

Civil Engineering Planning Report

Property:

River Barrow Activity Centre,
The Park, Carlow,
Co. Carlow.

Client:

Carlow County Council
C/o Kenneth Hennessy Architects

Date:

23/09/2021

Project Ref. No.:

K194

Directors:

Austin Dennany
John Reidy
Barry McGinn

BA BAI DipProjMgmt PGDipABRC CEng MIEI
BE DipProjMgmt DipConstLaw&CA CEng MIEI MCI Arb
BSc (Eng) DipEng DipProjMgmt DipConstLaw&CA CEng MIEI

Associate Directors:

Brian Healy BE CEng MIEI
Robert Power BEng BSc CEng MIEI
Conor McDonagh BE MSc CEng MIEI



Table of Contents

1.0	Introduction & Background	1
2.0	Civil Engineering Water and Drainage Services	3
2.1	Existing Services	3
2.2	Foul Water Drainage	6
2.3	Surface Water Drainage.....	7
	2.3.1 Site A – River Barrow Activity Centre	7
	2.3.2 Site B – Car Parking Area.....	7
2.4	Boat Washdown Area	7
2.5	Water Supply	8
3.0	Flooding.....	8
4.0	Traffic	8
4.1	Introduction	8
4.2	Swept Path Analysis	9
4.3	Visibility Splay.....	9
4.4	Construction Traffic Management Plan (CTMP)	9
4.5	Road Design	9
4.6	Conclusion.....	10
5.0	Site Investigation.....	10
	Appendix A – Site Location Plan	11
	Appendix B – Irish Water Asset Maps	12
	Appendix C – Carlow Town Main Drainage Drawing.....	14
	Appendix D – Irish Water Confirmation of Feasibility	15
	Appendix E – Foul Wastewater Discharge Calculations	17
	Appendix F – Water Demand Calculations	18
	Appendix G – Foul Network Calculations	19
	Appendix H – Storm Water Network Calculations.....	20

Document Control

Producer:	Date:	Verifier:	Date:	Approver:	Date:	Revision Status:
Brian Healy	29/04/21	Kevin Dunne	29/04/21	John Reidy	29/04/21	1 st
Brian Healy	23/09/21	Kevin Dunne	23/09/21	John Reidy	23/09/21	2 nd

1.0 Introduction & Background

DRA Consulting Engineers have been engaged by Carlow County Council to provide structural and civil engineering services up to Planning Stage for the River Barrow Activity Centre at The Park, Carlow, Co. Carlow.

The proposed development will consist of the construction of the River Barrow Activity Centre at 'Site A' and the provision of a car park at 'Site B' providing 14no. car parking spaces and bicycle parking. The main access to 'Site A' is via Barrow Street which connects to Maryborough Street. The main access to 'Site B' is at the junction of Maryborough and Sleaty Street. Figure 1 below the location of the proposed development.

