ARUP
80 YEARS

Cork County Council

Midleton Flood Relief Scheme

Options Report Addendum

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1. Introduction

1.1 Context

Midleton was severely flooded by Storm Babet on the 18th of October 2023. Following on from the event Arup was asked by Cork County Council (CCC) to reconsider the hydrological estimation undertaken to inform the Midleton Flood Relief Scheme given that the flow rate experienced at the Ballyedmond hydrometric gauge during Babet was the highest flow event ever recorded at the gauge and therefore impacts on its rating curve.

A revised hydrological assessment of the study area was undertaken and concluded:

- The Q100 design flow for the Ballyedmond gauge (HEP OW3) was revised upwards from circa 66.67m3/s to circa 84.29m3/s when the impact of Storm Babet was considered as part of the revised hydrological estimation. This represents an increase of circa 26.4% when compared with the original Hydrology report produced as part of the project in 2018;
- The higher design flows were simulated through the 1D/2D hydraulic model of the scheme area in order to determine the impact of the flows on design water levels. From this work it was established that the design water levels across Midleton increased by an average of circa 95mm. These higher design water levels in turn required changes to be made to a number of the flood defences in the fluvially dominated area with the changes varying between the individual defences. On average however the increase in defence height required to accommodate the post Storm Babet design flows and water levels is circa 100mm and the average increase in length of the defences is circa 10m. These changes to the direct defences are deemed to be modest and can be accommodated as part of the current scheme without any significant impact on the environmental and/or landscape heritage constraints.

Due to the changes in the defence's heights and lengths arising from the Post Babet revisions to the hydrology, the Emerging Preferred Option as originally outlined in the Options Report needed to be refined. This Options Report Addendum has therefore been drafted to detail the updates to the scheme which are required to ensure the Standard of Protection of the scheme (1% AEP Fluvial / 0.5% AEP tidal plus an allowance for freeboard) is maintained across the whole of the scheme area when the updated hydrology and design water level assessment is considered.

1.2 Contents of the Addendum report

The scope of the Addendum report is provided as:

- The Detailed Freeboard Analysis presented in the original options report has been updated using the revised post-Babet design water levels. The updated freeboard analysis is presented in Section 2 of this report;
- The previously proposed climate change allowance has been reassessed in light of the revised design water levels and is presented in Section 3;
- The modifications to the Midleton Flood Relief Scheme emerging preferred option arising from the change to the hydrology and design water levels are detailed in Section 4 of the report. It is noted that these changes incorporate the both the updated design water levels and the updated freeboard as well as the revised climate change allowance.

It is noted that the final defence heights and alignments will be developed and finalised through the planning design development and will be informed by the final topographic survey. the ground investigation surveys and stakeholder/landowner engagement. The revised defences presented in Section 4 are therefore subject to modest changes.

2. Detailed Freeboard Analysis

2.1 Introduction

Once the emerging preferred option was selected, a detailed freeboard assessment was undertaken in order to determine an appropriate allowance for the scheme. This section of the report presents the revised freeboard analysis undertaken to accommodate the revised design water levels post Storm Babet.

2.2 Freeboard Methodology

Two separate freeboard methodologies have been selected by Arup to inform the project:

- Environment Agency's Fluvial Freeboard Guidance Note (UK Environment Agency Report W187);
- CFRAM Guidance Note 22 issued by the OPW.

Both of these methods are described in the following sections of the report.

2.3 Reaches of the scheme area assessed

For the purpose of the freeboard analysis, the study area has been divided into nine distinct reaches as presented in Figure 2-1 and which are listed as:

- Owenacurra Reach
- Glenathonacash Reach
- Elfordstown Reach
- Dungourney Reach
- Ballinacurra Reach
- Owenacurra Millrace
- Water Rock/ Oatencake Reach
- IDL Millrace
- Owenacurra Estuary

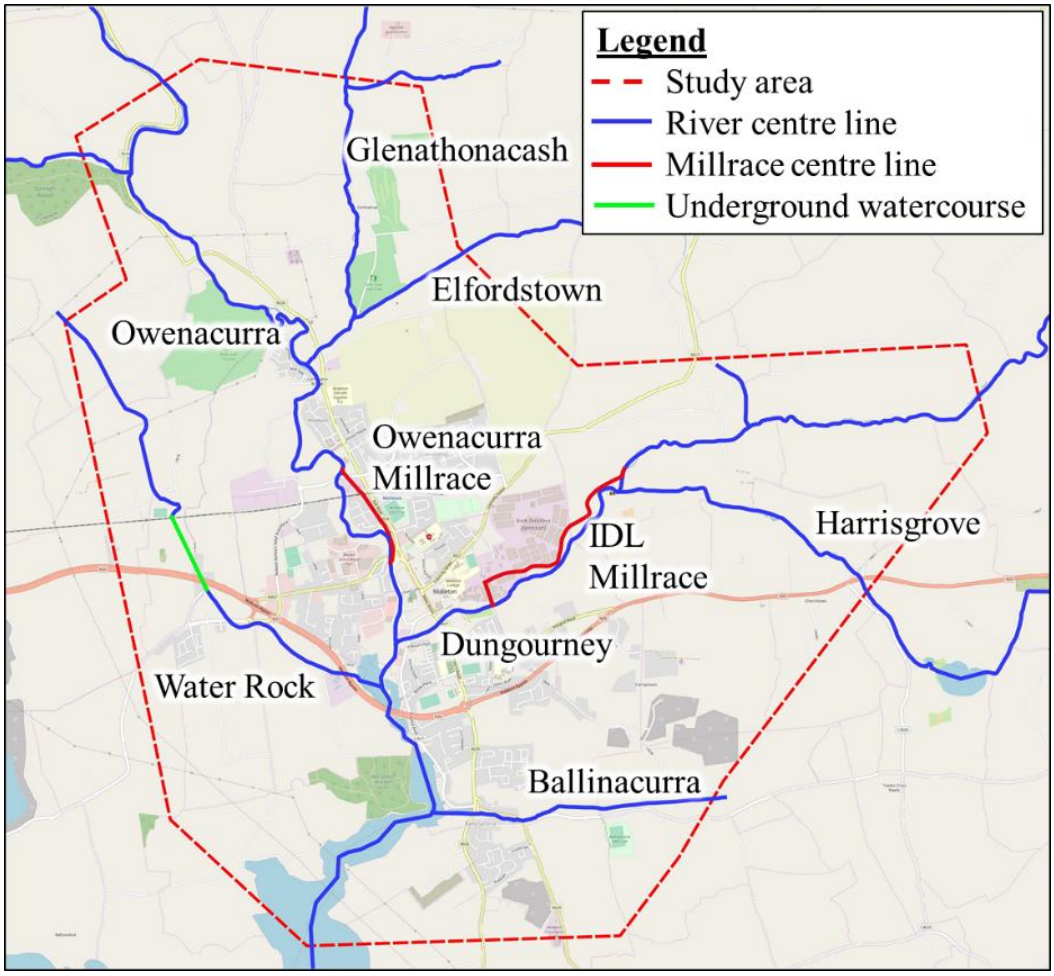


Figure 2-1 Scheme Area (© Open Street Map)

2.4 Minimum Freeboard Requirements

The project brief states that for fluvial reaches a minimum freeboard of 300mm must be adopted for hard defences, and 500mm for soft defences. The brief also states that these allowances are "generally increased by 0.2m for Coastal defences".

The coastal defence region of the scheme area has been defined as the area downstream of the confluence of the Owenacurra and Dungourney rivers where there exists a sufficient fetch length to generate surface waves at high tide which in turn introduces a risk of wave overtopping of the defences locally in this area.

Section 2.6.6 details the estimation of the tidal/coastal uncertainty allowance which has been estimated for the coastal defence region of the scheme and which has been applied to all defences within this region.

Applying the tidal/coastal uncertainty allowance results in a minimum freeboard allowance of 530mm for hard defences and 730mm for soft defences in the coastal region. A minimum freeboard allowance of 300mm for hard defences and 500mm for soft defences has been applied in all other areas of the scheme

2.5 Environment Agency Guidance W187

2.5.1 Overview

The analysis of freeboard was carried out in accordance with the Fluvial Freeboard Guidance Note (UK Environment Agency Report W187). The guidance is based on a qualitative approach which calculates a freeboard allowance for three separate items as indicated in Figure 2-2. The total freeboard is then calculated as the sum of these three separate freeboard allowances.

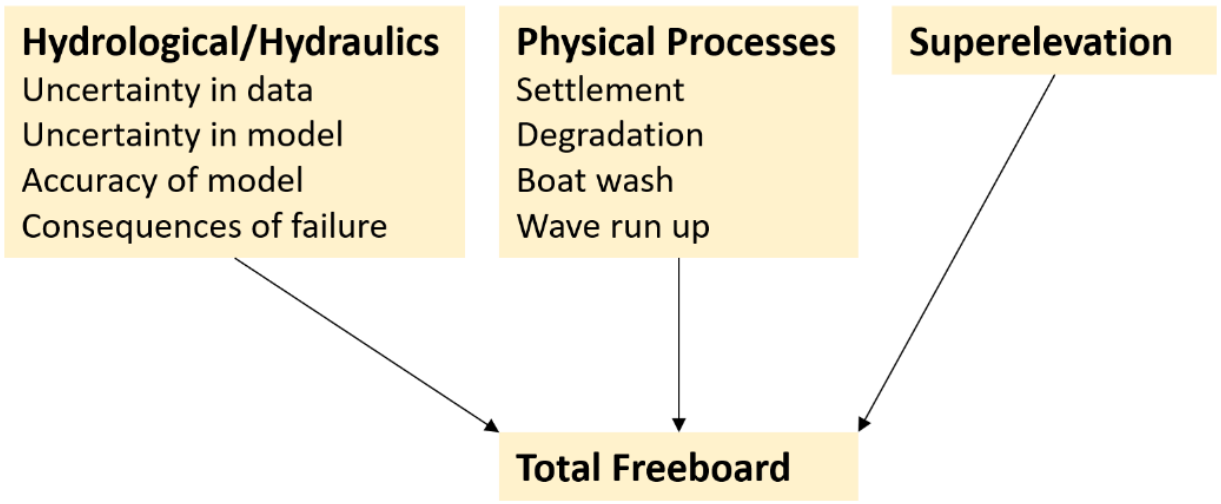


Figure 2-2 Schematic of Freeboard calculation

A number of assumptions have been adopted as part of the W187 assessment for Midleton:

- No allowance has been made for seiche as it is directly included in the design tidal water levels;
- Allowances for degradation, cracking, vermin impact and sedimentation have been ignored as they are not deemed to be significant in Midleton;
- Settlement allowance for embankments has been assumed at 0.2m;
- The consequence of failure has been assumed to be worst case with a score of 5.

Superelevation[2] was calculated using the free vortex method from channel conditions in the defenced scenario. The following formula was used to determine the change in water surface elevation:

$$\Delta h = \frac{\bar{u}^2 b}{gR}$$

Where;

- $\bar{u}$ = average velocity (m/s)
- Δh = change in water surface elevation across channel width, between banks (m)
- b = channel width (m)
- R = distance from centre of curve to centreline of channel (m)

It is noted that the dimensions of the watercourses were calculated using the geometry tool in Flood Modeller Pro and the bend radius has been determined from aerial imagery.

2.5.2 EA W187 method results

The results from the W187 method are presented in Figure 2-3 for both the left and right banks. The Y axis presents the estimates of total freeboard i.e. the sum of the hydrological/hydraulics freeboard, superelevation and physical processes.

[2] Superelevation is the effective increase in water levels as the river flows around a bend. There is an increase in the water level at the outer bank and a decrease water level on the inner bank because of the centrifugal force that is been exerted on the river body. Given than superelevation is not captured by the hydraulic model (which assumes a horizontal water level surface at each individual cross section) it needs to be considered as part of the freeboard assessment.

The X axis presents model chainage with each of the nine reaches presented sequentially on the axis. It can be seen from the plot that the freeboard allowance across the study ranges from 0.04m to 0.51 with a single outlier of 0.61m. The average freeboard value is circa 0.3m.

