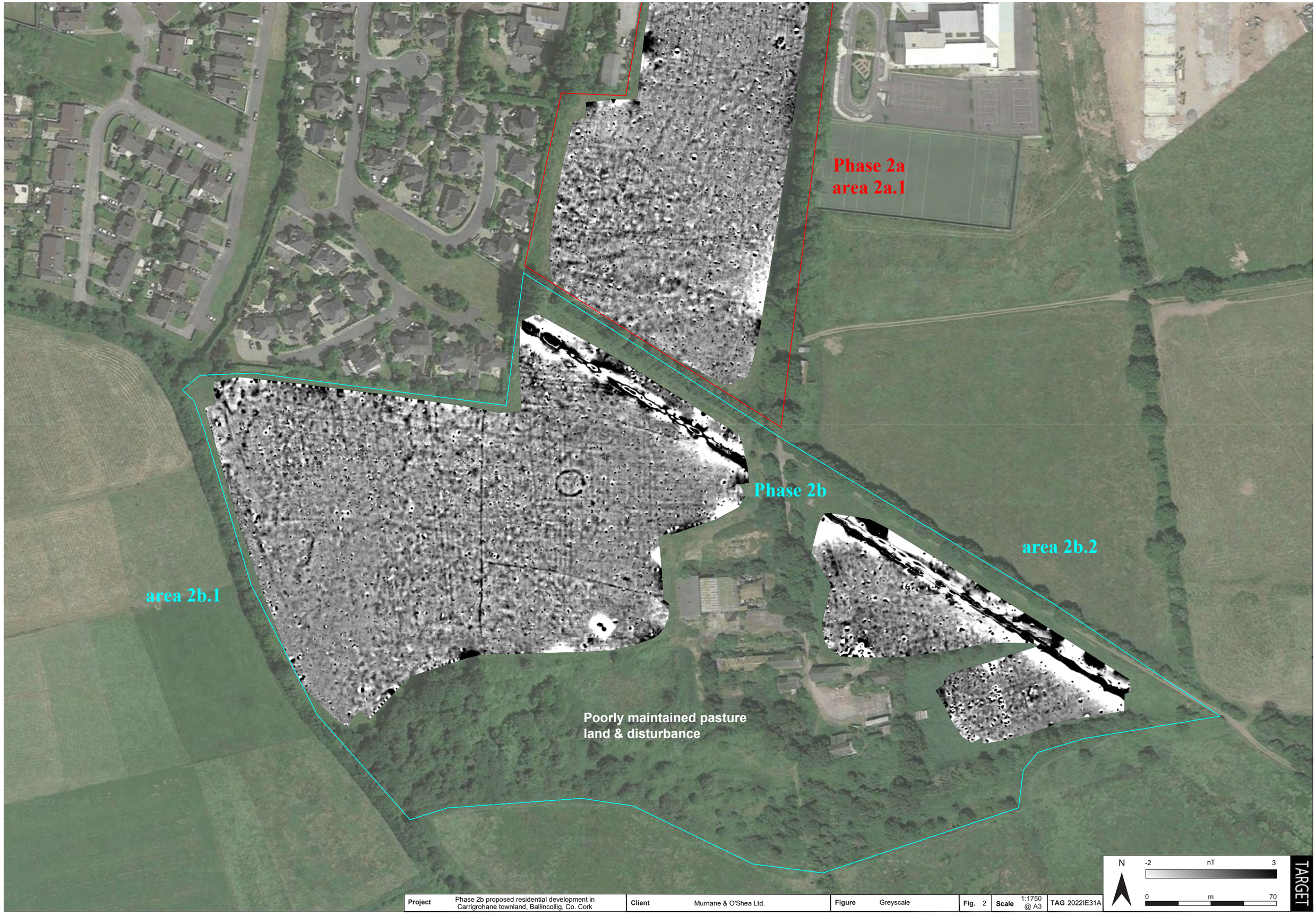
Phase 2a geophysical survey
Phase 2b geophysical survey
1km radius from site boundary
RMP

CO073-082
CO073-066
CO073-132
CO073-074
CO073-150
N22
CO073-101
CO073-103
CO073-161
CO073-104
CO073-100
N40
CO073-135
CO073-064
CO073-136
CO073-141
CO073-142
CO073-139
CO073-140
CO073-137
CO073-138
Maglin Road
N22
CO073-097
CO073-065
CO073-134
CO073-130
CO073-063
CO085-136001

N
0 m 400

Project	Phase 2b proposed residential development in Carrigrohane townland, Ballincollig, Co. Cork	**Client**	Murnane & O'Shea Ltd.	**Figure**	Site location	**Fig.** 1	**Scale** 1:10,000 @ A3	**TAG** 2022IE31

TARGET



Project	Phase 2b proposed residential development in Carrigrohane townland, Ballincollig, Co. Cork	**Client**	Murnane & O'Shea Ltd.	**Figure**	Greyscale	**Fig.** 2	**Scale**	1:1750 @ A3	**TAG** 2022IE31A



Project	Phase 2b proposed residential development in Carrigrohane townland, Ballincollig, Co. Cork	**Client**	Murnane & O'Shea Ltd.	**Figure**	Interpretation	**Fig.** 3	**Scale** 1:1750 @ A3	**TAG** 2022IE31A	TARGET

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APPENDIX 9-2 Archaeological Testing Reports – Lane Purcell Archaeology

Appendix 9.2a

Archaeological Testing

Carrigrohane, Ballincollig, Cork

Licence Number 24E0785
Preplanning

Avril Purcell MA MIAI
May 2025

Lane Purcell Archaeology,
64 Fr Mathew Road,
Turner's Cross,
Cork

Job Ref. LPA1248

on behalf of
MOS Homes Limited,
Link Road Business Centre
Link Road
Ballincollig
Cork

Abstract

The proposed development site is located in the townland of Carrigrohane to the south of Ballincollig, Co. Cork. It comprises two pasture fields and parts of two others at the southwest of the townland close to the Maglin River. There is the site of a standing stone (CO073-103) in the northwestern side of the proposed development site.

A geophysical survey was carried out on the site in 2022 which identified a circular ditched enclosure (Anomaly A), *c.* 16m diameter, with an east facing entrance (Nicholls 2022a). It is proposed to preserve it *in situ* within any future development.