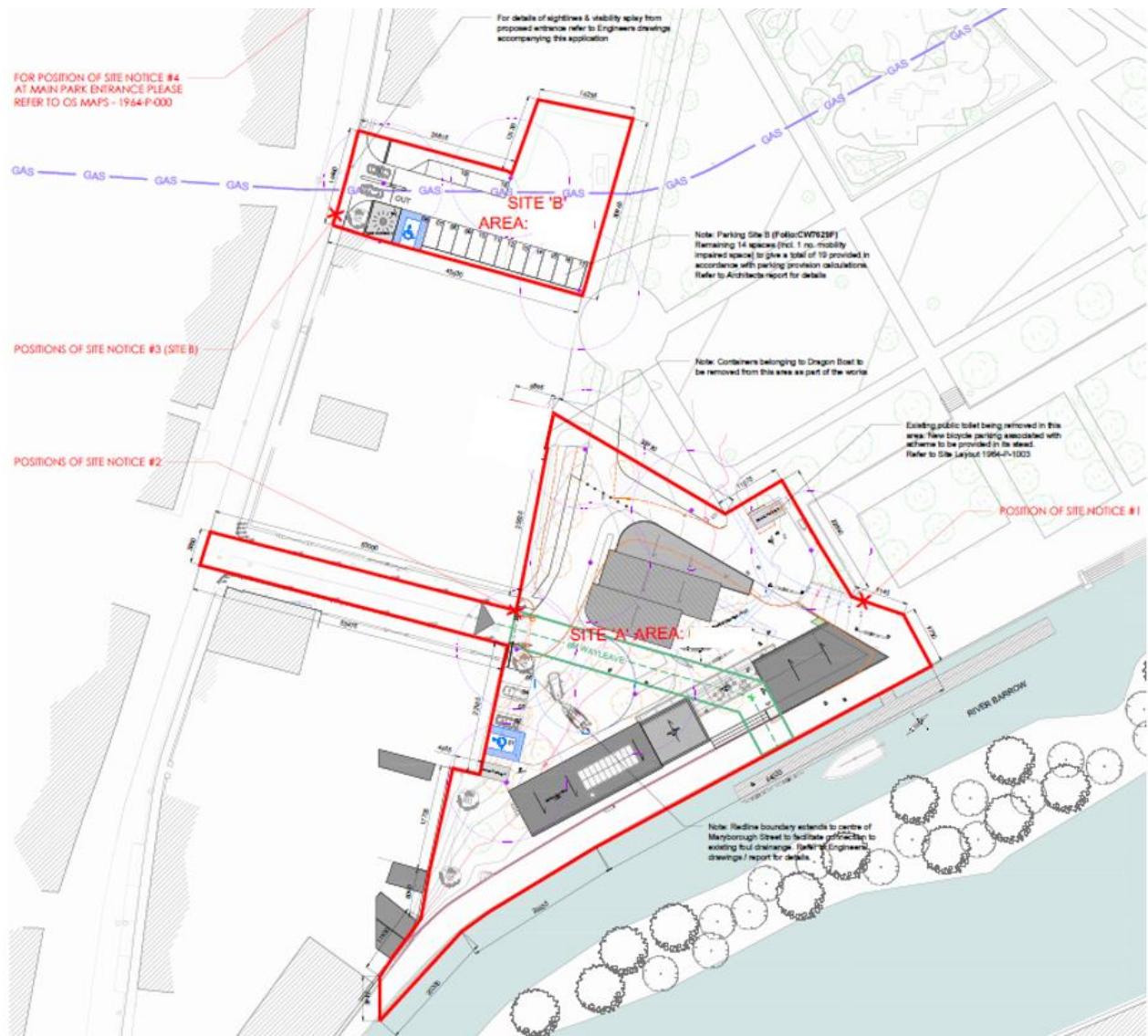


Figure 1 – Proposed Development (Site A & Site B)

The proposed development at 'Site A' is located in the south west corner of the existing park on an elevated area behind an existing flood defence wall.

A suite of geotechnical and environmental testing has been completed on 'Site A' by IGSL Ltd.

The River Barrow Activity Centre development at 'Site A' is a mix of single storey and 2-storey construction to be supported off piled foundations. Figure 2 below is a photograph of the existing flood defence wall at 'Site A'.



Figure 2 – Existing Flood Defence at 'Site A'

The site location map is enclosed in Appendix A of this report.

For reference, this report should be read in conjunction with the following drawings:

- Drawing No. K194-100-2: *Existing Site Plan*
- Drawing No. K194-150-2: *Proposed Drainage Layout*
- Drawing No. K194-160-2: *Proposed Watermain Layout*
- Drawing No. K194-170-2: *Proposed Road Layout & Sightlines*
- Drawing No. K194-175-2: *Proposed Vehicle Swept Path*

2.0 Civil Engineering Water and Drainage Services

This section outlines the following civil engineering services for the proposed development;

- Foul water drainage;
- Surface water drainage;
- Potable water supply.

It is proposed to construct separate foul and surface water drainage systems with separate outfalls to the respective combined and surface water public sewers. Therefore, no surface water will discharge to the public combined foul sewer system on Maryborough Street.

2.1 Existing Services

There is an existing gas main running through the proposed car park at 'Site B'. See Figure 3 extract below.

The asset maps and the main drainage drawing provided by Carlow County Council show an existing 600mm diameter concrete combined sewer overflow running across 'Site A' and discharging directly to the River Barrow. We understand that this system is a pressurised system and that the new development cannot discharge into this line. See Figure 4 and Figure 5 extracts below.

There is an existing 1200mm diameter concrete stormwater line running along the western portion of 'Site A' which turns south west and runs along Bachelors Walk. See Figure 5 extract below.

There is an existing combined sewer running along Maryborough Street which transitions from a 375mm diameter vitrified clay sewer to a 525mm diameter vitrified clay sewer at the intersection of Maryborough Street and Barrow Street. See Figure 4 extract below.

There is also a 150mm diameter uPVC watermain running along the eastern side of Maryborough Street. Relevant extracts from the maps and drawings are shown below. See Figure 6 extract below.

The asset maps for this site are provided in Appendix B and Appendix C of this report.