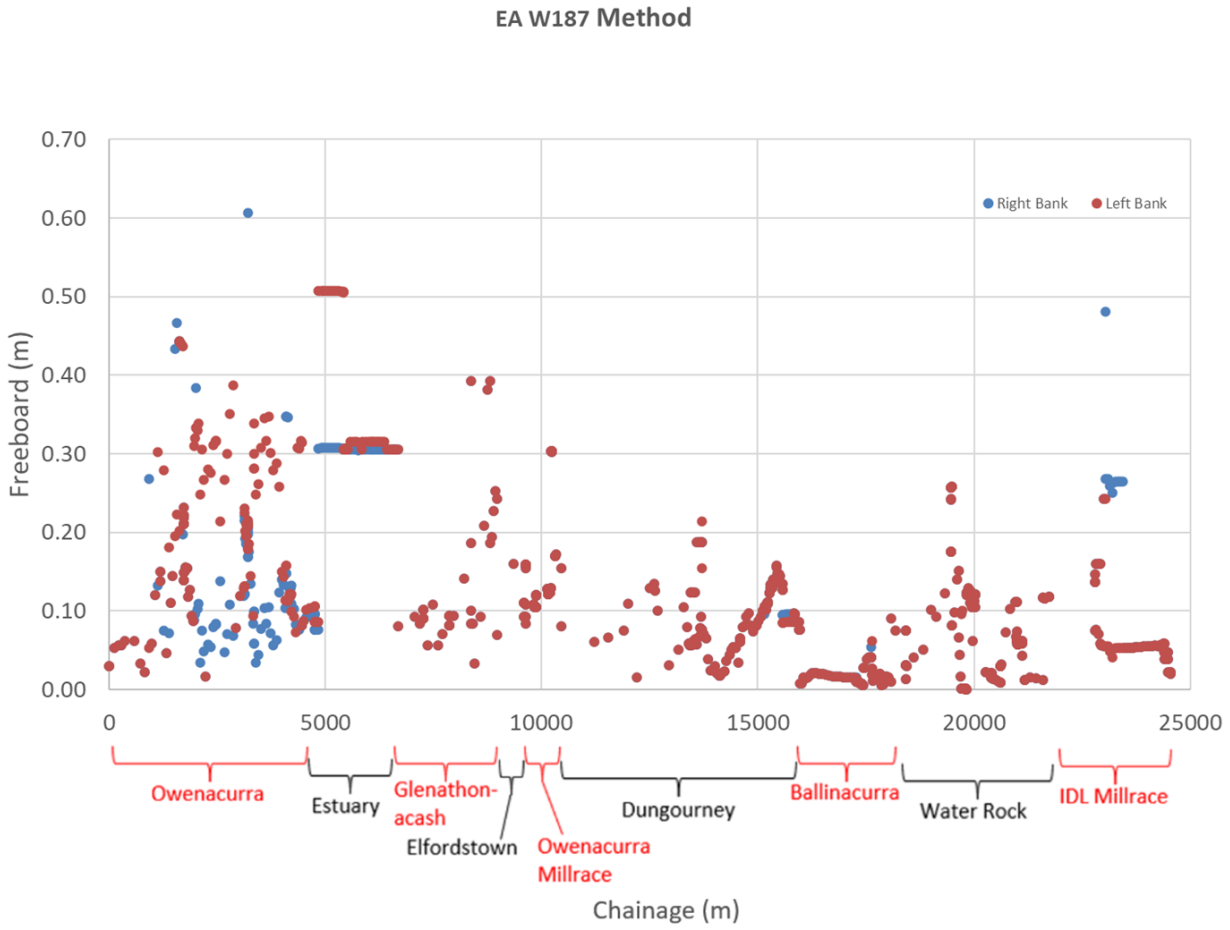


Figure 2-3 Freeboard estimates

Freeboard values greater than the proposed minimum requirement of 0.5m were estimated at one location:

- An allowance of 0.60m was estimated at the right bank of the Owenacurra at cross section **3OWE_3521** which is located on the bend immediately downstream of the Northern Relief Road;

The freeboard allowance at this location is driven by the superelevation arising from the bend in the river. The superelevation however is very localised and is not applicable across any significant length of the reach – the required freeboard upstream and downstream of cross section **3OWE_3521** is estimated as 0.21m (**3OWE_3531**) and 0.18m (**3OWE_3510**) respectively. The freeboard requirement of 0.6m is therefore only relevant locally to the bend in the river.

2.6 CFRAM Guidance Note 22

2.6.1 Introduction

CFRAM Guidance Note 22 was developed under the Western CFRAM Contract for the Office of Public Works (2014) and adopts a sensitivity analysis approach in determining the hydrological/hydraulic uncertainty.

As with the EA method, the total freeboard is estimated as the sum of three separate freeboard allowances for hydrological/hydraulics, superelevation and physical processes. The allowances for superelevation and physical processes are calculated in exactly the same way as per the EA W187 method – the differences between the methods therefore only relates to the hydrological/hydraulics uncertainty allowance only.

The steps in the CFRAM GN 22 method are listed as:

- Undertake a screening assessment from knowledge of the model build and its calibration;
- Undertake sensitivity tests on hydrological parameters;
- Undertake sensitivity tests on core hydraulic modelling parameters;
- Undertake additional hydraulic testing where necessary;
- Calculate the hydrological/hydraulic uncertainty allowance at every cross section of the model using a least squares approach;
- Assess the allowances for physical processes and superelevation (as per EA W187);
- Sum the hydrological/hydraulic, superelevation and physical processes allowances to derive the total freeboard.

The various steps in estimating the hydrological/hydraulic freeboard allowance are described in detail in the following sections.

2.6.2 Preliminary Screening Assessment

Midleton is at risk of fluvial and tidal flooding. Design water levels upstream of the tidal reach are sensitive to the hydrological boundaries and core hydraulic parameters and are therefore assessed as part of the sensitivity testing.

2.6.3 Hydrological Analysis Sensitivity Testing

The uncertainty in the Storm Babet hydrological flows (i.e. in the calculation of Qmed, Growth Curve etc.) was assessed as part of the CFRAM GN 22 assessment by considering a 20% increase in the peak flow rate. The hydraulic model was therefore re-run with all the hydrological inputs increased by a flat 20% uplift. The downstream tidal boundary and all other model parameters were left unchanged.

The results of the sensitivity suggest that the maximum design water levels are sensitive to a 20% increase in the design flow as water levels are increased throughout the reach. Water levels are particularly sensitive upstream of bridges which are surcharged (or very close to being surcharged) in the Q100 event such as upstream of the Lewis Bridge at the Baby Walk and upstream of the bridge adjacent to Clohessy's Yard on the Glenathonacash stream.

Figure 2-4 presents a longitudinal plot of the modelled reaches showing model chainage vs max water levels for the design Q100 and design Q100 +20% events. The difference between the water levels (i.e. Q100 +20% max water level – Q100 max water level) is plotted on the secondary axis and is referred to as "delta" in the figure. It can be seen from the figure that the delta varies between 0m and 0.76m across the model. The average delta between the max water levels for the design Q100 and design Q100 +20% increase in the peak flow rate was found to be 0.18m.

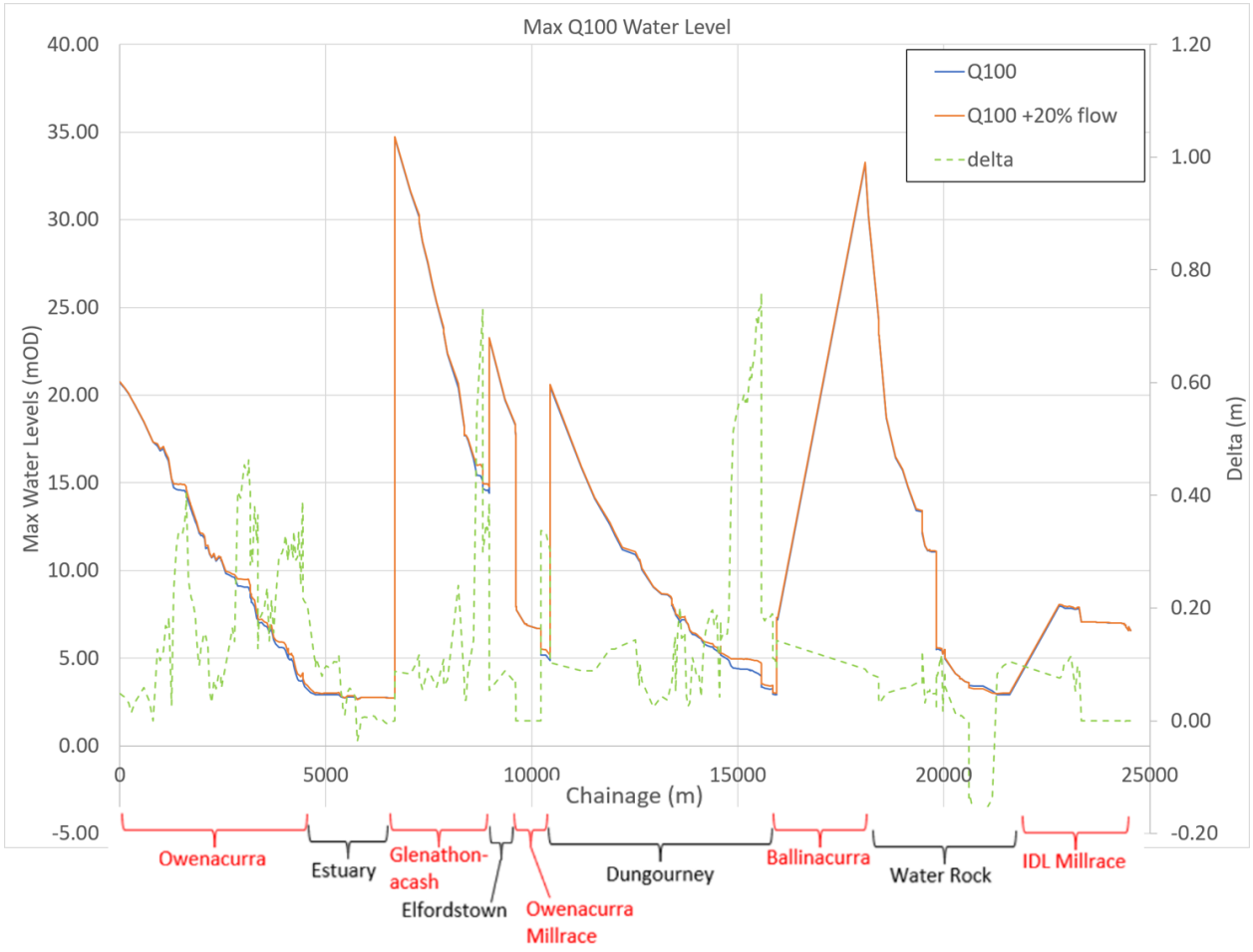


Figure 2-4 Q100 Max Water Levels- Base line vs +20% Sensitivity Longitudinal Plot

2.6.4 Increased Roughness Sensitivity Testing

The hydraulic model was simulated with a +15% increase in the channel roughness. It was evident from the results that the roughness sensitivity is less sensitive than the hydrology sensitivity as the increases in the maximum water level were not as significant. The average delta between the max water levels for the design Q100 and design Q100 +15% increase in the channel roughness was found to be 0.10m.

2.6.5 Structure Coefficient Sensitivity Testing

The CFRAM guidance recommends assessment of the afflux at critical structures which are likely to be sensitive to changes in the head loss coefficients. The model was therefore rerun with changes in the head loss coefficients to the key structures in the model: Lewis Bridge, Lidl Bridge and Moore's Bridge. From the results, it is evident that the modelled maximum water levels are not sensitive to the changes in the structure coefficients.

2.6.6 Tidal level uncertainty Analysis

The uncertainty in the design tidal water levels has been accounted as part of the Midleton FRS by adopting the uncertainty estimate for Cork Harbour as calculated by Arup to inform the Lower Lee FRS. A summary of the assessment is presented in the following table which considered the individual items assessed as part of the uncertainty assessment.

Table 2-1 Modelled water level uncertainty assessment undertaken as part of the Lower Lee FRS project

Parameter	Uncertainty Allowance	Comment
Boundary condition – peak design tidal level at the open sea boundary	150mm	Allowance taken from the ICWWS Study as produced by the OPW
Model Schematisation	100mm	100mm allowance is based on the maximum observed error in the hydraulic model calibration events simulated as part of the LL study.
Harbour Resonance	50mm	Allowance is based on engineering judgement
Spatially varying salinity	120mm	Based on the differences between the constant and spatially varying salinity model calibration runs undertaken as part of the LL study
Geoid and MSL to Malin conversion	50mm	This allowance is based on the range of MSL to OSGM15 conversion factors for the Cork Harbour prediction points as detailed in the ICWWS.
Total uncertainty allowance (least squares sum)	**228mm**	

As highlighted in the table an uncertainty allowance of 228mm was calculated for Cork Harbour as part of the Lower Lee study. This value has therefore been adopted as part of the freeboard assessment for Midleton for all the cross sections in the tidal/coastal reach.

2.7 CFRAM Method - Results

The results of each of the sensitivity model runs were imported into excel and a least squares calculation of the differences in the maximum water level between the sensitivity runs and the baseline was undertaken. The resulting estimates of total freeboard for the scheme area (i.e. the sum of the hydrological/hydraulics, superelevation and physical process freeboard) is presented in Figure 3.

It can be seen from the plot that the freeboard ranges from 5mm to 0.94m with an average value of circa 0.24m. By comparing the results against those presented in Figure 2-3 for the EA W187 method it can be seen that the CFRAM GN22 approach is generally more conservative i.e. the CFRAM method calculates higher freeboard allowances across the scheme area.