Archaeological testing was carried out on the proposed development site in September and October 2024 when 26 trenches were excavated across the proposed development site. No trenches were excavated across Anomaly A, as it will be retained *in situ*. Two possible postholes were identified as well as a third posthole or the socket of the now-removed standing stone. The exact nature of a linear feature was unclear and it may have been associated with uprooting of limestone bedrock or it may be a feature of possible archaeological potential.

The results of the testing will inform the proposed development layout.

1 Introduction

1.1 The proposed development site is located in the townland of Carrigrohane in Ballincollig, Cork (ITM 560000 569924) (Fig. 1). It comprises two pasture fields and parts of two others at the southwestern end of the townland close to the Maglin River (Fig. 2). The remains of a farm complex lie towards the centre of the proposed development site. There is one recorded archaeological site on the proposed development site, the site of a standing stone (CO073-103).

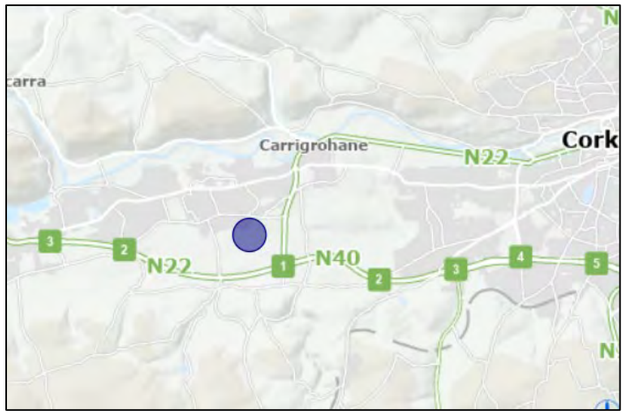


Figure 1: Ordnance Survey location map



Figure 2: Proposed development site on aerial image (2011-2103 MapGenie Digital) www.archaeology.ie

1.2 It is proposed to construct a Largescale Residential Development on the site. A geophysical survey was carried out on the site in 2022 (Nicholls 2022a). The survey identified a circular ditched enclosure (Anomaly A) (*c.* 16m in diameter) at the northern side of the proposed development site. It is proposed to preserve this *in situ* (Fig. 3). The farm complex towards the centre of the proposed development site is in ruins, heavily overgrown and inaccessible. It is proposed to demolish this complex in advance of development.

1.3 Preplanning archaeological testing was carried out in September and October 2024 (under licence 24E0785) when 26 trenches were excavated across the site. The layout of the test trenches was agreed in consultation with the City Archaeologist. The results of the testing will inform the development layout.

1.4 This report was compiled by Avril Purcell, Lane Purcell Archaeology, 64 Fr Mathew Road, Turner's Cross, Cork on behalf of MOS Homes Limited, Link Road Business Centre, Link Road, Ballincollig, Cork.

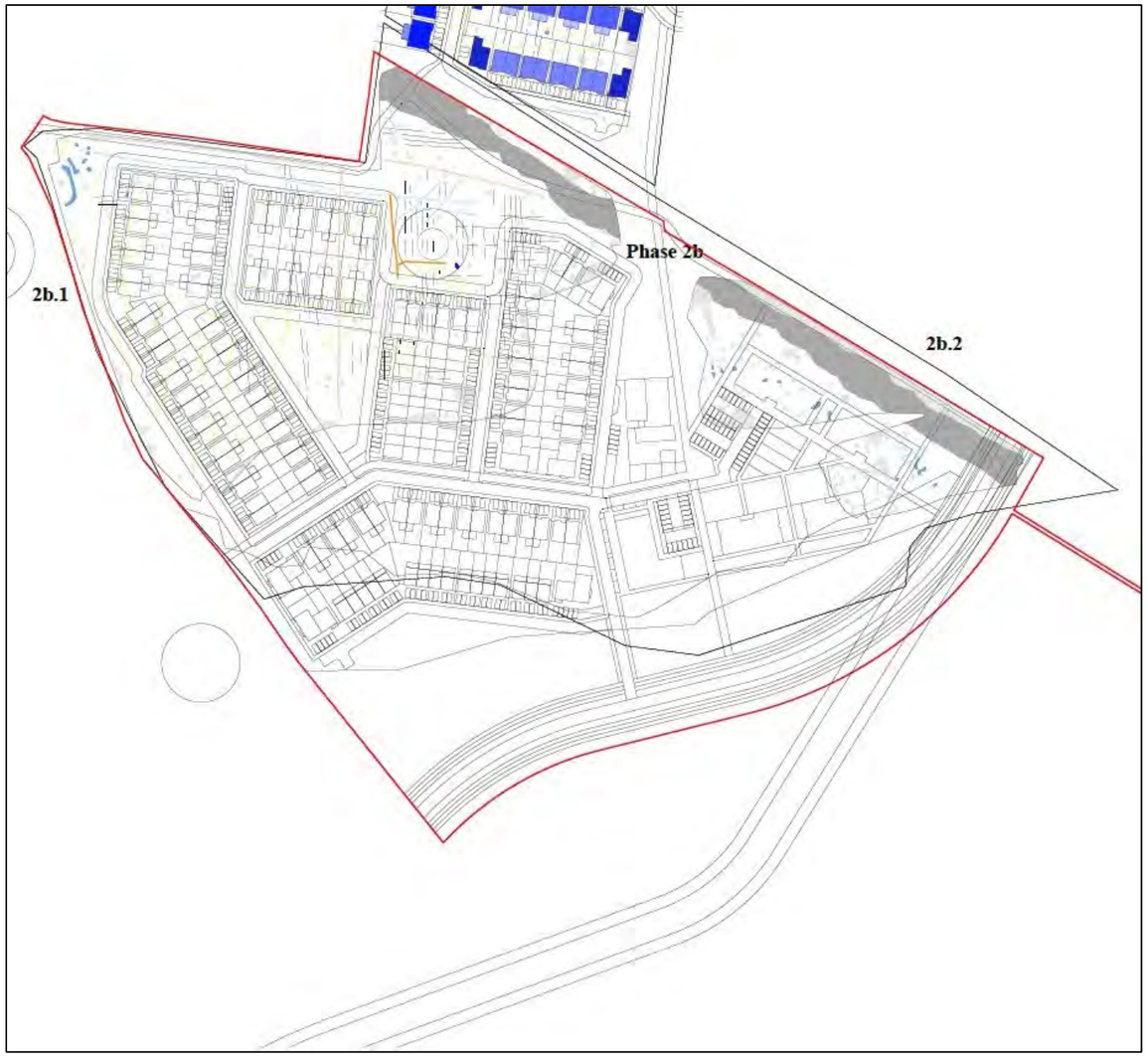


Figure 3: Preliminary development layout - overlaid on geophysical survey interpretation showing anomaly A preserved i*n situ*.