Figure 3 – Extract from Gas Main Services Map



Figure 4 – Extract from Irish Water Wastewater Services Map



Figure 5 – Extract from Irish Water Wastewater Services Map



Figure 6 – Extract from Irish Water Watermain Map

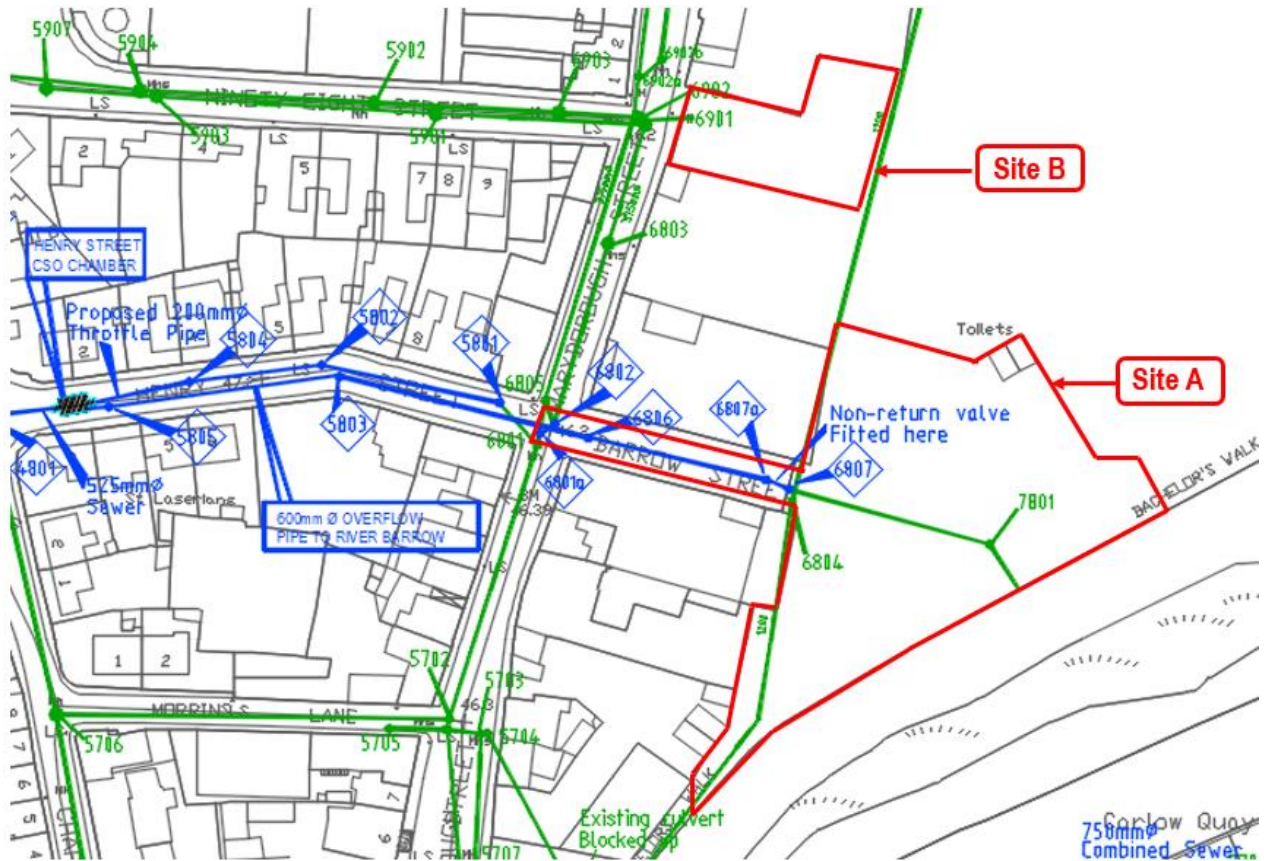


Figure 7 – Extract from Carlow Town Main Drainage Map

2.2 Foul Water Drainage

It is proposed that the foul effluent from the 'Site A' development will be discharged into an existing combined manhole located on Maryborough Street via a new 150mm diameter uPVC drain connection running down Barrow Street. It is proposed to fit a non-return flow valve to the new connection to mitigate against potential stormwater back flow to the subject site from the existing combined sewer system.

A Pre-Connection Enquiry (Reference Number: CDS20006994) was submitted to Irish Water and a Confirmation of Feasibility was received dated 20/11/2020. A copy of this Confirmation of Feasibility is contained in Appendix D of this report.

The proposed 'Site A' development has allowed for a 6.0m wayleave to the existing 600mm diameter concrete combined overflow sewer running from west to east through the site discharging into the River Barrow.

The foul wastewater discharge calculations for 'Site A' are provided in Appendix E of this report.

2.3 Surface Water Drainage

2.3.1 Site A – River Barrow Activity Centre

Infiltration tests carried out by IGSL LTD as part of their Site Investigation Report of 'Site A' concluded that it is unlikely that soakaway systems will function in these ground conditions. It will therefore be necessary to discharge run-off water to the existing surface water system.

It is proposed that the surface water from the 'Site A' development will be discharged into the existing 1200mm diameter concrete stormwater line to the west of the site without attenuation, as agreed with Mr. Kieran Cullinane, Senior Engineer with Carlow County Council. Surface water generated from impermeable surfaces (roof, access road and car parking spaces) will be collected by means of rainwater pipes, slot drains and road gullies. The collector drain will pass through a proprietary petrol interceptor to the surface water outfall manhole SWMH 3, before discharging into the existing 1200mm diameter concrete stormwater line. It is proposed to fit a non-return flow valve to the new connection to mitigate against potential stormwater back flow to the subject site.

2.3.2 Site B – Car Parking Area

The new car parking area at 'Site B', will be constructed as self-draining permeable pavements (i.e., permeable paving & porous asphalt). Permeable pavements allow rainwater to infiltrate through the surface and into the underlying stone sub-base, allowing for initial storage before gradually infiltrating into the ground below over a period of time.

It is estimated that, depending on weather conditions, up to 30% of surface water entering permeable pavement systems can be subsequently lost through evaporation and, therefore, does not leave the site in the form of exit water. An additional advantage of permeable paving systems is that water exiting such systems typically has a pH value of approximately 7.5. Rainfall typically has a pH value of approximately 4.5. According to the CIRIA SUDS Manual 2015, the layers of stone and the geotextile membrane act as a form of trickle filter. Organic matter and silt are caught by the geotextile membrane and held within the laying course. Heavy metals have an affinity to particulates, adhering to the surface of the organic matter and silt. They are subsequently stabilised and retained within the sub-base. Hydrocarbons are digested within the sub-base by naturally occurring microbes. Research undertaken at Coventry University on microbial growth has shown that such systems are capable of degrading at least 70g of oil per square meter per annum. Prior to construction of the carpark, a specialist designer will be engaged to design a proprietary permeable pavement and to ensure that it is appropriate to deal with any hydrocarbon spillages or leaks that may occur in the carpark.

2.4 Boat Washdown Area

It is proposed to provide a designated area for users to wash down boats and equipment on 'Site A'. This will consist of an external contained hard (impermeable) surface area where equipment can be washed down. The wash will be collected by means of a surface channel drain discharging into a precast concrete gravity flow silt chamber. The discharge will then be treated with a UV light sterilisation unit for biological control before discharging into the surface water system within the subject site. This will prevent pathogens such as Crayfish plague from entering the River Barrow during the operational phase of the development. It is considered that there would be no cumulative water quality impacts which would pose a significant risk to designated sites.