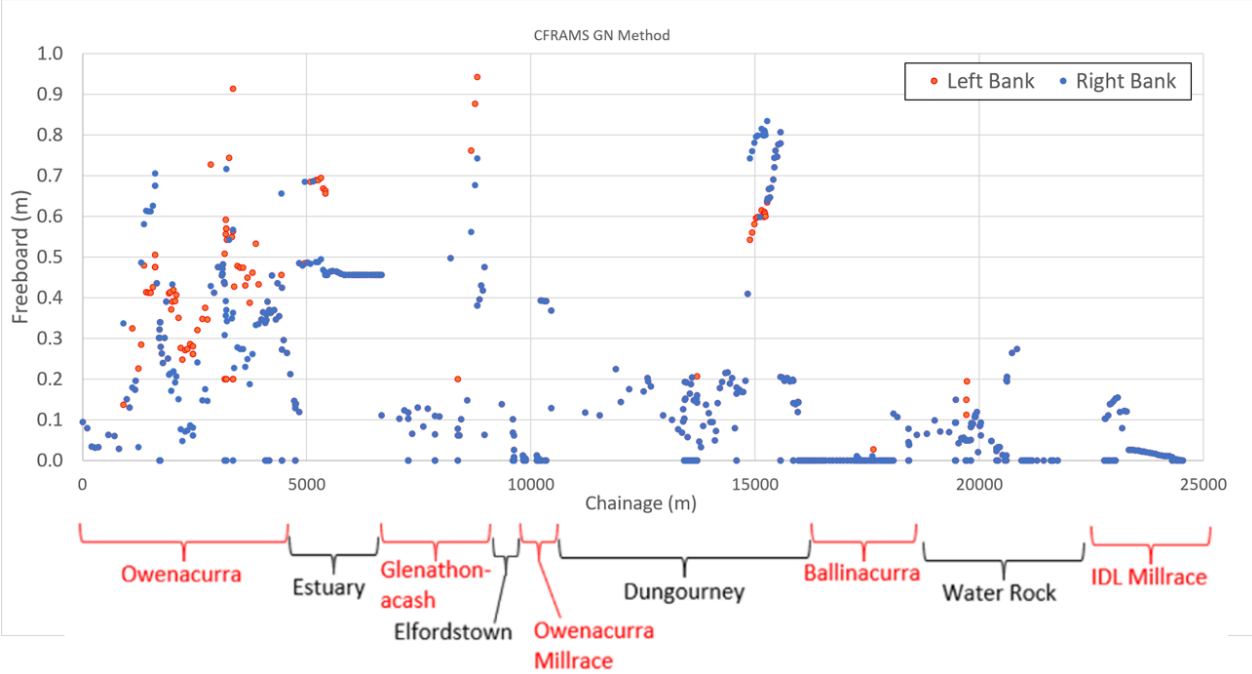


Figure 2-5 Freeboard estimates (CFRAM guidance note method)

From Figure 2-5 it can be seen that there are a large number of cross sections in which the freeboard requirement exceeds the proposed minimum requirement of 0.3m. To aid the reader in interpreting these results, the points are presented separately in Figure 2-6 for the right bank and in Figure 2-7 for the left bank. The Y axis has been modified in both plots to only show values greater than 0.5m. The cross-section labels are also included on the plots.

It can be seen from the figures that there are a relatively large number of points on both banks that exceed 0.5m. These can be grouped into four individual areas:

- Both upstream and downstream of Moore's Bridge on the Owenacurra where the freeboard requirement is generally less than 0.7m.
- Immediately downstream of the NRR (3OWE_3521) which has a large freeboard requirement (0.57m) due to superelevation at the bend in the river;
- Throughout most of the length of the Glenathonacash tributary. The maximum value of circa 0.94m is upstream of the arch bridge on the R626 which crossed over the Glenathonacash adjacent to Clohessy's Yard;
- Upstream of the Lewis Bridge throughout the Baby Walk and in the People's Park where the maximum freeboard requirement is circa 0.5m.

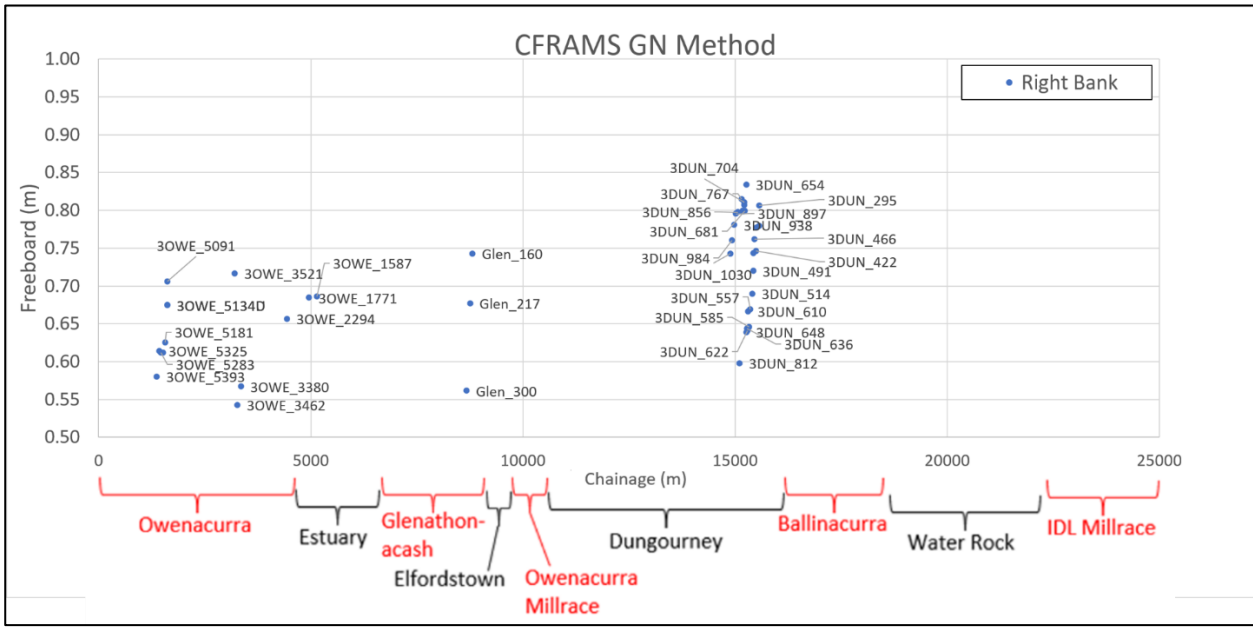


Figure 2-6 Freeboard estimates > 0.5m Right Bank (CFRAM guidance note method)

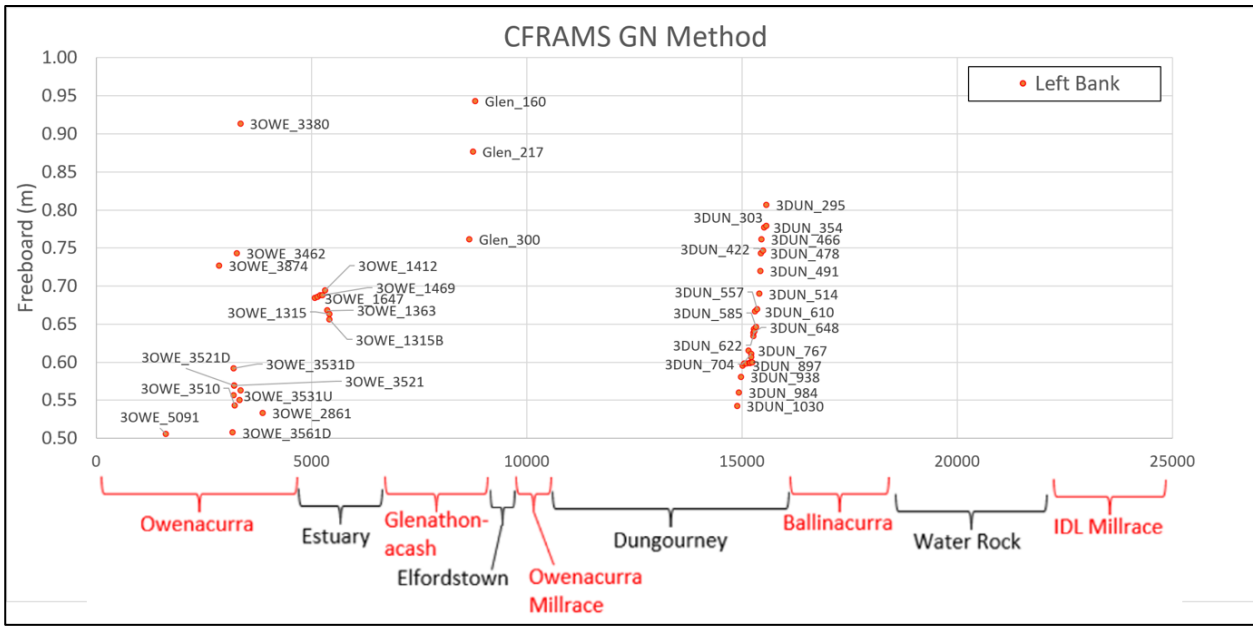


Figure 2-7 Freeboard estimates > 0.5m Left Bank (CFRAM guidance note method)

2.8 Top of wall defence levels

The top of wall (TOW) flood defence levels have been calculated at each cross section by adding the freeboard requirement as estimated by the CFRAM GN22 method to the design water level. The height of the flood defence above ground on the dry side is then calculated by subtracting the TOW level from the existing ground level at that location. The viability of the proposed wall heights in the context of their landscaping/visual impact can then be assessed by considering the TOW level locally at each location. Key to the assessment is the recognition that wall heights in excess of 1.1m/1.2m are very likely to have a negative landscaping/visual impact when situated close to properties or when they are located in a public realm area of the town.

The following table presents the TOW assessment for the areas where the freeboard requirement is greater than 0.5m as described above.

Table 2-2 High Level assessment of required defence heights

Area	Assessment	Conclusion
Upstream of Moore's Bridge	Required defence heights vary throughout the reach and generally less than 1.2m high for most of the reach. There are however a few sections (i.e. immediately upstream of Moore's Bridge in the landscaped area of Tir Cluain) where the required top of the embankment will typically be 1m to 2m above existing ground level along its length due to localised low points in the topography.	The required defence heights can be accommodated through this reach and no significant landscaping/visual impacts are foreseen. The defences upstream of Moore's Bridge will however need to be considered in order to ensure that they are integrated into the existing green areas of Tir Cluain.
Downstream of Moore's Bridge	Due to poor model calibration downstream of Moore's Bridge (discussed in the Hydraulics Report) a minimum freeboard of 0.6m has been applied in this area	The required defence heights can be accommodated through this reach with defence levels generally less than 1.2m above ground level.
Upstream of the NRR	Due to the impact of potential blockage of the NRR Bridge the proposed defence freeboard upstream at the Vella Homes site is estimated as 0.62mOD.	The required defence heights can be accommodated through this reach with defence levels generally less than 1.1m above ground level.
Immediately downstream of the NRR	The high freeboard requirement is only applicable to the right bank and not to the left bank. However, no defences are proposed for the right bank at this location as the existing ground levels on the Western side are higher than the design water level. It is noted that even if the design water level were to be increased by the superelevation allowance, there would still be no properties at risk on the right bank.	It is therefore not proposed to construct defences on the right bank over this length of reach.
Glenathonacash tributary	The required defence heights will exceed 2.5m along the Glenathonacash with the freeboard requirement applied	While the required defence heights along this reach are greater than 2.5m, no negative landscaping or visual impacts are foreseen as the defences are not impacting on any amenity areas or on any residential properties. The proposed length of the defences may however need to be increased in order to accommodate the freeboard requirement along the reach in order to prevent bypassing of the defences. It is noted that some sections of the left bank are space constrained and will require further consideration as part of the detailed design. A further detailed topographic survey of the area will inform on this.
Baby Walk/People's Park	The required defence heights along Baby Walk and in the People's Park are generally less than 2.0m with a few localised areas where the heights exceed 2.1m. It is noted that the existing wall height along Baby Walk is circa 1.5/1.6m high.	Defence heights of circa 2.1m would have significant visual impact locally which is one of the prime amenity areas of the town.

Of the areas for which the CFRAM GN 22 method estimates a freeboard requirement greater than 0.5m, only the reach along the Baby Walk/People's Par involves a significant visual and landscaping impact. The EA W187 method however estimates a much lower freeboard requirement for this reach and it is therefore appropriate to consider both the design water levels, and the associated sensitivity runs used to inform the CFRAM GN 22 freeboard assessment in order to ensure that the CFRAM method is not overly conservative. This is discussed in the next section of the report.

2.9 Conservatism of the design water levels through the Baby Walk/People's Park

The boundary conditions used to inform the scheme design hydraulic model runs[3] are conservative due to the key assumption on Joint Probability i.e. that the peak of the tide, the peak of the fluvial event and the seiche event all occur at the same time. The conservatism is however deemed appropriate as it ensures a robustness in the design of the works.

Adopting the same approach for the CFRAM GN 22 sensitivity runs is however deemed to be overly conservative particularly in relation to the 20% uplift in flow sensitivity. The joint probability assumption as noted above, coupled with a 20% increase in the peak flow is deemed to have a very low probability of occurrence and hence is deemed to be overly conservative. The approach presented in the previous section of the report therefore risks overstating the freeboard requirements and hence overdesigning the scheme.