2 Archaeological and Historic Background

2.1 The proposed development site is located in the townland Carrigrohane on the southeastern edge of Ballincollig, in the parish of Carrigrohane and barony of East Muskerry, Co. Cork. There is one recorded archaeological sites on the proposed development site a standing stone (CO073-103) which no longer exists. The stone was located on the northwestern side of the proposed development site and was extant when inspected in 1995 (Ronan *et al*, 2009).There are twenty-four recorded archaeological sites within a 1km radius of the proposed development site. These sites are listed in the Record of Monuments and Places (RMP) for County Cork and the Sites and Monuments Record (SMR) database of the Archaeological Survey of Ireland (ASI) (Table 1 and Fig. 4). They provide evidence for human settlement and activity in the area dating from as early as the Neolithic (*circa* 4000-2400 BC) and indicate the archaeological potential of the proposed development site. The RMP lists all archaeological monuments and places known to be of archaeological importance in the county and affords them statutory protection under the National Monuments Act 1930 to 2004 (1994 amendment). The SMR database is a working database of all known archaeological monuments in the state and is continually updated.

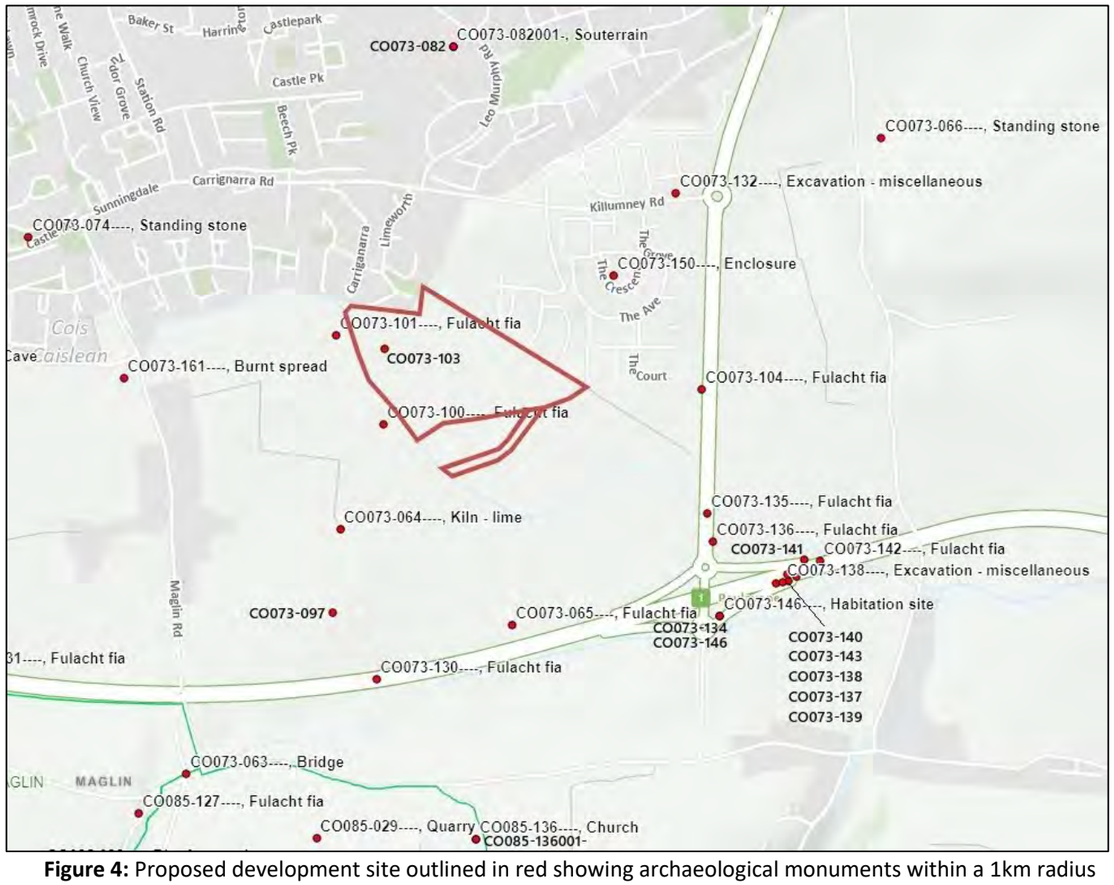


Figure 4: Proposed development site outlined in red showing archaeological monuments within a 1km radius (www.archaeology.ie)

SMR/RMP No.	Site Type	Townland	Distance from site
CO073-103	Standing stone	Carrigrohane	Within site
CO073-101	Fulacht fia	Maglin	35m to W
CO073-100	Fulacht fia	Maglin	40m to W
CO073-074	Standing stone	Ballincollig	755m to W