2.5 Water Supply

It is proposed that the potable water supply for the 'Site A' development will be sourced from the 150mm diameter uPVC main line in Maryborough Street via a new 100mm diameter PE connection running down Barrow Street. As per the foul drainage, there are existing toilet facilities in the park which may be taking water supply from barrow street, however no record of this line is currently available.

The water demand calculations are provided in Appendix F of this report.

3.0 Flooding

'Site A' is located in an area which is defended to above the 0.1% AEP Event by an existing flood defence wall along Bachelors Walk. 'Site B' is located in an area susceptible to a 0.1% Fluvial AEP Event (1 in 1000 year flooding event). A Flood Risk Assessment has been prepared and will accompany this planning submission as a separate document.

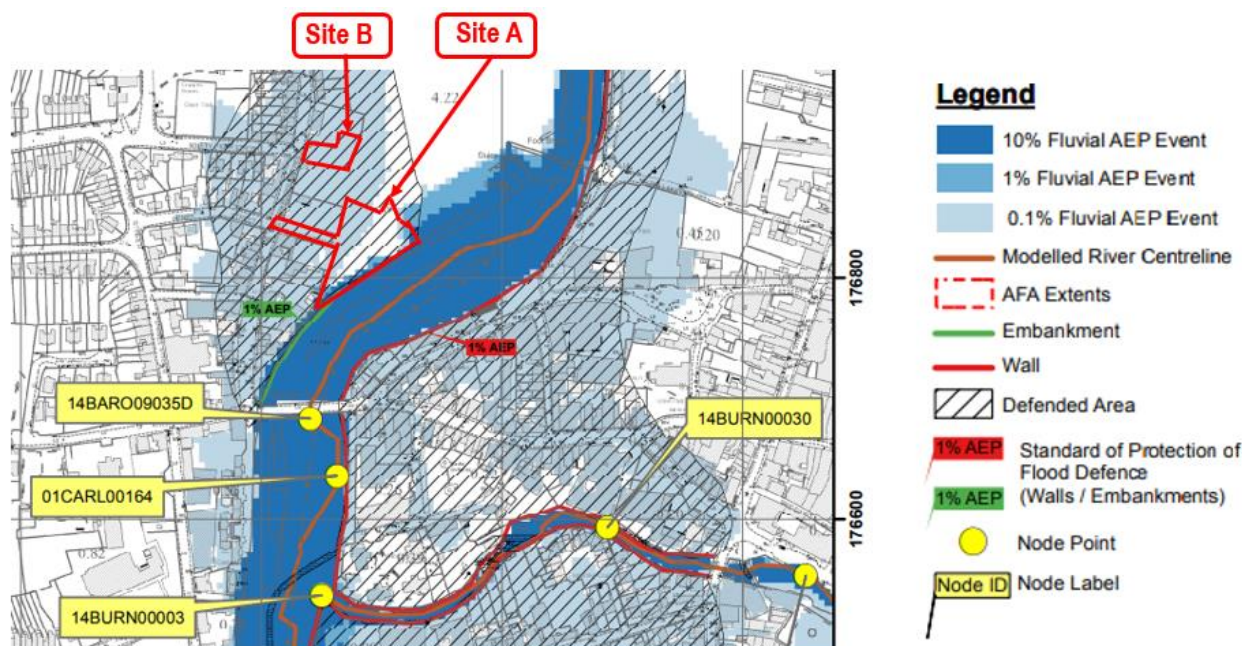


Figure 8 – Extract from Carlow All Probabilities Fluvial Flood Map (Source www.floodinfo.ie)

4.0 Traffic

4.1 Introduction

Vehicular access to the proposed 'Site A' River Barrow Activity Centre shall be accommodated by an existing entry point to Carlow Town Park at Barrow Street. This entry point shall be the main entrance to the site and will accommodate refuse collection, emergency vehicles, car/taxi drop off access and boat drop off access. The proposed 'Site B' Car Park includes 14 car parking spaces (including 1no. mobility impaired space) and bicycle parking shall be accessed via Maryborough Street and will have an entry/exit control barrier. The existing two-way road network in the vicinity of the proposed development consists of local roads servicing largely residential neighbourhoods and retail/restaurants/business units along the streetscape.

Traffic calming measures are provided on Sleaty Street (north of the proposed development) in the form of speed ramps / pedestrian crossings. Public footpaths are provided on both sides of Sleaty Street and Maryborough Street. There are no dedicated cycling facilities on the existing streetscape. Street lighting is provided on one side of the road and a 50km/h speed limit is in operation.

4.2 Swept Path Analysis

A swept path analysis has been undertaken by as part of this planning submission and has demonstrated that 'Site A' and 'Site B' access and internal layout can appropriately accommodate the manoeuvring and circulation of all user and emergency vehicles.

4.3 Visibility Splay

A visibility splay analysis was conducted for the proposed 'Site B' Car Park where vehicles will exit out onto the junction of Maryborough and Sleaty Street. Due to the existing road levels of Sleaty Street and Maryborough Street, only the horizontal plane was deemed necessary for assessment.

As set out within Section 4.4.5 of DMURS (Design Manual for Urban Roads and Streets), the visibility splay for the horizontal plane comprises of two key dimensions, 'x' and 'y' distances.

- "The x distance is the distance along the minor arm from which visibility is measured."
- "The x distance is the distance a driver exiting from the minor road can see to the left and right along the major arm."