There are a number of ways in which this over conservatism can be addressed as part of the analysis:

- The CFRAM GN 22 sensitivity model runs could be simulated with the seiche removed from the downstream boundary conditions and/or phase differences introduced into the timing of the fluvial and tidal peaks;
- Less conservative percentage uplifts in the flow could be adopted for the flow sensitivity simulation runs[4].

The first of these approaches has not been considered as it would introduce an inconsistency between the scheme design water levels and the sensitivity runs undertaken to inform the freeboard assessment. The second of the approaches has therefore been adopted and is presented in the following section of the report.

2.10 Additional sensitivity analysis for the Baby Walk/People's Park

A reduced uplift in the hydrological flow of +10% was considered as part of the sensitivity analysis for the Baby Walk. The results of the model were used to inform an updated freeboard assessment through the reach from which the required TOW height was reassessed.

Figure 2-8 presents the required TOW levels through the Baby Walk/People's Park for both the 20% uplift and 10% uplift in flow scenarios.[5] The top of the existing wall along the Baby Walk is also indicated with the red line.

It can be seen from the figure that the TOW level for the 10% uplift in flow sensitivity is circa 260mm lower in the Baby Walk and circa 230mm lower in the People's Park when compared with the 20% uplift in flow scenario. It can also be seen from the figure that an average freeboard of circa 0.49m is achieved in the Baby Walk and circa 0.42m is achieved in the People's Park.

The top of the existing wall along the Baby Walk is circa 4.3mOD. It can be seen from the plot that the 10% and 20% uplift in flow sensitivity is circa 300mm and 560mm higher than this level respectively.

[3] The fluvially dominated design scenario involves simulating a 1% AEP river flow with the 20% AEP tidal event both of which are assumed to peak at the same time. The 20% AEP peak tidal level includes an allowance of 150mm for seiche which is applied throughout the full tidal cycle.

[4] The flow sensitivity makes by far the biggest contribution of all the sensitivities considered to the CFRAM GN 22 freeboard requirement. Only this sensitivity is therefore considered here.

[5] In practice the top of an RC wall or embankment would be constructed level, and the required longitudinal gradient would be accounted for with vertical steps at appropriate locations.

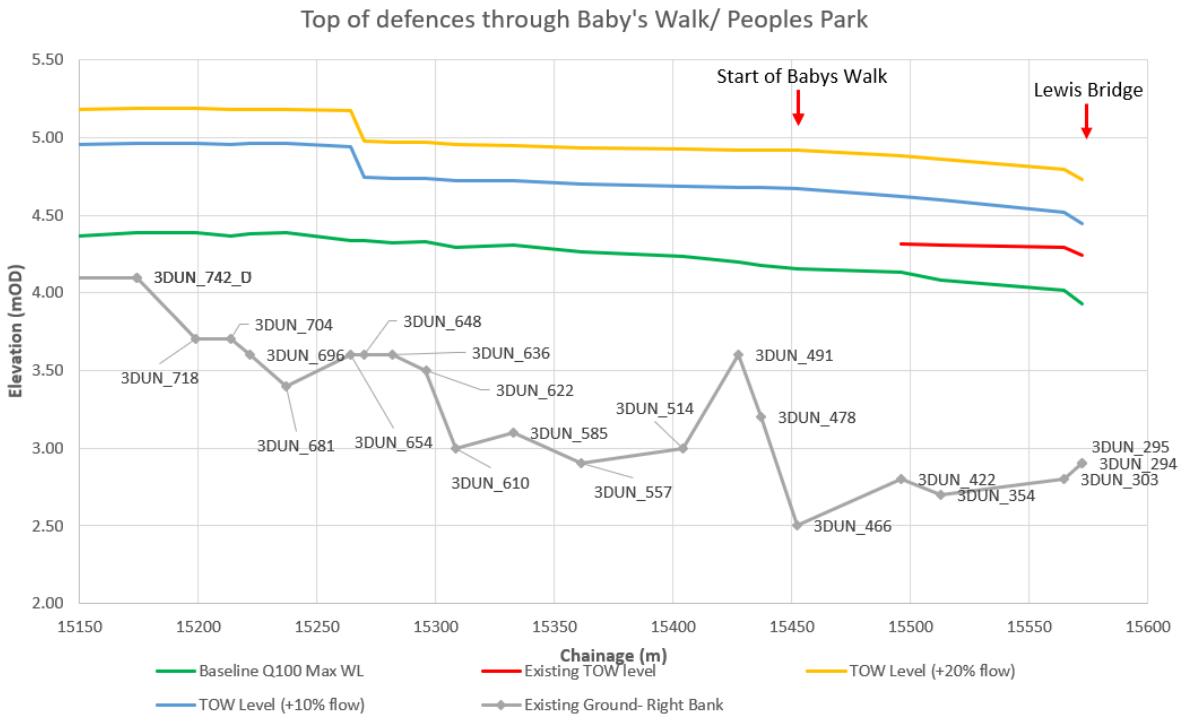


Figure 2-8 TOW levels and baseline water levels through the Baby Walk and the People's Park

2.10.1 Conclusion

Given the findings of both the EA W187 method and the CFRAM GN 10% flow sensitivity, and also by considering the local landscaping and visual constraints, it is proposed to adopt a freeboard allowance of 0.5m for the Baby Walk and the People's Park. The justification for this approach is given as:

- The 0.5m allowance is in keeping with the findings of the EA W187 method;
- The freeboard requirement estimated by the CFRAM GN 22 method with a 20% uplift in flow sensitivity is deemed to be overly conservative. When a reduced 10% uplift in flow sensitivity is considered the freeboard requirement through the reach is circa 0.5m and is therefore in keeping with the EA W187 method.

2.11 Freeboard only defences

It is evident from the freeboard assessment that there are a number of locations with ground levels higher than the design water level, but lower than the design flood defence level, i.e. lower than the design water level plus the freeboard allowance.

It was agreed by the Steering Group that defences for these areas would be provided as part of the scheme given that the freeboard in effect is a consideration of the inherent uncertainty of the design water levels. These defences are referred to as "freeboard only defences" and are being limited to flood cells that are being defended as part of the proposed scheme i.e. freeboard only defences are proposed for any independent flood cells where defences have not already been proposed as part of the current scenario. This is in keeping with the approach taken on previous flood relief schemes implemented by the OPW in Ireland.

2.12 Summary of the Freeboard Assessment

It is proposed to adopt a minimum freeboard allowance of 0.3m for the entire scheme area. There are however a number of areas where higher freeboard allowances should be adopted. These are summarised in Table 2-3.

Table 2-3 Average freeboard allowance

Area	Watercourse	Reach location	Average freeboard allowance (mm)
Area 1	Glenathonacash	Upstream of Carrigogna Bridge	750*
	Glenathonacash	Downstream of Carrigogna Bridge	750*
	Owenacurra	Tír Cluain	500*
	Owenacurra	Upstream of Moore's Bridge	600
	Owenacurra	Downstream of Moore's Bridge	600
	Owenacurra	Willowbank Embankment	500*
	Owenacurra	Upstream of Northern Relief Rd (NRR)	620
	Owenacurra	Downstream of NRR Bridge	710*
	Owenacurra	Downstream Rail Line Bridge	500*
	Owenacurra	Millbrook	500*
	Owenacurra	River Wharf Apartments & Old Swimming Pool Site/ MyPlace	320
	Owenacurra	Upstream of New Cork Rd Bridge	320
Area 3 North	Owenacurra	Woodlands/ Riverside Way	560*
	Owenacurra	Downstream of Lidl Bridge	300
	Owenacurra	Kennedy Park / ESB Site	300
	Dungourney	Downstream of Bailick Road Bridge	300
	Owenacurra Estuary	Chadwick's	530
	Owenacurra Estuary	Bailick Road Embankment	730*
	Dungourney	Downstream of Lewis Bridge	300
	Dungourney	Baby's Walk	500
	Dungourney	People's Park	500
	Dungourney	Irish Distillers Limited (IDL)	700*
Area 3 South	Owenacurra Estuary	Ballyannan Wood Walk Carpark	530
	Owenacurra Estuary	The Moorings	530
	Owenacurra Estuary	The Granary	530
	Owenacurra Estuary	Bailick Road	530
	Owenacurra Estuary	Grain Silo Site	530
	Owenacurra Estuary	Wood Quay Apartments	530
	Owenacurra Estuary	Commissioner's Quay	530
	Owenacurra Estuary	Charleston Wharf	530

Area	Watercourse	Reach location	Average freeboard allowance (mm)
	Owenacurra Estuary	Charleston Maltings	530
	Owenacurra Estuary	Bailick Road (South)	530
	Owenacurra Estuary	South Quay	530
	Owenacurra Estuary	The Maltings Apartments	530
	Owenacurra Estuary	Quay House	530
Area 4	IDL Millrace	Greenway	500*
Area 5	Ballinacurra	Ballinacurra Storage Area	500*
Area 6	Oatencake/Water Rock Lower	Upstream of Wastewater Plant (WwTP)	500*

* Includes a 200mm settlement allowance for embankments

3. Accounting for Climate Change in the Design of the Scheme

3.1 Introduction

A Scheme Climate Change Adaptation Plan (SCCAP) has been undertaken as part of the Midleton FRS project. The principle behind a SCCAP is that interventions/modifications on a flood scheme (i.e. raising the height of an existing flood defence) are only implemented when they become needed in order to maintain the required standard of protection as flood risk is increased due to climate change. A SCCAP approach can therefore provide greater value for money than the more traditional approach of implementing a once-off intervention.

The primary objective of the study was to develop a set of viable climate change adaptation pathways for mitigating flood risk in Midleton in the future under various climate scenarios. The viability of the pathways were considered in the context of the BCRs of the various options/adaptation options as well as well as the technical, social and environmental impacts.

A short summary of the Midleton SCCAP is provided in the following section. The reader is referred to the Midleton SCCAP report for a detailed description of the work.

The implementation of an allowance for Climate Change as part of the Current Scenario scheme in light of the revised post Storm Babet design water levels is considered later in the chapter.

3.2 Key Findings of the Midleton SCCAP

The findings of the Midleton SCCAP can be summarised as follows:

- The emerging preferring option is adaptable to the onset of climate change in both the MRFS and HEFS
- There are three viable adaptation options for the scheme in the MRFS which in turn have a number of viable adaptations in the HEFS as indicated in the decision tree schematic below. The scheme therefore has considerable flexibility as regards adaptation planning.

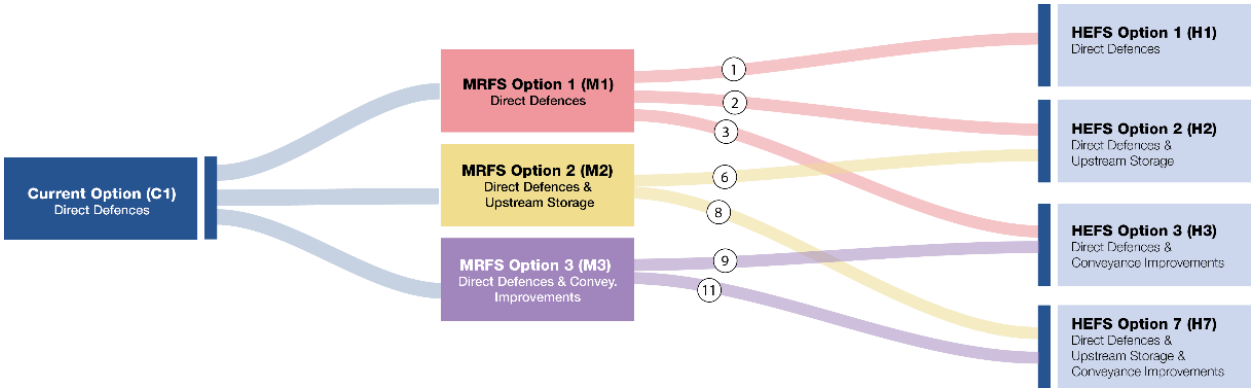


Figure 3-1 SCCAP Decision Tree – Viable pathways only

- From the MCA Light assessment, it is evident that some adaptation options perform better than others in a number of the criteria. There is however no significant advantage of any one option as they all generally perform well in the MCA scoring.
- Both the adaptation options and the full pathways for each of the scenarios considered are strongly cost beneficial.
- When the findings of both the MCA light and BCR analysis are considered, it is evident that there are no clear advantages of any one pathway over another as the BCR's and MCA scoring are all relatively similar across the study area.
- The target SoP of the scheme (1% Fluvial/0.5% Tidal AEP) will start to reduce once the scheme has been constructed when a linear onset of climate change is assumed. The tipping point[6] for the project has been defined as the MRFS T10 event. This is equivalent to a sea level rise scenario of circa 210mm above the present day which may occur in the next 17 to 46 years depending on the rate of climate change onset.
- The trigger point[7] will precede the tipping points by approximately 5 – 8 years.
- The project Steering Group have deemed that the estimated trigger and tipping points could potentially occur too soon after construction of the scheme. Consideration therefore needs to be given to adopting an assumptive allowance as part of the Current Scenario scheme in order to move the tipping point further into the future by increasing the SoP of the Scheme in the present day.
- The SCCAP will remain a "live" study even after the flood scheme for the current scenario has been constructed and will be reviewed and reassessed periodically as new knowledge on the changing climate is gathered.