CO073-161	Burnt spread	Ballincollig	560m to W
CO073-064	Lime kiln	Maglin	290m to W
CO073-082	Ringfort	Carrigrohane	570m to N
CO073-082001-	Souterrain	Carrigrohane	570m to N
CO073-150	Enclosure	Carrigrohane	275m to NE
CO073-132	Excavation	Carrigrohane	525m to NE
CO073-066	Standing stone	Carrigrohane	905m to NE
CO073-104	Fulacht fia	Carrigrohane	270m to E
CO073-135	Fulacht fia	Curraheen	415m to SE
CO073-136	Fulacht fia	Curraheen	470m to SE
CO073-141	Fulacht fia	Curraheen	660m to SE
CO073-139	Fulacht fia	Curraheen	650m to SE
CO073-137	Burnt mound	Curraheen	644m to SE
CO073-138	Excavation	Curraheen	660m to SE
CO073-140	Burnt mound	Curraheen	670m to SE
CO073-142	Fulacht fia	Curraheen	670m to SE
CO073-143	Fulacht fia	Curraheen	670m to SE
CO073-065	Fulacht fia	Maglin	375m to S
CO073-134	Fulacht fia	Curraheen	615m to S
CO073-146	Habitation site	Curraheen	615m to S
CO073-130	Fulacht fia	Maglin	500m to S
CO085-136	Church	Ballynora	845m to S
CO085-136001-	Graveyard	Ballynora	845m to S
CO085-029	Quarry	Ballynora	900m to S
CO085-063	Bridge	Ballynora, Maglin	930m to SW
CO085-127	Fulacht fia	Maglin	1km to SW
CO073-097	Country house	Maglin	420m to SW

Table 1: RMP/SMR sites within a 1km radius of the proposed development site

2.2 The earliest recorded site in the vicinity of the proposed development site was identified and excavated during the construction of the N22 Ballincollig By-pass. A habitation site (CO073-146) was excavated on the road corridor in Curraheen to the southeast of the proposed development site. It revealed evidence of a multi-phased settlement dating to the Late Neolithic/Beaker Period and later activity from the early medieval period. Thirty five sherds of Beaker pottery, flint debitage, charcoal and charred seeds were recovered from a single pit on this site. Charcoal from the pit was dated to the 2580–2200 BC (Danaher 2002b). Two enclosing fosses were also excavated at the site, the larger of the two would appear to have been the settlement area while the smaller may have functioned as an animal compound. Radiocarbon dating of both fosses gave an early medieval date (AD 400-900). Over 100 features consisting of post-holes, stake-holes and pits were excavated within the larger enclosure and a post and wattle oval house (c. 8m E-W; 6m N-S) was identified in the NE quadrant (*ibid.*). In Carrigrohane to the northeast of the proposed development site, three pits (CO073-132) were excavated, also in advance of road construction. The pits contained inclusions of heat-shattered stones. A sherd of possible Bronze Age pottery, flint and chert debitage and a miniature stone (porcellanite) axe were recovered from this site (Danaher, 2002a). An isolated semi-circular pit (CO073-138) was identified in Curraheen which contained heat-shatter stones and charcoal (Russell, 2002).

2.3 The majority of the sites in the vicinity of the proposed development site are fulachtaí fia (totaling thirteen in number) along with three burnt mounds or spreads. Two (CO073-100 and CO073-101) of these lie just outside the proposed development site on the western side of the Maglin River. Fulachtaí fia are generally interpreted as ancient cooking sites, but could have been used for any purpose that required large quantities of hot or boiling water. They usually survive as a spread, or mound, of heat-shattered and burnt stone. The burnt stone generally fills and covers one or more troughs or pits cut into the ground. The trough, which was sometimes lined with timber, wattle or stone, would have been excavated below the water table, near a spring or stream and allowed to fill with water. A fire was set adjacent to the trough, to heat stones, and the water was then heated or boiled by immersing the fire-heated stones in it. Experiments have shown that large quantities of water can be boiled in this way in about twenty minutes and joints of meat wrapped in straw can be cooked over several hours. After each use the burnt and heat-shattered stones would have to be cleaned out of the trough. Over time this material accumulated to form a crescent shaped mound of burnt material around the trough. Fulachtaí fia are usually dated to the Bronze Age (2400-500BC). Although they are generally interpreted as cooking sites they were also used for bathing, processing textiles, tanning, brewing, extraction of fats from meat, and soap making, or even a combination of these functions (Ó Drisceoil, 1988; Monk 2007; Quinn & Moore 2007). Burnt mounds and spreads are usually the levelled remains of ploughed out fulachtaí fia.

2.4 The standing stone (CO073-103) on the northwestern side of the proposed development site was visited by the ASI in 1995, at which time it was upstanding. It is now no longer extant. It is described in the Archaeological Inventory of Co Cork (Ronan, *et al*. 2009) as follows:
In pasture. This standing stone (0.6m x 0.17m; H 1.2m) comprises a thin slab that is orientated E-W and leans heavily to the N.
There are two other standing stones in the vicinity of the proposed development site; one in Carrigrohane (CO073-066) and the other in Ballincollig (CO073-074) which was removed when a housing estate was built *c.* 1980 (Power *et al.,* 1997). Standing stones may have had a number of functions in the prehistoric landscape. They were often erected in prominent locations and may have marked routeways or tribal boundaries while others may have marked burials or had a ceremonial or ritual purpose. Those erected in the prehistoric period tend to be aligned NE-SW. The standing stone that stood on the proposed development site was oriented E-W while the one in Carrigrohane (CO073-066) is orientated NE-SW. More recent standing stones may have been erected as scratching posts for animals.

2.5 A small number of recorded archaeological sites in the vicinity of the proposed development site date to the early medieval period including a ringfort and souterrain in Carrigrohane (073-082 and CO073-082001-). These monuments date to the historic, early medieval period, also known as the Early Christian period (5th to the 12th century AD), when Christianity was introduced to the country. Ringforts (also known by the names rath, lios, cathair or caiseal/cashel) are defended farmsteads and are the most characteristic monument of this period. Their main phase of construction and occupation dates from the beginning of the 7th century AD to the end of the 9th century. They are generally circular or oval in plan, defined by an earthen bank with an external ditch or fosse. Some ringforts have associated souterrains (underground chambers connected by narrow creepways) as defensive features which may have also been used for storage. Others have associated corn-drying kilns and sometimes external structures. Generally, it has been speculated that the elite of society occupied ringforts and that the less wealthy lived in undefended settlements scattered across the landscape. In more recent archaeological investigations, particularly on road infrastructure projects in Co. Cork, the number and type of unenclosed medieval settlements identified has been growing, suggesting more diversity in contemporary settlement patterns (Monk 2019) and challenging the perceived importance of ringforts within the early medieval landscape. The ringfort and souterrain in Carrigrohane (CO073-082 and CO073-082001-) to the north were investigated in advance of a proposed development. Both the inner and outer ditches were identified as well as internal and external features and evidence for a possible souterrain (Moloney 2003).