Based on the speed limit of 50 km/h on Maryborough Street and Sleaty Street, from which it is proposed to access the proposed Car Park, 45.0 metres of sightlines ('y' distance) need to be achieved at the site access location, measured from a point of 2.4 metres ('x' distance) along the centre of the main site access arm.

The analysis undertaken demonstrated the visibility splay for the proposed 'Site B' +Car Park is adequate with local extension of the existing double yellow lines on the eastern side of Sleaty Street.

4.4 Construction Traffic Management Plan (CTMP)

Prior to the construction of the works, the appointed Contractor shall prepare a construction traffic management plan (CTMP) which will outline their approach to the project and detail potential impacts on the public road network. Appropriate mitigation measures shall also be identified, including the detailing of specific haul routes, provision of road signage and designated times of access by large construction vehicles.

4.5 Road Design

Road access, internal road and footpaths shall be constructed in accordance with Recommendations for Site Development Works for Housing Areas and Carlow County Council approved details.

4.6 Conclusion

The proposed 'Site A' River Barrow Activity Centre is located in the centre of Carlow Town in an existing public park which is served by the local urban road network with multiple access points, as is the proposed 'Site B' Car Park. Given the scale of the proposed development and the fact that it is located in an existing public space that is well served by the existing road network, it is held that the level of increase in road traffic during the operational phase of the development would be negligible. As such, the existing road network is deemed to have sufficient capacity to safely serve the proposed development.

5.0 Site Investigation

IGSL Limited were engaged to prepare a Site Investigation Report and a Waste Characterisation Assessment for 'Site A'. The findings of these reports can be summarised as follows;

Site Investigation Report Summary – dated February 2021:

The borehole and rotary drilling investigations revealed that piled foundations will be required to support the proposed structures on the subject site.

Infiltration tests of the subject site concluded that it is unlikely that soakaway systems will function in these ground conditions.

Waste Characterisation Report – dated January 2021:

The laboratory testing revealed that all samples taken from the subject site are classified as non-hazardous material and recommends that a copy of the Waste Characterisation report be provided in full to the relevant waste management facilities to which the made ground and subsoils will be consigned to confirm its suitability for acceptance.

We trust you find the above to be of use however, should you have any queries or require any further information, please don't hesitate to contact us.