The consideration of the assumptive allowance for the scheme is presented in the following section of the report.

[6] Tipping points relate to the moment in time when the SoP offered by an existing flood protection option(s) falls below what is deemed to be an acceptable level. In many cases, this will equate to the original target SoP of the scheme. In some cases, however it may be lower than this due to various social / economic / environmental constraints;

[7] Trigger points relate to when the planning to implement an adaptation option (i.e. the raising the height of an existing flood defence) needs to commence in order to maintain the required SoP of a flood defence option;

3.3 Resilience of the Proposed Scheme to Climate Change

The flood mitigation measures proposed as part of the Proposed Scheme are considered in the context of a long-term strategy which is adaptive to changes in climate and its potential impact on flood risk.

3.3.1 Consideration of an assumptive allowance for the scheme

A fully assumptive approach to managing flood risk associated with climate change would involve designing the scheme in the present day to cater for the flood risk associated with a future climate change scenario. The fully assumptive approach is not proposed for most areas within the scheme as it would not be cost-beneficial or socially acceptable due to visual impacts of high defences.

It is however proposed to include an assumptive allowance as part of the design, to partly mitigate against future flood risk as part of the current scenario scheme. This approach will offer a higher Standard of Protection than the target SoP for a period of time after construction.

It was agreed with the project Steering Group that an assumptive climate change allowance of 100mm will be provided, in addition to the target SoP (Current 1% Fluvial/0.5% Tidal AEP) design water levels. This allowance is included in addition to the proposed design level in order to increase the SoP of the scheme in the present day and help mitigate the impact of climate change once the scheme has been constructed.

There are a number of elements of the scheme where it is considered practical to take a fully assumptive approach to managing flood risk associated with climate change. In these instances, it is proposed to provide a HEFS target SoP (HEFS 1% Fluvial/ HEFS 0.5% Tidal AEP) now such that adaptions of these elements are not required in the future. The areas where it is proposed to provide a HEFS target SoP are on the outskirts of the town in areas which are not visually sensitive. The increase in defence height required to provide a HEFS target SoP is considered marginal.

Area	Location	Feature reference	Current SoP Design Water Level (mOD)	HEFS SoP Design Water Level (mOD)	Delta (mm)
Area 4	Greenway	C09_A4_E001_R	7.84	7.99	150
Area 5	Ballinacurra Storage Area	C06_A5_E001_L C06_A5_E001_R C06_A5_E002_R	6.50	6.60	100

3.3.2 Consideration of climate change adaptability in the defence design

To allow for adaptability of the scheme to future climate change, the foundations of the hard flood defences have been designed to facilitate future increases in their heights, to allow the walls/flow control structures to be efficiently raised in the future without major reconstruction. Similarly, the flood defence embankments/flood storage areas can be increased in height without any major reconstruction.

Any such future works would require the appropriate consents at that time.

4. Design Basis of the Proposed Scheme

4.1 Flood defence types

The Proposed Scheme described in the following sections is diverse in terms of the types of engineering interventions that have been developed by the design team including embankments, flood relief walls, groundwater pumping wells, regrading works, drainage infrastructure and culverts. These design interventions reflect the wide variety of constraints that the design team have had to work within to ensure the most suitable design solution is chosen.

The selection of the flood defence type is based on the following:

- Where feasible, the existing flood defences are reused, strengthened or raised as necessary.
- Where space allows and the ground conditions are suitable, the proposed flood protection measure is an embankment.
- Where there is insufficient space for an embankment and the ground conditions are suitable, a reinforced concrete wall with integral reinforced concrete foundation is proposed.
- In areas of soft ground where there is insufficient space for conventional foundation, the reinforced concrete wall has a piled foundation.
- Where construction space is restricted or due to ground conditions, a sheet piled wall solution is adopted.
- Glass panel flood walls are provided at scenic locations where appropriate.
- Regrading is proposed to tie defences into existing ground levels or to maintain the relative flood defence wall heights to a maximum of 1.1m in so far as is achievable.
- Upstream flood storage has been provided where the available land area and topography enable the temporary retention of floodwaters during storm events, reducing peak downstream flows while avoiding significant impacts on neighbouring properties and infrastructure.

4.2 Flood defence levels

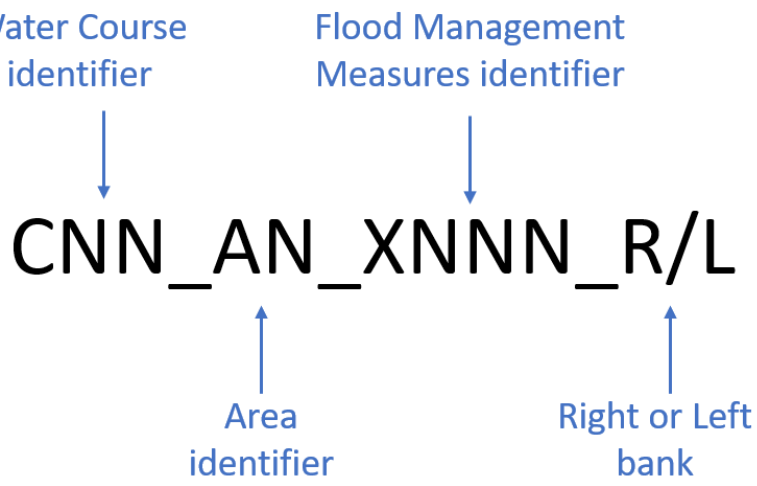
In order to arrive at the required flood defence levels along the extents of the proposed scheme, the following has been included:

1. Design water level for the target SoP which is derived from the hydraulic modelling results.
2. Climate Change allowance, which is outlined in Section 3.3.1.
3. Freeboard which is the term used to describe the allowance in the design height of flood defence walls and embankments to account for uncertainties in the scheme design in the areas of hydrology (flow estimation and probability), hydraulic modelling (roughness of the river channel, afflux through bridge, etc.) and tidal and wave action. A freeboard assessment was carried out for the Proposed Scheme, and the freeboard allowance varies throughout the scheme depending on the specific issues for each defence. This is detailed in Section 2.
4. A settlement allowance, minimum 200mm, has been added to the freeboard for embankments to allow for settlement.

4.3 Naming System of Emerging Preferred Option Elements

For ease of reference to the reader, the various elements of the flood relief scheme have been assigned a unique identifier, as per the following format:

WatercourseIdentifier_AreaIdentifier_FloodManagementMeasureIdentifier_Right / Left Bank



Watercourse and Flood Management Measures Identifiers are listed below:

Table 4-1 Watercourse identifiers

Watercourse identifier	
Owenacurra	C01
Owenacurra Estuary	C02
Glenathonacash	C03
Owenacurra Millrace	C04
Dungourney	C05
Ballinacurra	C06
Oatencake/Water Rock Upper (not in this scheme)	C07
Oatencake/Water Rock Lower	C08
IDL Millrace	C09

Table 4-2 Flood Management Measures identifier

Flood Management Measures identifier	
Bridge	B
Channel	CH
Culvert	CU
Embankment	E
Flow Control Structure	FC
General interference	G

Flood Management Measures identifier	
Groundwater Pumping Well	GW
Walls and Buildings	L
Pumping installations / station	PS
Roads / Regrading	R

This naming convention has been adopted in the tables in the next section of the report.

5. Detailed Description of the Proposed Scheme

5.1 General Overview

The Proposed Scheme is described in more detail in the sections below. The works for the Proposed Scheme will be located in Midleton Town and its close environs and will comprise measures including the construction of direct flood defences, (i.e. flood walls and embankments), a flood storage area, groundwater pumping wells, and a drainage system including pumping stations to cater for stormwater run-off.

The proposed works are described throughout as being on the left or right bank of watercourses. The reader should understand this to mean the left or right bank when someone is looking downstream.

A summary of the proposed activities in each of the work package areas is included in Table 5-1 with further detail on the proposed works provided thereafter.

An overview of the layout of the Proposed Scheme is shown in Figure 5-1.

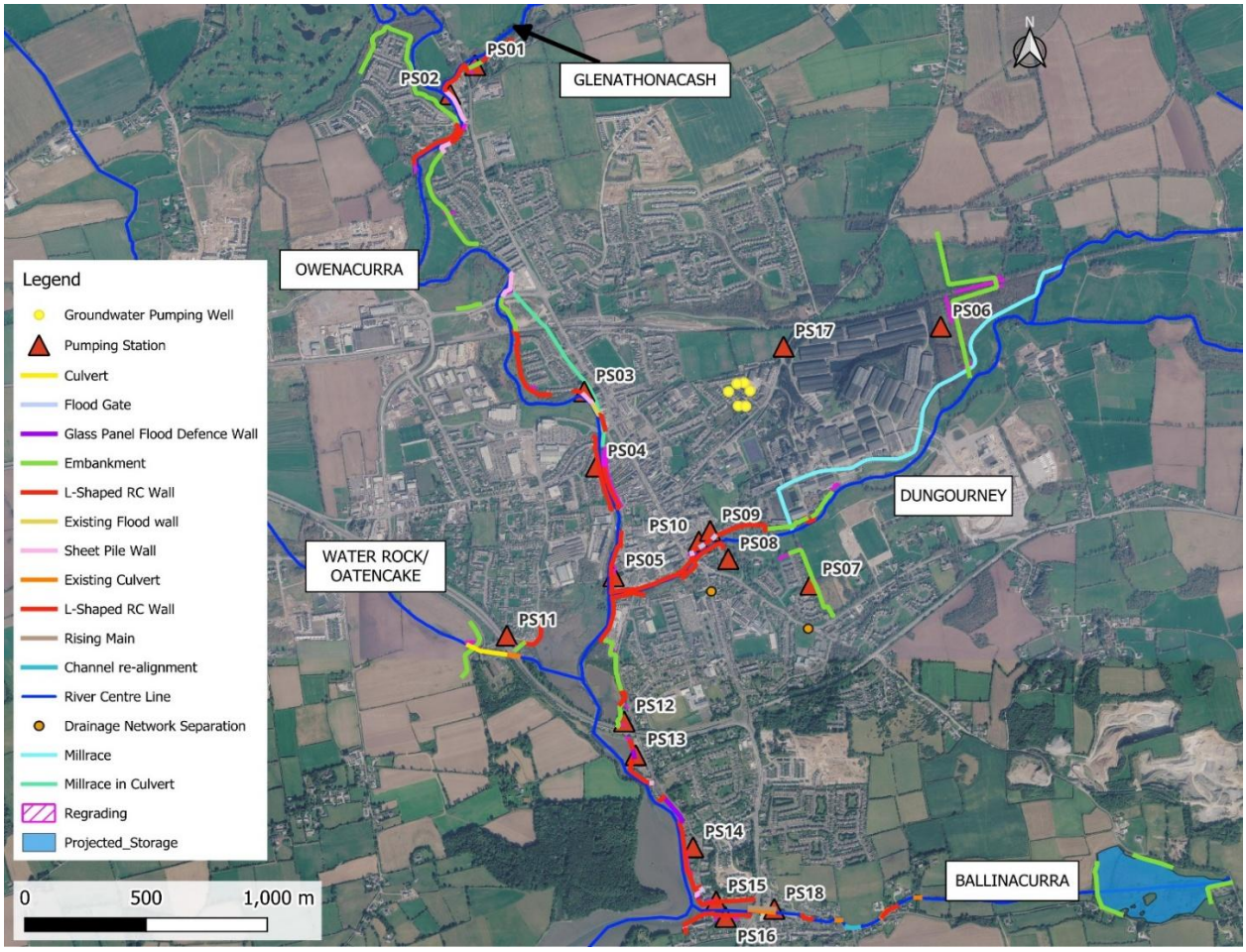


Figure 5-1 Overall Layout of Proposed Flood Relief Works.

Table 5-1 Summary of Proposed Works

Area	Location	Feature reference	Proposed Works
Area 1	Upstream of Carrigogna Bridge	C03_A1_L001_L	Construction of reinforced concrete (RC) L-shaped wall, drainage infrastructure and ground regrading.
	Upstream of Carrigogna Bridge	C03_A1_E001_L	Construction of an embankment with ground regrading, drainage infrastructure and construction of pumping station PS01.
	Carrigogna Bridge wing wall	C03_A1_L002_L	Construction of reinforced concrete L-shaped walls with cladding.
	Carrigogna Bridge	C03_A1_B001	Cleaning, repointing, underpinning and grouting of existing bridge and utility diversion.
	Clohessy's Yard	C03_A1_L003_L	Construction of reinforced concrete L-shaped wall with ground regrading, scour protection and drainage infrastructure.
	Tír Cluain	C01_A1_E001_R	Construction of a flood defence embankment with ground regrading and drainage infrastructure.
	Clohessy's Yard South	C01_A1_L001_L	Installation of sheet piled flood defence wall with RC capping beam, drainage infrastructure and construction of pumping station PS02.