Souterrains also date to the early medieval period and in many cases are associated with ringforts but can also be found in isolation. They are underground structures generally earth- or rock-cut, comprising

chamber(s) connected by narrow creepways. The term souterrain derives from the French *sous* meaning under and *terre* meaning earth. When in contemporary use they would have been called *óin* or *uam* (*uaimh* in modern Irish) and on cartographic sources are often noted as caves (Clinton, 2001 and Power *.,* 1992). They were probably used for as defensive features and also as storage (*ibid*.).

The term enclosure is frequently applied to ringforts which have been levelled and no visible surface trace remains. The enclosure in Carrigrohane (CO073-150) to the northeast was identified by geophysical survey in 2008 (Nicholls, 2008) in advance of the Heathfield residential development and the surrounding area was subsequently archaeologically tested (Cummins, 2008). The enclosure was preserved *in situ* within the development and subsequent archaeological monitoring of the surrounding area, during construction, revealed no features or finds of archaeological significance (Purcell and O'Leary, 2019).

2.6 Recent archaeological investigations in the areas immediate to the proposed development site have identified further archaeological remains. These will be added to the archaeological record in due course. In 2023 archaeological testing and subsequent excavation was carried out in advance of an extension to the Heathfield development immediately to the north (Purcell 2023). A cluster of pits was identified by geophysical survey (Nicholls 2022b). Subsequent archaeological excavation confirmed the presence of over twenty large pits of prehistoric date as well as associated stake-holes and postholes (Purcell, in preparation). In 2024 two small prehistoric pits were identified during archaeological testing in advance of development in the adjoining townland of Maglin to the west (Purcell and O'Leary 2024). In 2024 archaeological testing on a proposed greenway to the north of the proposed development site revealed an inhumation of Iron Age or early medieval date, probably within the ditch of an earlier enclosure (Purcell, in preparation). The enclosure was identified as a possible archaeological feature in a geophysical survey (Nicholls 2022a).

2.7 The area of the proposed development site is depicted on the 1842 Ordnance Survey (OS) 6-inch map (Fig. 5) as comprising all or part of nine fields set around an unnamed settlement or farm complex (part of which remains upstanding). The complex comprises six, mostly rectangular, buildings at the southern end of a lane that extends south from the Carrigrohane to Killumney road. The lane stops at the complex and recommences some distance to the south where it continues to the Maglin River. A well is depicted near the commencement of the lane in the field to the south of the complex and a lime kiln is depicted, close to the western border in an area of overgrowth. The Maglin River which defines the western and southwestern sides of the proposed development site is denoted as a parliamentary boundary. The standing stone is neither named nor depicted.

When the 25-inch OS map (1903) was compiled the area of the proposed development site had been substantially altered by the construction of the Cork & Macroom Direct Railway, the line of which defines the northern and northeastern site boundary (Fig. 6). A level crossing now cuts through the lane from the Carrigrohane to Killumney road providing access to the complex to the south. The complex itself had been expanded and modified and is now named "Carriganarra". To the south of the complex the layout remains unchanged other than the removal of the south-running lane. The well to the south is depicted and named "well" and the lime kiln to the west is shown and marked "Lime Kiln (disused)". Again the standing stone is neither named nor depicted.

The OS 6-inch map of 1939 depicts minor changes to the area of the proposed development site (Fig. 7). Field boundaries are largely unchanged but small changes have been made to the Carrignarra settlement complex. Again the standing stone is neither named nor depicted.

OS aerial photographs (Fig. 2) from the end of the 20th and start of the 21st century show the settlement complex as comprising a number of buildings, including modern haybarns around two open yards, one to the east of the lane and the other to the west.

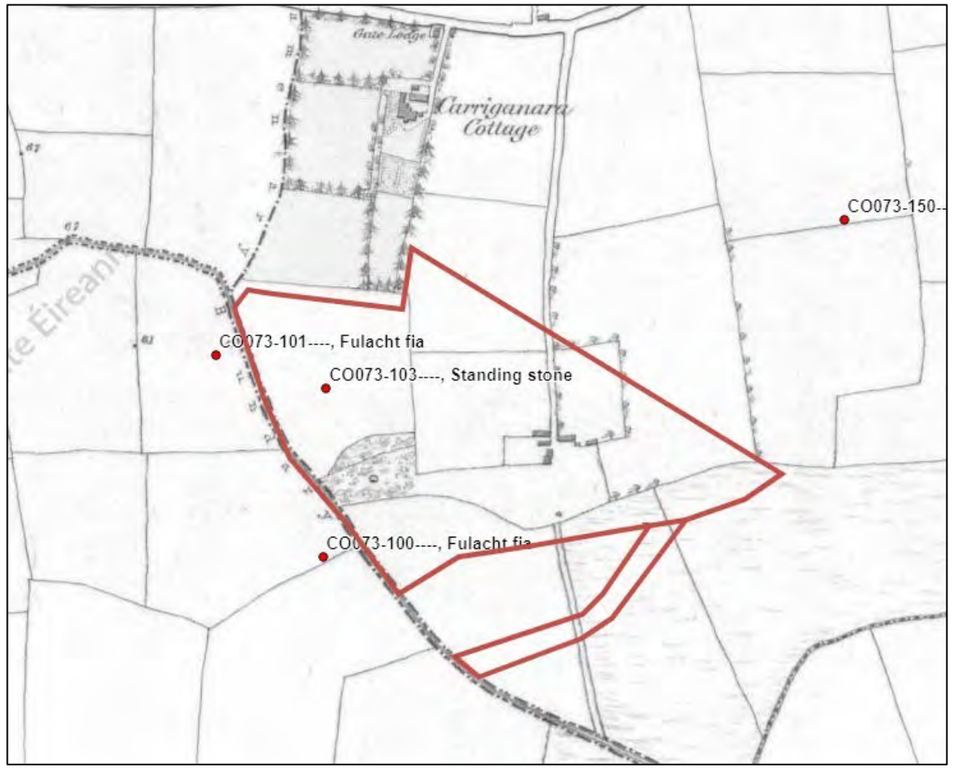


Figure 5: Extract from OS 6-inch map (1842) (www.archaeology.ie)