End of Report



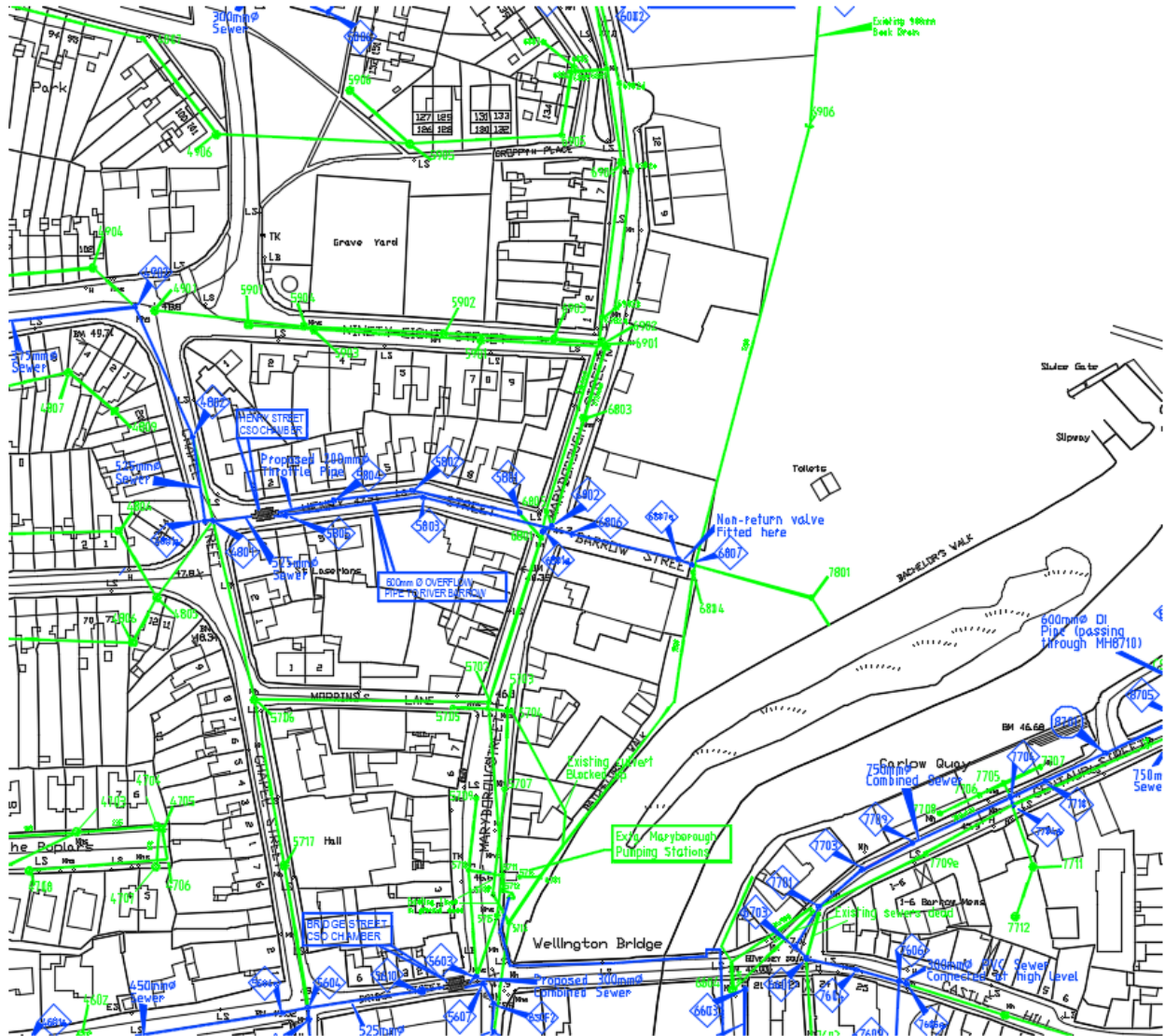
Signed: _____

Date: 23rd-September-2021

Brian Healy BE CEng MIEI
Chartered Engineer

On behalf of DRA Consulting

Appendix C – Carlow Town Main Drainage Drawing



Appendix D – Irish Water Confirmation of Feasibility



Brian Healy
14 Crescent Mall
Henrietta Street
Wexford
Y35XD1K

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

12 November 2020

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

www.water.ie

Re: CDS20006994 pre-connection enquiry - Subject to contract | Contract denied
Connection for Business Connection of 2 units at Carlow Town Park, Carlow, Co. Carlow

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Carlow Town Park, Carlow, Co. Carlow (the Premises). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

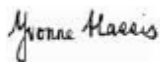
SERVICE	OUTCOME OF PRE-CONNECTION ENQUIRY <u>THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.</u>
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

General Notes:

- 1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
- 2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
- 3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
- 4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at <https://www.water.ie/connections/get-connected/>
- 5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
- 6) Irish Water Connection Policy/ Charges can be found at <https://www.water.ie/connections/information/connection-charges/>
- 7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
- 8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
- 9) To access Irish Water Maps email datarequests@water.ie
- 10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Alvaro Garcia from the design team on 022 54623 or email agarcia@water.ie. For further information, visit www.water.ie/connections.

Yours sincerely,



Yvonne Harris
Head of Customer Operations

Appendix E – Foul Wastewater Discharge Calculations

Reference Document:

Irish Water: Code of Practice for Wastewater Infrastructure.

Data:

100 sq. m Café & Ancillary Building (Assume 1 Person per 1 sq. m) = 100 Persons
30 l/person/day

400 sq. m Facilities Building (Assume 1 Person per 7 sq. m) = 57 Persons
50 l/person/day

300 sq. m Boat Rental and Storage (Assume 1 Person per 30 sq. m) = 10 Persons
50 l/person/day

Average discharge:

$100 \times 30 = 3000$ l/day

$57 \times 50 = 2850$ l/day

$10 \times 50 = 500$ l/day

Total = 6350 l/day

$6350 / (24 \times 3600) = 0.07$ l/s

Peak discharge:

6 x Dry weather Flow: $0.07 \times 6 = 0.44$ l/s

Appendix F – Water Demand Calculations

Reference:

Irish Water: Code of Practice for Water Infrastructure.

Data:

100 sq. m Café & Ancillary Building (Assume 1 Person per 1 sq. m) = 100 Persons
30 l/person/day

400 sq. m Facilities Building (Assume 1 Person per 7 sq. m) = 57 Persons
50 l/person/day

300 sq. m Boat Rental and Storage (Assume 1 Person per 30 sq. m) = 10 Persons
50 l/person/day

Boat Wash Down
Light Duty Pressure washer= 0.158 l/s--> 2h/day (Consumption)

Average daily demand:

$100 \times 30 = 3000$ l/day
 $57 \times 50 = 2850$ l/day
 $10 \times 50 = 500$ l/day
 $0.158 \times (2 \times 3600) = 1137.6$ l/day
Total = 7487.6 l/day


Average hour water demand:

$7487.6 / (24 \times 3600) = 0.087$ l/s


Peak hour water demand:


$0.087 \times 1.25 = 0.109$ l/s


Appendix G – Foul Network Calculations

	DRA Consulting Engineers The Park Lord Edward Street Limerick	File: K194-Flow_Rev_3.pfd Network: Foul network Sandra Torrico Real 16/04/2021	Page 1						
	Design Settings								
Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	1.00						
Flow per dwelling per day (l/day)	2676	Connection Type	Level Inverts						
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.200						
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200						
Additional Flow (%)	0	Include Intermediate Ground	x						
Nodes									
Name	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)				
FWMH 1.0	46.750	Adoptable	671595.661	676868.270	0.900				
FWMH 2.0	46.210	Adoptable	671549.874	676879.840	1.080				
EX. COMB. MH	46.110	Adoptable	671542.108	676879.529	1.050				
Links									
Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	FWMH 1.0	FWMH 2.0	47.226	1.500	45.850	45.130	0.720	65.6	150
1.001	FWMH 2.0	EX. COMB. MH	7.772	1.500	45.130	45.060	0.070	111.0	150
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (ha)		
1.000	1.082	19.1	0.0	0.750	0.930	0.000	0.0		
1.001	0.831	14.7	0.0	0.930	0.900	0.000	0.0		
Flow v9.1 Copyright © 1988-2021 Causeway Software Solutions Limited									