Area	Location	Feature reference	Proposed Works
	Moore's Lane	C01_A1_L002_R	Construction of reinforced concrete L-shaped wall, cladding, drainage infrastructure, road widening, road regrading and paving.
	Moore's Lane South	C01_A1_L003_R	Construction of reinforced concrete L-shaped wall, cladding, drainage infrastructure, road widening, scour protection and paving.
	Moore's Bridge Downstream Left Bank	C01_A1_R001_L	Ground regrading, drainage infrastructure, and scour protection.
	Cloonmullin House North	C01_A1_L002_L	Construction of reinforced concrete L-shaped wall, cladding, drainage infrastructure, and scour protection.
	Cloonmullin House South	C01_A1_L003_L	Installation of sheet piled flood defence wall with RC capping beam, cladding, drainage infrastructure, and scour protection.
	Willowbank Embankment	C01_A1_E001_L	Construction of a flood defence embankment with ground regrading, fencing and drainage infrastructure.
	Broomfield West Biodiversity Enhancement Area		Planting of a native hedgerow of approx. 246m, and a mix of native tree species of 220 no., including 160 no. clear-stemmed trees and 60 no. multi-stemmed trees.
Area 2	Vella Homes Site	C01_A2_L001_L	Demolition of existing block wall and associated concrete deck and piles. Installation of sheet piled wall with RC capping beam, ground regrading, cladding and drainage infrastructure.
	Vella Homes Site	C01_A2_G001_L	Construction of flow control structure on the millrace.
	Upstream of Northern Relief Rd (NRR)	C01_A2_E001_R	Construction of an embankment and installation of fencing.
	Downstream of NRR Bridge	C01_A2_E001_L	Demolition of existing bridge, construction of an embankment with ground regrading, fencing and drainage infrastructure.
	Rail Line Bridge Abutment (Upstream)	C01_A2_L001_L	Demolition of existing walls, construction of a reinforced concrete L-shaped wall.
	Rail Line Bridge Abutment (Downstream)	C01_A2_L002_L	Demolition of existing walls, construction of a reinforced concrete L-shaped wall.
	Millbrook Wall	C01_A2_L003_L	Construction of reinforced concrete L-shaped wall, drainage infrastructure and fencing.
	Millbrook Wall	C01_A2_L004_L	Construction of reinforced concrete L-shaped wall, and construction of new boundary fence.
	Downstream of Millbrook	C01_A2_L005_L	Construction of reinforced concrete L-shaped wall, drainage infrastructure, and cladding.
	The Stables	C01_A2_L006_L	Demolition of existing wall, installation of sheet piled wall, scour protection, drainage infrastructure and cladding.
	River Wharf Apartments & Old Swimming Pool Wall	C01_A2_L007_L	Cleaning and repointing of existing flood defence wall and removal of vegetation, installation of scour beam and drainage infrastructure. Installation of flap valve at downstream end of millrace outfall.
	MyPlace Flood Defence	C01_A2_L008_L	Construction of reinforced concrete L-shaped wall, cladding, drainage infrastructure and pumping station PS03.

Area	Location	Feature reference	Proposed Works
	Upstream of New Cork Rd Bridge	C01_A2_L001_R	Construction of reinforced concrete L-shaped wall, drainage infrastructure and cladding.
Area 3 North	Woodlands	C01_A3N_L001_R	Construction of reinforced concrete L-shaped wall, cladding, drainage infrastructure and pumping station PS04.
	Lidl Carpark Flood Defences	C01_A3N_L001_R	Construction of reinforced concrete L-shaped wall, cladding and drainage infrastructure.
	Riverside Way Park	C01_A3N_R001_L	Road and footpath regrading and paving works.
	Riverside Way	C01_A3N_L001_L	Construction of reinforced concrete L-shaped wall, drainage infrastructure, cladding, road widening and paving. Demolition and reconstruction of existing boundary walls
	Riverside Way	C01_A3N_L002_L	Construction of reinforced concrete L-shaped wall, drainage infrastructure, cladding.
	O Farrells Funeral Home / Gasworks Site	C01_A3N_L003_L	Construction of reinforced concrete flood defence wall with rotary bored pile foundations, ground regrading, cladding, drainage infrastructure, scour protection.
	Kennedy Park / ESB Site (East)	C01_A3N_L004_L	Construction of reinforced concrete flood defence wall with rotary bored pile foundations, ground regrading, cladding, drainage infrastructure and pumping station PS05.
	ESB Site (South)	C05_A3N_L009_R	Construction of reinforced concrete flood defence wall with rotary bored pile foundations, ground regrading and drainage infrastructure.
	Hyde's Stonework/ Cuddigan's Yard	C05_A3N_L008_R	Construction of reinforced concrete flood defence walls with rotary bored pile foundations, cladding and drainage infrastructure.
	Bailick Road Bridge	C05_A3N_B001	Existing bridge railings to be removed, construction of reinforced concrete flood defence parapet wall and cladding.
	Uisce Éireann Site (North)	C05_A3N_L004_L	Construction of reinforced concrete L-shaped wall, drainage infrastructure, cladding.
	Uisce Éireann Site (East)	C02_A3N_L001_L	Construction of reinforced concrete L-shaped wall, drainage infrastructure, cladding.
	Chadwick's	C02_A3N_L002_L	Construction of reinforced concrete walls with rotary bored pile foundations, drainage infrastructure and fencing.
	Bailick Road Embankment	C02_A3N_E001_L	Construction of an embankment with ground regrading and drainage infrastructure.
	Bailick Road Wall	C02_A3N_ L003 _L	Construction of reinforced concrete L-shaped wall, drainage infrastructure and cladding.
	Bailick Park	C05_A3N_ E002_L	Construction of an embankment with ground regrading, drainage infrastructure, paving and pumping station PS12.
	Midleton House	C05_A3N _L007_R	Construction of reinforced concrete wall with rotary bored pile foundations, cladding and drainage infrastructure.
	Rock House	C05_A3N_L002_L	Construction of reinforced concrete L-shaped wall, drainage infrastructure, and cladding.
	Baby's Walk	C05_A3N_L004_R C05_A3N_L005_R	Construction of reinforced concrete L-shaped wall, drainage infrastructure, cladding, pumping stations PS09 and PS10,

Area	Location	Feature reference	Proposed Works
		C05_A3N_L006_R	paving works, road junction raising, flap valve on IDL millrace and installation of flood gates.
	Roxboro Close	C05_A3N_L001_L	Cleaning, repointing and grouting of existing river wall, construction of reinforced concrete walls with rotary bored pile foundations, drainage infrastructure, cladding, paving and pumping station PS08.
	People's Park	C05_A3N_L003_R	Construction of reinforced concrete L-shaped wall, cladding and drainage infrastructure.
	Irish Distillers Limited (IDL) Embankment	C05_A3N_E003_R	Construction of an embankment with ground regrading and drainage infrastructure.
	IDL Wall	C05_A3N_L001_R	Construction of reinforced concrete L-shaped wall, drainage infrastructure, culverting of millrace outfall and flap valve.
	IDL Embankment Northeast	C05_A3N_E001_R C05_A3N_E002_R C05_A3N_E003_R	Construction of an embankment with ground regrading, drainage infrastructure.
	Midleton GAA Grounds / Park South	C05_A3N_E001_L	Construction of an embankment with ground regrading, drainage infrastructure, and pumping station PS07.
	Drainage network separation at St. Mary's Road and Youghal Road (west)		Construction of a new surface water drainage system on Youghal Road (west) and St. Mary's Road
	Drainage network separation at Youghal Road (east)		Construction of a new surface water drainage system on Youghal Road (east)
Area 3 South	Ballyannan Wood Walk Carpark	C02_A3S_L001_L C02_A3S_L002_L	Construction of reinforced concrete wall with rotary bored pile foundations, glass panel flood defences, paving, pumping station PS13.
	Cois Na hAbhann	C02_A3S_L003_L	Cleaning, repointing and grouting of existing walls, construction of reinforced concrete L-shaped wall, cladding, drainage infrastructure and paving.
	The Moorings	C02_A3S_L004_L	Construction of reinforced concrete L-shaped wall and drainage infrastructure.
	The Moorings	C02_A3S_L005_L	Construction of reinforced concrete L-shaped wall and drainage infrastructure.
	Existing River Access	C02_A3S_L006_L	Construction of reinforced concrete L-shaped wall, drainage infrastructure, and installation of flood gate.
	The Granary (North)	C02_A3S_R002_L	Regrading of existing ground to tie into existing building at flood defence level.
	The Granary (South)	C02_A3S_R003_L	Cleaning, repointing and grouting of existing wall, construction of reinforced concrete L-shaped flood defence, regrading of existing ground to tie into existing building at flood defence level.
	Bailick Road	C02_A3S_L008_L	Construction of flood defence wall with rotary bored pile foundations, glass panel flood defences, drainage infrastructure, cladding, and paving.

Area	Location	Feature reference	Proposed Works
	Grain Silo Site	C02_A3S_L009_L	Cleaning, repointing and grouting of existing wall, construction of reinforced concrete flood defence wall with rotary bored pile foundations, drainage infrastructure, and cladding.
	Wood Quay Apartments	C02_A3S_L010_L	Cleaning, repointing and grouting of existing wall, construction of reinforced concrete flood defence wall with rotary bored pile foundations, drainage infrastructure, cladding, and pumping station PS14.
	Commissioner's Quay	C02_A3S_L011_L	Cleaning, repointing and grouting of existing wall, construction of reinforced concrete flood defence wall with rotary bored pile foundations, raising of existing ground levels, drainage infrastructure and cladding.
	Charleston Wharf	C02_A3S_L012_L	Demolition and reinstatement of existing balconies, cleaning, repointing and grouting of existing wall, construction of reinforced concrete flood defence walls with rotary bored pile foundations, and cladding.
	Charleston Wharf (South)	C02_A3S_L013_L	Cleaning, repointing and grouting of existing wall, construction of reinforced concrete flood defence wall with rotary bored pile foundations, cladding, paving, and installation of flood gate at existing slipway.
	Charleston Maltings (North)	C02_A3S_L014_L	Demolition of existing concrete block wall, installation of sheet piled flood defence wall with cladding and coping, and drainage infrastructure.
	The Boathouse Charleston Maltings	C02_A3S_L015_L	Removal of existing railing, cleaning, repointing and grouting of existing wall, construction of sheet piled flood defence walls, installation of glass panel flood defences, and cladding.
	Charleston Maltings (South)	C02_A3S_L016_L	Demolition and reinstatement of existing timber balconies and railings, cleaning, repointing and grouting of existing wall, construction of reinforced concrete flood defence wall with rotary bored pile foundations, cladding and pumping station PS15.
	Bailick Road (South)	C02_A3S_L017_L	Cleaning, repointing and grouting of existing wall, construction of reinforced concrete flood defence wall with rotary bored pile foundations, drainage infrastructure, and cladding.
	South Quay UE Pump Station	C02_A3S_L018_L	Construction of reinforced concrete L-shaped flood defence wall, cladding.
	South Quay	C02_A3S_L019_L	Construction of reinforced concrete L-shaped flood defence wall, drainage infrastructure, ground regrading, paving, cladding and pumping station PS16.
	UE Pump House	C02_A3S_L020_L	Construction of reinforced concrete L-shaped flood defence wall, cladding, and drainage infrastructure.
	The Maltings Apartments	C02_A3S_L021_L	Cleaning, repointing and grouting of existing wall, construction of reinforced concrete wall with rotary bored pile foundations, drainage infrastructure, paving, and cladding.
	Quay House	C02_A3S_L022_L	Construction of reinforced concrete L-shaped wall, cladding, drainage infrastructure, paving and installation of flood gate at existing slipway.
Area 4	Greenway	C09_A4_E001_R	Construction of flood defence embankment with ground regrading, drainage infrastructure, and pumping station PS06

Area	Location	Feature reference	Proposed Works
	IDL Millrace Upstream	C09_A4_FC001_R	Construction of flow control structure on IDL Millrace (upstream)
	IDL Millrace Embankment Tie-in	C09_A4_FC002_R	Construction of flow control structure on Millrace at embankment tie-in
	IDL Millrace Downstream	C09_A4_FC003_R	Construction of flow control structure on Millrace (downstream)
	Lauriston	GW_01 to GW_06	Construction of 6 groundwater pumping wells, drainage infrastructure, attenuation tank and pumping station PS17.
Area 5	Storage Area	C06_A5_E001_R	Construction of flood defence embankment to allocate the storage upstream Ballinacurra.
	Storage Area	C06_A5_E001_L	Construction of flood defence embankment to allocate the storage upstream Ballinacurra.
	Storage Area	C06_A5_E002_R	Construction of flood defence embankment to allocate the storage upstream Ballinacurra.
	Storage Area	C06_A5_FC001_R	Construction of flow control structure in Ballinacurra storage area
	Ballinacurra	C06_A5_CU001_R	Culvert maintenance.
	Ballinacurra	C06_A5_CU002_R	Culvert maintenance.
	Ballinacurra	C06_A5_L001_L	Construction of reinforced concrete L-shaped wall.
	Ballinacurra	C06_A5_CH001_R	Channel re alignment.
	Ballinacurra	C06_A5_CU003_R	Culvert maintenance.
	Ballinacurra	C06_A5_L001_R	Construction of reinforced concrete L-shaped wall.
	Ballinacurra	C06_A5_CU004_R	Culvert maintenance.
	Ballinacurra	C06_A5_RM001_R	Construction of a rising main going from Ballinacurra to the estuary.
	Ballinacurra	C06_A5_FV001_R	Repairing of the existing flap valve of the culvert that connects Ballinacurra with the estuary.
Area 6	Upstream of Wastewater Plant (WwTP)	C08_A6_E001_R	Construction of flood defence embankment, inlet structure, installation of trash screen and ground regrading.
	Downstream of Storage Area to N25	C08_A6_CU001	Construction of reinforced concrete culvert, ground regrading
	Dwyer's Road (South)	C02_A6_E002_R	Construction of a flood defence embankment with ground regrading, drainage infrastructure and pumping station PS11.
	Dwyer's Road (North)	C02_A6_L001_R	Construction of reinforced concrete L-shaped wall with ground regrading, drainage infrastructure, cladding and paving.