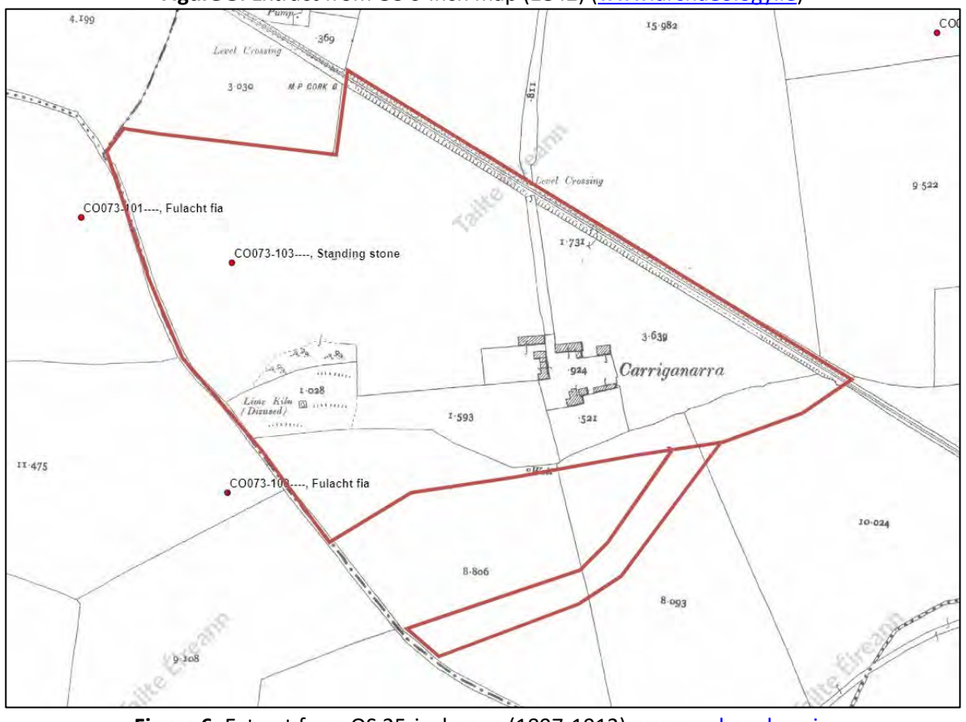


Figure 6: Extract from OS 25-inch map (1897-1913) www.archaeology.ie

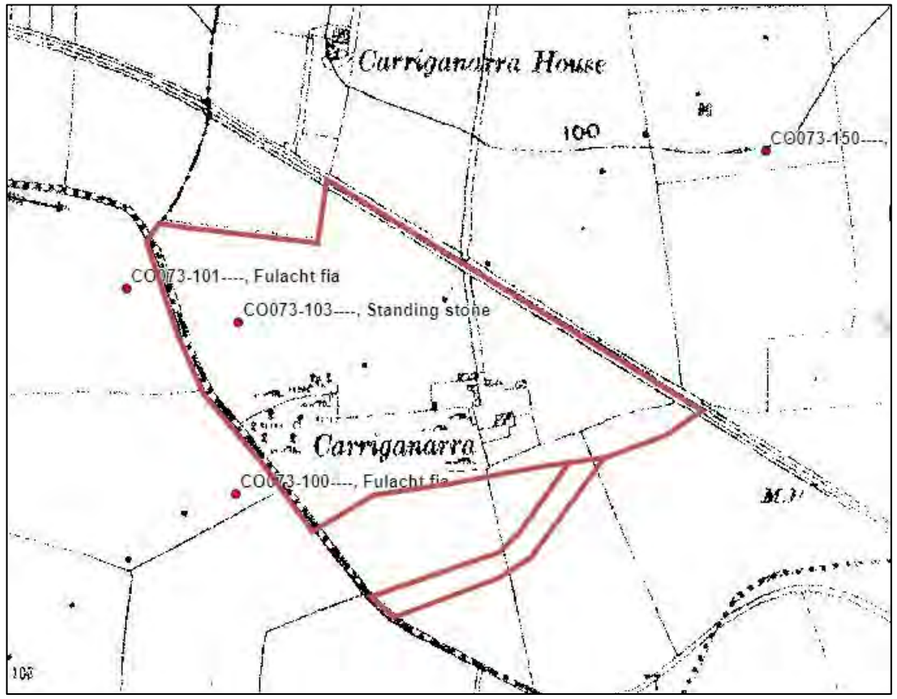


Figure 7: Extract from OS 6-inch map (1939) www.archaeology.ie

3 Geophysical Survey

3.1 The northern section of the proposed development site was subject to geophysical survey in 2022 (under licence 22R0331) (Nicholls 2022a). A high resolution magnetometry survey was carried out across Fields 1 (2b.1) and 2 (2b.2) covering and area of 4.8ha; the southern Fields (3 and 4) were not suitable for survey due to poor ground conditions and dense vegetation cover. The survey was undertaken to identify, locate and describe geophysical anomalies of possible archaeological origin within the land.

3.2 A circular ditched enclosure (*c.* 16m diameter) was recorded in Field 1 (2b.1) (Fig. 8). The enclosure had an east-facing entrance and a number of responses of interest were indicated in proximity to it, including a potential pit to the southeast and traces of possible early field systems to the south and west. The survey results also display the effects of recent land use, in the form of small and large scale ferrous and remnants of three field boundaries and past cultivation. Strong magnetic variation to the north and north-east was associated with the former Great Southern Railway line (ibid.). The survey results are outlined in Table 3 below:

Area	Anomaly(s)	Location	Description & likely provenance
2b.1	A	NE of survey centre	*Archaeology* Magnetically strong circular ditched enclosure c.16m in diameter with an E facing entrance. This enclosure is visible as a faint circular cropmark on recent google aerial imagery.
2b.1	B	E-NE of survey centre	*? Archaeology* Possible pit type feature. Interpretation is tentative given the proximity of modern ferrous debris, responses from former boundaries, past cultivation and natural soil/geological variation.
2b.1	C	NE of survey centre	*? Part of early field system* Weakly magnetic linear trends potentially forming part of a rectangle at the perimeter of enclosure A. Interpretation is tentative given the proximity and similar magnitude of former cultivation trends.
2b.1	D	W-NW	*?? Archaeology* Sub-rectangular positive potentially representing part of an enclosure extending beyond the site boundary. However, D lies on a steep W facing slope in proximity to patterns of former cultivation and natural sol/geological variation. A natural soil/geological and/or recent landuse explanation should also be considered.
2b.1	E	W-E	*Trend* Parallel linear trends of potential note c5-6m apart from one another, potentially representing remnants of a former trackway or road. Interpretation is tentative.
2b.1	F-G	N	*Trend* Weakly magnetic curvilinear trends bordering the limits of phase 2b.1. These are barely visible above the 'magnetic background', and located at the edge of an existing boundary. Interpretation is highly tentative. A recent landuse and/or natural soil/geological explanation should also be considered.
2b.2	H	SE	*?? Archaeology* Irregular positive responses. An archaeological or natural soil/geological explanation for H is equally plausible.

Table 2: Description of anomalies identified in geophysical survey (Nicholls 2022a)



Figure 8: Geophysical interpretation of the proposed development site (Nicholls, 2022a)

4 Test Trenches

4.1 Archaeological testing was carried out on the 26th September and the 1st and 2nd of October 28th 2024 (under licence 24E0785) to verify the results from the geophysical survey and to identify any other subsurface archaeological remains. Twenty six trenches were excavated across the proposed development site (Fig. 9). The weather conditions were generally dry and overcast. All trenches were mechanically excavated using a grading bucket and were 2.2m wide. The trenching extended across the four fields, of which Fields 1 and 2 were subject to geophysical survey - the ground conditions in Fields 3 and 4 made them unsuitable for survey. Field 1 was a fairly level pasture field in which the standing stone (CO073-103) had been located and Trench 7 was laid out so that it would extend across the site of this stone. The southeastern end of the field, adjacent to the settlement complex appeared to have been disturbed with several piles of stone and material in this area. Field 2 was under rough pasture, partially cut by discontinuous dense hedgerows and was bounded to the west by the garden of a house. Field 3 was heavily overgrown, falling to the south to low lying boggy ground which was densely covered by reeds and bog grasses. The heavily overgrown remains of a lime kiln lie at the northern end of the field. Field 4 was low-lying, boggy ground, densely overgrown with reeds and bog grasses.

It is proposed that a greenway will run along the northern edge of the proposed development site (in Field 1) and archaeological testing was carried out here in 2024 (Purcell, in preparation).

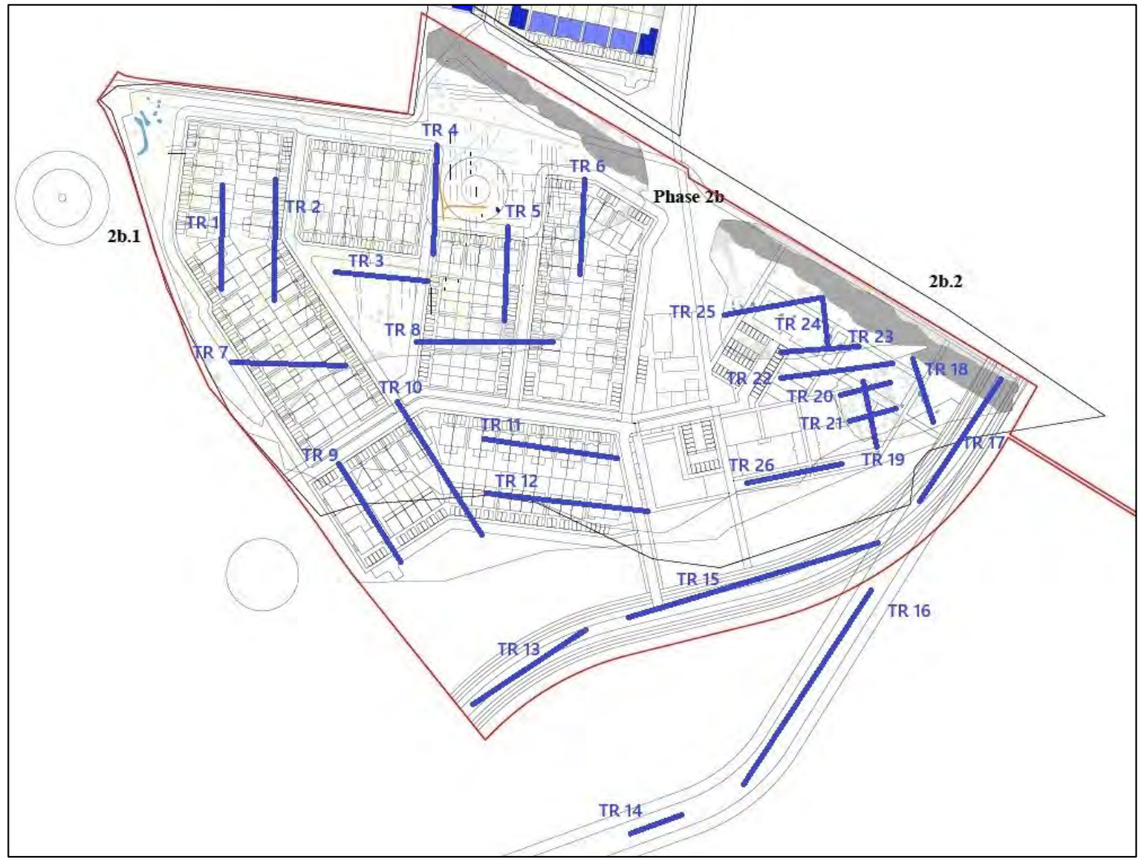


Figure 9: Test trenches excavated across the proposed development overlaid on preliminary development layout