Appendix H – Storm Water Network Calculations

	DRA Consulting Engineers The Park Lord Edward Street Limerick	File: K194-Flow_Rev_3.pfd Network: Storm Network Sandra Torrico Real 16/04/2021	Page 1								
	Design Settings										
Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00								
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0								
Additional Flow (%)	0	Minimum Velocity (m/s)	0.80								
FSR Region	Scotland and Ireland	Connection Type	Level Inverts								
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200								
Ratio-R	0.300	Preferred Cover Depth (m)	1.200								
CV	0.750	Include Intermediate Ground	x								
Time of Entry (mins)	5.00	Enforce best practice design rules	✓								
Nodes											
Name	Area (ha)	T of E (mins)	Cover Level (m)								
Diameter (mm)	Easting (m)	Northing (m)	Depth (m)								
SWMH 1.0	0.076	5.00	47.590								
SWMH 2.0	0.063	5.00	47.580								
SWMH 3.0	0.049	5.00	47.390								
EX.S.W MH	0.000		47.140								
			1200								
			671631.341								
			676863.993								
			1200								
			671617.493								
			676855.884								
			1200								
			671602.317								
			676848.950								
			1200								
			671598.159								
			676853.350								
			1.430								
			1.590								
			1.590								
			1.440								
Links											
Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SWMH 1.0	SWMH 2.0	16.048	0.600	46.160	45.990	0.170	94.4	225	5.20	50.0
1.001	SWMH 2.0	SWMH 3.0	16.685	0.600	45.990	45.800	0.190	87.8	225	5.40	50.0
1.002	SWMH 3.0	EX.S.W MH	6.054	0.600	45.800	45.700	0.100	60.5	225	5.46	50.0
	Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)			
	1.000	1.346	53.5	10.3	1.205	1.365	0.076	0.0			
	1.001	1.396	55.5	18.8	1.365	1.365	0.139	0.0			
	1.002	1.684	66.9	25.5	1.365	1.215	0.188	0.0			
Simulation Settings											
Rainfall Methodology	FSR	Analysis Speed	Normal								
FSR Region	Scotland and Ireland	Skip Steady State	x								
M5-60 (mm)	17.000	Drain Down Time (mins)	240								
Ratio-R	0.300	Additional Storage (m ³ /ha)	20.0								
Summer CV	0.750	Check Discharge Rate(s)	x								
Winter CV	0.840	Check Discharge Volume	x								
Storm Durations											
15	30	60	120	180	240	360	480	600	720	960	1440
Return Period (years)	Climate Change (CC %)		Additional Area (A %)		Additional Flow (Q %)						
5	0		0		0						
30	0		0		0						
100	20		0		0						
Flow v9.1 Copyright © 1988-2021 Causeway Software Solutions Limited											

	DRA Consulting Engineers The Park Lord Edward Street Limerick	File: K194-Flow_Rev_3.pfd Network: Storm Network Sandra Torrico Real 16/04/2021	Page 2																																																																																	
Results for 5 year Critical Storm Duration. Lowest mass balance: 100.00%																																																																																				
<table border="1"> <thead> <tr> <th>Node Event</th> <th>US Node</th> <th>Peak (mins)</th> <th>Level (m)</th> <th>Depth (m)</th> <th>Inflow (l/s)</th> <th>Node Vol (m³)</th> <th>Flood (m³)</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>15 minute winter</td> <td>SWMH 1.0</td> <td>10</td> <td>46.241</td> <td>0.081</td> <td>13.9</td> <td>0.1769</td> <td>0.0000</td> <td>OK</td> </tr> <tr> <td>15 minute winter</td> <td>SWMH 2.0</td> <td>10</td> <td>46.103</td> <td>0.113</td> <td>25.2</td> <td>0.2170</td> <td>0.0000</td> <td>OK</td> </tr> <tr> <td>15 minute winter</td> <td>SWMH 3.0</td> <td>10</td> <td>45.932</td> <td>0.132</td> <td>33.9</td> <td>0.2300</td> <td>0.0000</td> <td>OK</td> </tr> <tr> <td>15 minute winter</td> <td>EX.S.W MH</td> <td>10</td> <td>45.812</td> <td>0.112</td> <td>33.5</td> <td>0.0000</td> <td>0.0000</td> <td>OK</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Link Event (Upstream Depth)</th> <th>US Node</th> <th>Link</th> <th>DS Node</th> <th>Outflow (l/s)</th> <th>Velocity (m/s)</th> <th>Flow/Cap</th> <th>Link Vol (m³)</th> <th>Discharge Vol (m³)</th> </tr> </thead> <tbody> <tr> <td>15 minute winter</td> <td>SWMH 1.0</td> <td>1.000</td> <td>SWMH 2.0</td> <td>13.7</td> <td>0.843</td> <td>0.257</td> <td>0.2623</td> <td></td> </tr> <tr> <td>15 minute winter</td> <td>SWMH 2.0</td> <td>1.001</td> <td>SWMH 3.0</td> <td>24.9</td> <td>1.132</td> <td>0.448</td> <td>0.3674</td> <td></td> </tr> <tr> <td>15 minute winter</td> <td>SWMH 3.0</td> <td>1.002</td> <td>EX.S.W MH</td> <td>33.5</td> <td>1.532</td> <td>0.500</td> <td>0.1325</td> <td>15.8</td> </tr> </tbody> </table>				Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status	15 minute winter	SWMH 1.0	10	46.241	0.081	13.9	0.1769	0.0000	OK	15 minute winter	SWMH 2.0	10	46.103	0.113	25.2	0.2170	0.0000	OK	15 minute winter	SWMH 3.0	10	45.932	0.132	33.9	0.2300	0.0000	OK	15 minute winter	EX.S.W MH	10	45.812	0.112	33.5	0.0000	0.0000	OK	Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)	15 minute winter	SWMH 1.0	1.000	SWMH 2.0	13.7	0.843	0.257	0.2623		15 minute winter	SWMH 2.0	1.001	SWMH 3.0	24.9	1.132	0.448	0.3674		15 minute winter	SWMH 3.0	1.002	EX.S.W MH	33.5	1.532	0.500	0.1325	15.8
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status																																																																												
15 minute winter	SWMH 1.0	10	46.241	0.081	13.9	0.1769	0.0000	OK																																																																												
15 minute winter	SWMH 2.0	10	46.103	0.113	25.2	0.2170	0.0000	OK																																																																												
15 minute winter	SWMH 3.0	10	45.932	0.132	33.9	0.2300	0.0000	OK																																																																												
15 minute winter	EX.S.W MH	10	45.812	0.112	33.5	0.0000	0.0000	OK																																																																												
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)																																																																												
15 minute winter	SWMH 1.0	1.000	SWMH 2.0	13.7	0.843	0.257	0.2623																																																																													
15 minute winter	SWMH 2.0	1.001	SWMH 3.0	24.9	1.132	0.448	0.3674																																																																													
15 minute winter	SWMH 3.0	1.002	EX.S.W MH	33.5	1.532	0.500	0.1325	15.8																																																																												
Flow v9.1 Copyright © 1988-2021 Causeway Software Solutions Limited																																																																																				