5.2 Area 1

The proposed flood relief works in Area 1 are located to the north of Midleton town. The works will extend approximately 230m upstream of the Carrigogna bridge (R626) on the Glenathonacash River and downstream to the confluence of the Glenathonacash and the Owenacurra Rivers.

On the Owenacurra River, works will extend from the confluence of the Glenathonacash and the Owenacurra Rivers downstream to the Northern Relief Road.

The proposed works are located in the townlands of Broomfield West, Carrigogna & Knockgriffin.

An overview of the layout of the proposed flood relief works in Area 1 is shown in Figure 5-2.

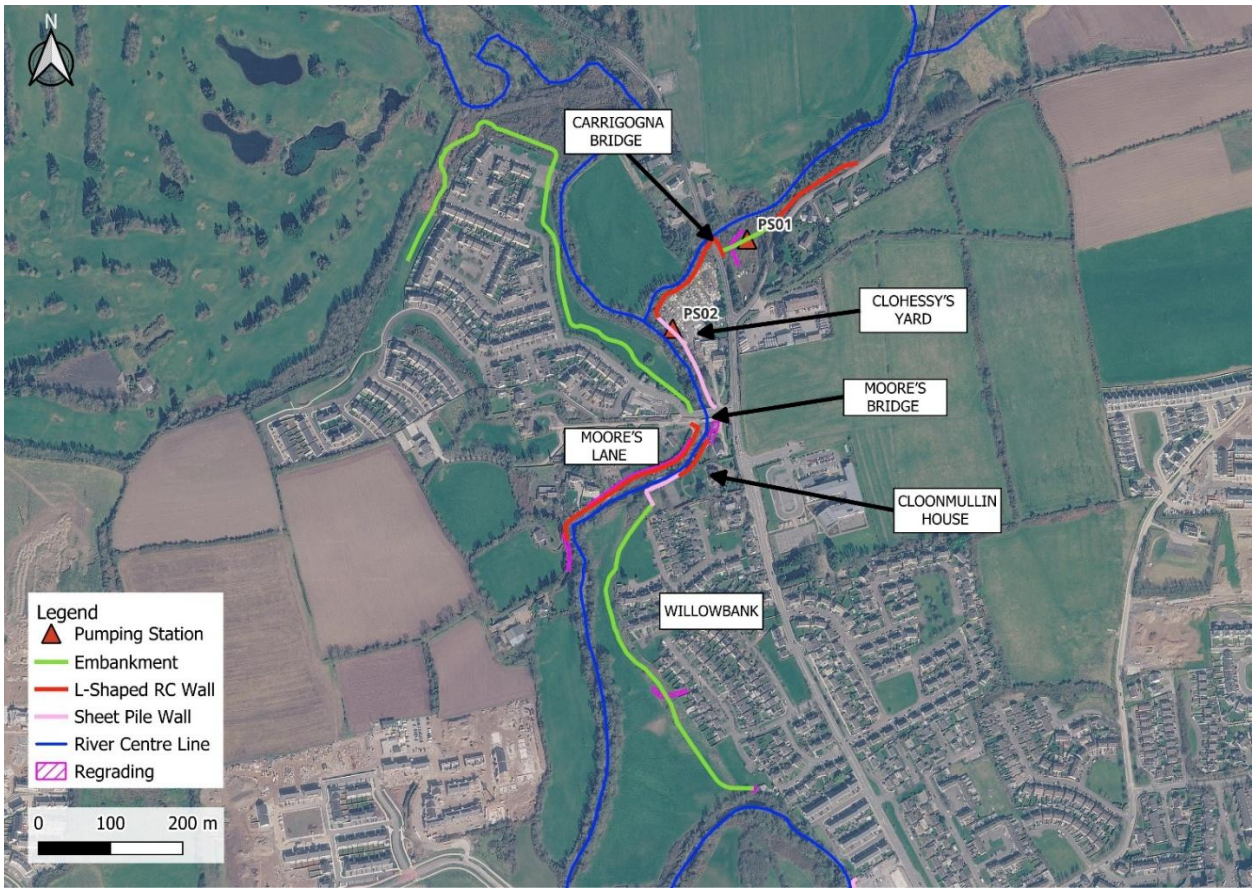


Figure 5-2 Overview of the proposed works in Area 1 (Not to scale. Extracted from Atlas Mapviewer)

A detailed description of the proposed works in Area 1 of the Proposed Scheme is provided below.

5.2.1 Tír Cluain

Tír Cluain is located approximately 1.4km north of Midleton Main Street. The area comprises a housing estate with residential areas stretching outwards to the south, and more rural lands to the north, west and east. The Owenacurra River flows in a southernly direction past the eastern edge of Tír Cluain. Consent for the works in this area have been sought and approved under the Part 8 process, under the Planning Regulations.

An overview of the layout of the proposed flood relief works in the Tír Cluain area is shown in Figure 5-3.



Figure 5-3 Layout of Proposed Flood Relief Works- Tír Cluain

C01_A1_E001_R – Tír Cluain

The proposed flood defence embankment is to wrap around the northern and eastern boundaries of the estate as shown in Figure 5-3, in order to prevent overland flow from entering the estate from the North and East. The approximate length of the embankment is 810m. The embankment is to be constructed with side slopes of 1 vertical: 2 horizontal with a 4m wide flat crest at the top of the embankment to facilitate routine inspection and maintenance. The top of the embankment will typically be 1m to 2m above existing ground level along its length. The top of the embankment will tie into the existing high ground at either end of the flood defence level.

A network of filter drains and surface water pipes will be constructed on the dry side of the embankment to facilitate surface water drainage. The network will drain into an existing attenuation tank located at the eastern end of the estate. Modifications to the existing drainage are also proposed as part of the works.

5.2.2 Glenathonacash River

Figure 5-4 presents the proposed flood relief works along the Glenathonacash. The following section of the report provides further detail on the proposed works in this area.

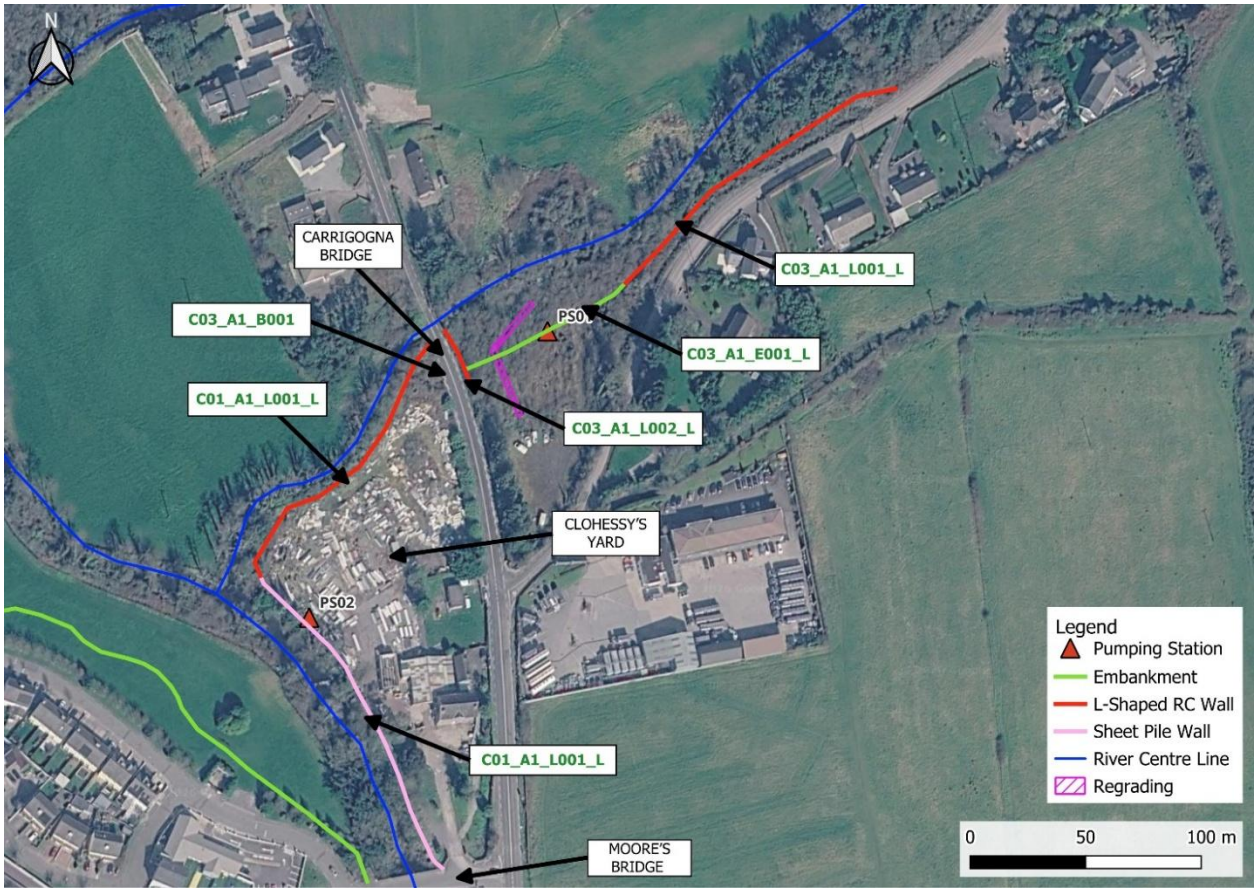


Figure 5-4 Layout of Proposed Flood Relief Works- Glenathonacash.

C03_A1_L001_L – Upstream of Carrigogna Bridge

At the upstream reach of Carrigogna Bridge, the proposed works will involve the construction of a reinforced concrete (RC) L-shaped flood defence wall, together with localised ground regrading to tie into adjacent existing ground level. The proposed defence will extend for approximately 146m and will have a typical height of 1.4m above existing ground level.

Drainage infrastructure will be constructed on the dry side of the wall to effectively manage surface water and prevent ponding on the dry side of the defences. A swale with a filter drain underneath will run along the dry side of the defence and will terminate in an overflow chamber at the proposed pumping station PS01, which is located on the dry side of the proposed embankment downstream, described below.

C03_A1_E001_L – Upstream of Carrigogna Bridge

Immediately upstream of Carrigogna Bridge, the flood defence works will comprise the construction of a flood defence embankment incorporating earthworks, ground regrading, and associated drainage infrastructure. The embankment will extend for approximately 79m and will reach a typical height of 2.7m above existing ground level.

The embankment will have side slopes of 1:3 vertical to horizontal ratio. A permanent 4m wide access/maintenance ramp will be constructed along the embankment crest to facilitate future inspection and maintenance. It will be accessed via a short hardstanding track leading from the adjacent public road.

The works will also include the construction of drainage infrastructure and pumping station PS01, which will manage surface water during flood events. A swale with a filter drain underneath will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station. The pumping station is located on the dry side of the proposed embankment, within the existing yard.

During non-flood event conditions, surface water will discharge to the river under gravity through the proposed surface water outfall which is located in the vicinity of the pumping station. During a flood event, any run off will be pumped through the proposed rising main with non-return valve to the river.

C03_A1_L002_L – Carrigogna Bridge Wing Wall

The existing Carrigogna Bridge wing wall will be reconstructed as part of the Proposed Scheme. These works will include the construction of reinforced concrete L-shaped retaining walls with appropriate cladding to match the existing bridge stonework. The proposed works will restore and improve the condition of the existing bridge without disrupting the existing fabric of the bridge. Carrigogna Bridge is not a protected structure but retains local architectural and functional value as part of the historic transport network, therefore masonry cladding and capping is proposed to ensure appropriate connection to existing walls.

C03_A1_B001 – Carrigogna Bridge

At Carrigogna Bridge, cleaning, repointing, underpinning, and grouting of the existing bridge structure will also be undertaken.

An existing 150mm diameter watermain will be removed from the eye of the bridge to reduce blockage risk in the area. This watermain will be diverted and fixed to the upstream exterior wall of the bridge.

C01_A1_L001_L – Clohessy's Yard South

At Clohessy's Yard, the proposed works will include the construction of a reinforced concrete L-shaped flood defence wall extending approximately 131m, between Carrigogna Bridge and the confluence of the Glenathonacash River with the Owenacurra River, with a typical height of 1.1m above proposed ground level.