4.2 Trenches 1 to 26 area described as follows:

Trench No.	Description
Trench 1	58m long; oriented NS 0 – 0.28m Topsoil 0.28 – 0.4m Mid-orange-brown, loamy clay subsoil with moderate inclusions of stone. A stoney pocket was apparent at the southern end.
Trench 2	66m long; oriented NS 0 – 0.25m Topsoil 0.25 – 0.4m Mid-mid-orange-brown, loamy clay subsoil with moderate inclusions of stone. At the northern end a small deposit of slightly darker slightly silty clay was visible (0.3m diameter). This was not further investigated but may be a possible posthole and of possible archaeological significance.
Trench 3	56m long; oriented EW 0 – 0.29m Topsoil 0.29 – 0.5m Light orange-brown fine loamy clay subsoil with occasional stone. A small feature (0.6m EW x 0.5m NS) was identified at the east of centre in the trench. This was not further investigated but may be a possible posthole and of possible archaeological significance.
Trench 4	62m long; oriented NS 0 – 0.25m Topsoil 0.25 – 0.35m Light orange-brown, fine loamy clay subsoil with occasional limestone protruding along the length of the trench. At the southern end the subsoil was slightly more gritty.
Trench 5	51m long; oriented NS 0 – 0.3m Topsoil 0.3 – 0.4m Light orange brown, fine loamy clay slightly stoney subsoil.
Trench 6	55m long; oriented NS 0 – 0.27m Topsoil 0.27 – 0.4m Light orange brown, fine loamy clay slightly stoney subsoil. The southern end of the trench was close to an existing haybarn and the surrounding area (approximately 14m-15m) was very heavily disturbed with concrete and plastic mixed through the soil.
Trench 7	65m long; oriented EW 0 – 0.3m Topsoil 0.3 – 0.4m Light orange-brown, fine loamy clay slightly stoney subsoil. This trench was designed to cross the location of the standing stone (CO073-103). No evidence for the socket for the stone was found, however, a small feature (0.7m in diameter) was identified at the eastern end of the trench in the approximate location of the standing stone. This was filled with mid-red-brown, charcoal-flecked loamy clay. It was partially investigated by hand to a depth of 0.08m and had an evenly sloping base. It appears to be a feature of archaeological significance, possibly a posthole.
Trench 8	73m long; oriented EW 0 – 0.3m Topsoil 0.3 – 0.4m Light orange brown, fine loamy clay slightly stoney subsoil. The trench was dug in two sections around a pair of electrical poles.
Trench 9	60.5m long; oriented NW SE 0 – 0.15m Topsoil 0.15 – 0.55m Light grey-orange-brown, firm silty clay subsoil. The upslope (northern end) of the trench (28m long) contained a fill of clay mixed with concrete, plastic, wood etc. to a depth upwards of 1.5m. The remainder of the trench, which fell to the south, appeared to be largely undisturbed other than a machine-cut trench cut across the southern end.
Trench 10	67m long; oriented NW SE 0 – 0.17m Topsoil 0.17 – 0.5m Light brown-grey-orange, firm silty clay subsoil. As in Trench 9, the upslope (northern end) of the trench (42m) contained a fill of stoney clay to a depth upwards of 1.6m. The southern end of the trench was undisturbed. A NE-SW stone-filled drain 0.45m wide cut across the southern end of the trench.

Trench 11	72m long; oriented EW 0 – 0.15m Topsoil 0.15 – 1.6m+ Mid-brown, stoney clay with occasional plastic, concrete, wood and pipe. The full length of this trench contained a fill of stoney clay to a depth upwards of 1.6m.
Trench 12	79m long; oriented EW 0 – 0.15m Topsoil 0.15 – 1.8m+ Mid-brown, stoney clay with occasional plastic, concrete, wood and pipe. As in Trench 11, the entire length of this trench contained a fill of stoney clay to a depth upwards of 1.8m.
Trench 13	62m long; oriented NE-SW 0 – 0.15m Topsoil 0.15 – 0.48m Light orange-brown-grey, firm silty clay subsoil. Water began to pool in the trench.
Trench 14	29.3m long; and oriented NE-SW 0 – 0.15m Topsoil 0.15 – 0.55m Light orange-brown-grey, firm silty clay subsoil. A pocket of stoney manganese (approximately 2m diameter and 0.02m deep) was exposed.
Trench 15	113.5m long; oriented EW 0 – 0.15m Topsoil 0.15 – 0.5m Light orange-brown-grey, firm silty clay subsoil with very occasional charcoal. The trench was in two section cut by a substantial hedgerow which separated Fields 3 and 4.
Trench 16	90m long; oriented NE-SW 0 – 0.15m Topsoil 0.15 – 0.45m Light orange-brown-grey, firm silty clay subsoil with occasional manganese and iron panning and very occasional charcoal. The trench was in two sections cut by a substantial hedgerow which separated Fields 3 and 4.
Trench 17	44m long; oriented NE-SW 0 – 0.15m Topsoil 0.15 – 0.5m Light pink-orange-brown-grey, firm sandy clay subsoil. The trench was in two section cut by a substantial hedgerow that separated Fields 2 and 4. The northern section of the trench (approximately 10m length) was heavily disturbed from the construction of a water main through the area.
Trench 18	38m long; oriented NW-SE 0 – 0.2m Topsoil 0.2 – 0.33m Mid-orange-brown, fine loamy clay subsoil with pockets of limestone throughout 0.33 – 0.4m Light grey fine gritty gravel with pockets of limestone. A linear feature (0.4m wide) was exposed at the southern end of the trench running E-W across it. It was filled with mid-brown, silty clay with occasional charcoal. It was partially investigated by hand and was found to be 0.2m deep with steeply sloping side and a slightly irregular base. It may be of archaeological potential but may also be derived from disturbance related to extracting limestone in the past.
Trench 19	32m long; oriented EW 0 – 0.08m Topsoil 0.08 – 0.3m Mid-orange-brown, fine loamy clay subsoil with fractured limestone throughout the trench, in places just under the sod.
Trench 20	31.5m long; oriented EW 0 – 0.1m Topsoil 0.1 – 0.35m Mid-orange-brown, fine loamy clay subsoil with fractured limestone throughout the trench, in places just under the sod.
Trench 21	29m long; oriented NS 0 – 0.2m Topsoil 0.2 – 0.25m Mid-orange-brown, fine loamy clay subsoil with fractured limestone throughout the trench, in places just under the sod.
Trench 22	46m long; oriented EW