	DRA Consulting Engineers The Park Lord Edward Street Limerick	File: K194-Flow_Rev_3.pfd Network: Storm Network Sandra Torrico Real 16/04/2021	Page 3																																													
Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%																																																
<table border="1"> <thead> <tr> <th>Node Event</th> <th>US Node</th> <th>Peak (mins)</th> <th>Level (m)</th> <th>Depth (m)</th> <th>Inflow (l/s)</th> <th>Node Vol (m³)</th> <th>Flood (m³)</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>15 minute winter</td> <td>SWMH 1.0</td> <td>10</td> <td>46.259</td> <td>0.099</td> <td>20.4</td> <td>0.2176</td> <td>0.0000</td> <td>OK</td> </tr> <tr> <td>15 minute winter</td> <td>SWMH 2.0</td> <td>10</td> <td>46.138</td> <td>0.148</td> <td>37.1</td> <td>0.2853</td> <td>0.0000</td> <td>OK</td> </tr> <tr> <td>15 minute winter</td> <td>SWMH 3.0</td> <td>10</td> <td>45.973</td> <td>0.173</td> <td>49.7</td> <td>0.3023</td> <td>0.0000</td> <td>OK</td> </tr> <tr> <td>15 minute winter</td> <td>EX.S.W MH</td> <td>10</td> <td>45.842</td> <td>0.142</td> <td>49.1</td> <td>0.0000</td> <td>0.0000</td> <td>OK</td> </tr> </tbody> </table>	Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status	15 minute winter	SWMH 1.0	10	46.259	0.099	20.4	0.2176	0.0000	OK	15 minute winter	SWMH 2.0	10	46.138	0.148	37.1	0.2853	0.0000	OK	15 minute winter	SWMH 3.0	10	45.973	0.173	49.7	0.3023	0.0000	OK	15 minute winter	EX.S.W MH	10	45.842	0.142	49.1	0.0000	0.0000	OK			
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status																																								
15 minute winter	SWMH 1.0	10	46.259	0.099	20.4	0.2176	0.0000	OK																																								
15 minute winter	SWMH 2.0	10	46.138	0.148	37.1	0.2853	0.0000	OK																																								
15 minute winter	SWMH 3.0	10	45.973	0.173	49.7	0.3023	0.0000	OK																																								
15 minute winter	EX.S.W MH	10	45.842	0.142	49.1	0.0000	0.0000	OK																																								
<table border="1"> <thead> <tr> <th>Link Event (Upstream Depth)</th> <th>US Node</th> <th>Link</th> <th>DS Node</th> <th>Outflow (l/s)</th> <th>Velocity (m/s)</th> <th>Flow/Cap</th> <th>Link Vol (m³)</th> <th>Discharge Vol (m³)</th> </tr> </thead> <tbody> <tr> <td>15 minute winter</td> <td>SWMH 1.0</td> <td>1.000</td> <td>SWMH 2.0</td> <td>20.2</td> <td>0.904</td> <td>0.378</td> <td>0.3579</td> <td></td> </tr> <tr> <td>15 minute winter</td> <td>SWMH 2.0</td> <td>1.001</td> <td>SWMH 3.0</td> <td>36.5</td> <td>1.204</td> <td>0.658</td> <td>0.5050</td> <td></td> </tr> <tr> <td>15 minute winter</td> <td>SWMH 3.0</td> <td>1.002</td> <td>EX.S.W MH</td> <td>49.1</td> <td>1.659</td> <td>0.734</td> <td>0.1791</td> <td>23.2</td> </tr> </tbody> </table>	Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)	15 minute winter	SWMH 1.0	1.000	SWMH 2.0	20.2	0.904	0.378	0.3579		15 minute winter	SWMH 2.0	1.001	SWMH 3.0	36.5	1.204	0.658	0.5050		15 minute winter	SWMH 3.0	1.002	EX.S.W MH	49.1	1.659	0.734	0.1791	23.2												
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)																																								
15 minute winter	SWMH 1.0	1.000	SWMH 2.0	20.2	0.904	0.378	0.3579																																									
15 minute winter	SWMH 2.0	1.001	SWMH 3.0	36.5	1.204	0.658	0.5050																																									
15 minute winter	SWMH 3.0	1.002	EX.S.W MH	49.1	1.659	0.734	0.1791	23.2																																								
Flow v9.1 Copyright © 1988-2021 Causeway Software Solutions Limited																																																