The works will also incorporate ground regrading to tie into adjacent existing ground levels. Scour protection utilising riprap will be installed to the riverbank on the slight bend in the river (Glenathonacash River) to protect the defences against erosion.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the proposed pumping station PS02, which is located on the dry side of the proposed wall downstream, detailed below. This will operate as detailed below, with gravity discharge during non flood event conditions, and run off being pumped to the river during flood events.

At Clohessy's Yard South, flood defences are required from the confluence of the Glenathonacash River with the Owenacurra River to Moore's Bridge and will comprise the installation of a sheet piled flood defence wall with a reinforced concrete capping beam, extending approximately 151m with a typical height of 1.6m above existing ground level.

Associated works will include drainage infrastructure and the construction of pumping station PS02, which will facilitate the management of surface water on the dry side of the defences. The pumping station is located on the dry side of the proposed wall, within the existing yard, immediately downstream of the confluence of the Glenathonacash River with the Owenacurra River.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS02. During non flood event conditions, this will discharge to the river under gravity through the proposed surface water outfall which is located in vicinity of the pumping station. During a flood event, any run off will be pumped through the proposed rising main with non-return valve to the river.

5.2.3 Downstream of Moore's Bridge

Figure 5-5 presents the proposed flood relief works downstream of Moore's Bridge. The following section of the report provides further detail on the proposed works in this area.

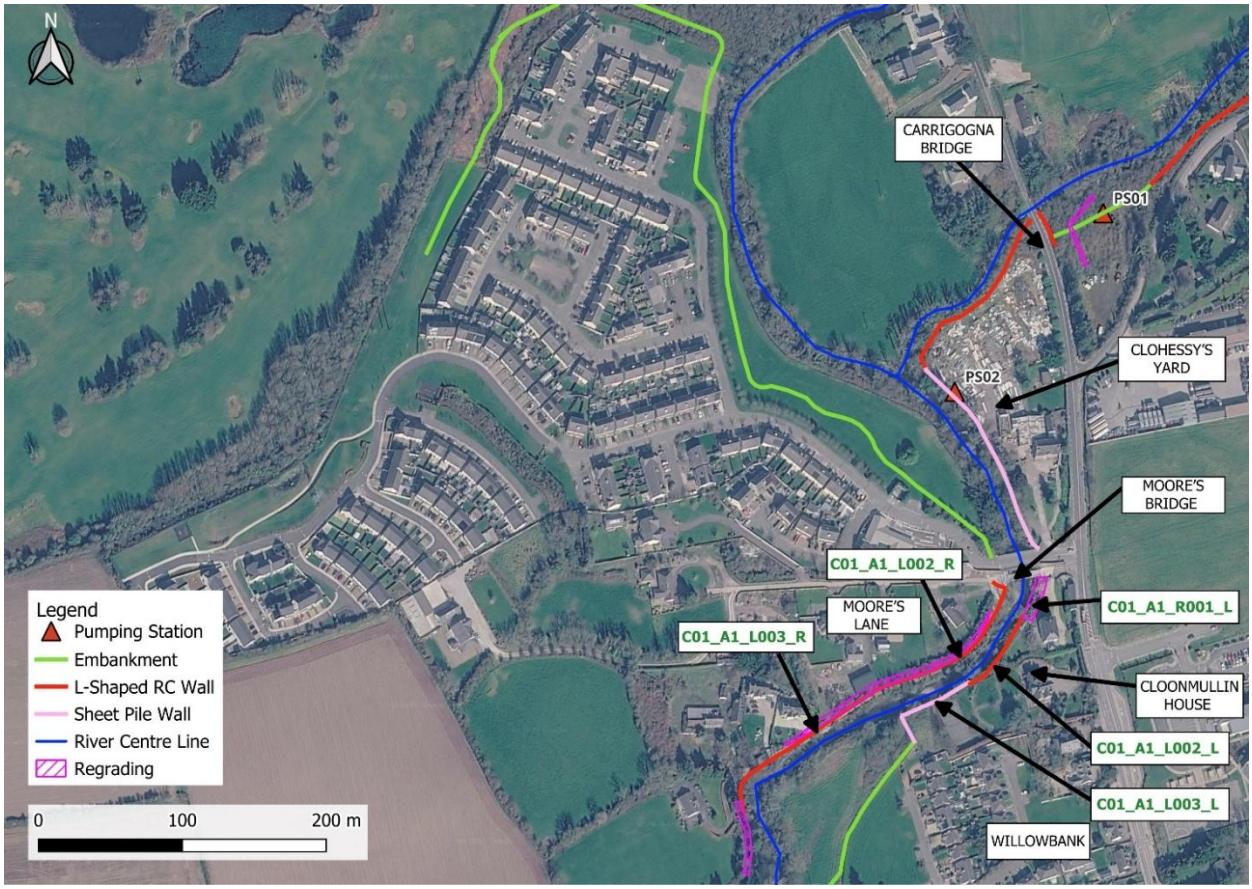


Figure 5-5 Layout of Proposed Flood Relief Works- Downstream of Moore's Bridge.

C01_A1_L002_R – Moore's Lane

Downstream of Moore's Bridge on the right bank, the proposed works on Moore's Lane will involve the construction of a new reinforced concrete L-shaped flood defence wall masonry clad on both sides, extending approximately 96m with a typical height of 1.1m above existing ground level.

The tie-in into Moore's Bridge at the northern end will require the demolition of a section of the existing wall and the installation of a new entrance gate to residential property.

In order to maintain the riparian tree line along the riverbank at Moore's Lane and the residential access, the wall will be set back from the tree line. To facilitate this, the road will be realigned. The proposed works will require permanent land take including existing hedgerow and parts of gardens to allow the construction of the realigned road and flood defence wall. Regrading of the road will be required to tie into existing high ground at the southern end of the flood defence in this location. The landowner's boundary fences will be reinstated with planting to replace the boundary hedgerows removed (approx. 140m in length) for the construction of the road.

A carrier drain with a filter drain adjacent will run along the dry side of the flood defence wall and will discharge to the river under gravity through the proposed surface water outfall located downstream of the proposed flood defence wall described below.

Existing private services in the laneway (foul, water) will be diverted as required.

C01_A1_L003_R – Moore's Lane South

Further south along Moore's Lane, the proposed works will comprise the construction of a masonry clad reinforced concrete L-shaped wall extending approximately 168m with a typical height of 1.2m above existing ground level.

Associated works will include construction of a new boundary wall, together with road regrading and ground regrading to tie into existing ground levels. Scour protection utilising riprap will also be installed in the riverbank immediately upstream and downstream of the existing bend in the river and drainage infrastructure will be installed to manage the surface water on the dry side of the flood defences.

A carrier drain with a filter drain adjacent will run along the dry side of the flood defence and will discharge to the river under gravity through the proposed surface water outfall. The outfall will have a headwall fitted with non-return valve.

C01_A1_R001_L – Moore's Bridge Downstream Left Bank

Downstream of Moore's Bridge on the left bank, the proposed works will include ground regrading and scour protection utilising riprap at the northern extent of the site to tie into high ground at Moore's Bridge.

It is proposed that a filter drain will be constructed on the dry side of the defence and will connect to a surface water carrier drain at the downstream end of the Willowbank embankment, described in Section 5.2.4.

C01_A1_L002_L – Upstream of Cloonmullin House and Cloonmullin House North

Upstream of Cloonmullin House and on the northern extent of the Cloonmullin House site, the proposed works will include the construction of a masonry clad reinforced concrete L-shaped wall extending approximately 60m with a typical height of 1.4m above existing ground level.

Proposed works include scour protection utilising riprap on the wet side of the defence to ensure stability.

It is proposed that a filter drain will continue on the dry side of the flood defence wall and will connect to a surface water carrier drain at the downstream end of the Willowbank embankment as described in Section 5.2.4.

C01_A1_L003_L – Cloonmullin House South

At the southern extent of the Cloonmullin House river boundary, the works will comprise the installation of a masonry clad sheet piled flood defence wall with a reinforced concrete capping beam. The proposed defence wall will extend for approximately 74m with a typical height of 1.2m above existing ground level.

Associated works will include scour protection utilising riprap on the wet side of the defence to ensure stability.

It is proposed that a filter drain will continue on the dry side of the defence and will connect to a surface water carrier drain at the downstream end of the Willowbank embankment as described in Section 5.2.4.

5.2.4 Willowbank

Figure 5-6 presents the proposed flood relief works in the area around Willowbank. The following section of the report provides further detail on the proposed works in this area.

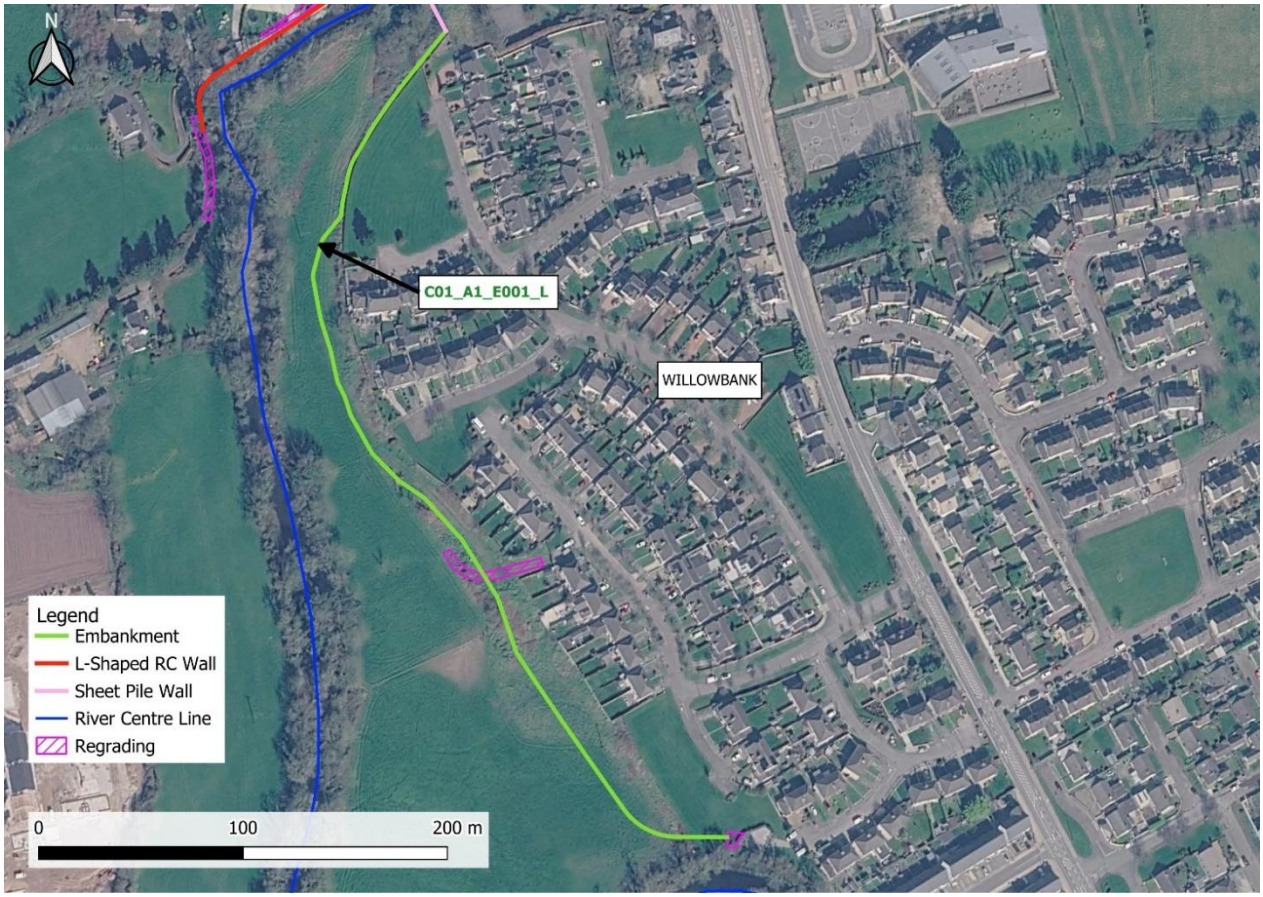


Figure 5-6 Layout of Proposed Flood Relief Works- Willowbank.

C01_A1_E001_L – Willowbank Embankment

Adjacent to the Willowbank Housing Estate, the works will involve the construction of a flood defence embankment extending approximately 501m, with a typical height of 2.5m above existing ground level.

The embankment will have side slopes of 1:3 vertical to horizontal with a 4m wide flat crest at the top of the embankment and adjoining maintenance and access ramp/track to facilitate routine inspection and maintenance. It will be accessed via a short hardstanding track connected to Willowbank Court.

A filter drain will be constructed on the dry side of the defence and will connect to a surface water carrier drain at the downstream end of the Willowbank embankment. This surface water carrier drain will discharge into the river at the proposed surface water outfall, which will be fitted with a headwall and non-return valves.

5.3 Area 2

The Proposed Scheme in Area 2 is located to the north of Midleton town centre. The works extend from Willowbank, passing the Northern Relief Road Bridge, the railway line and Millbrook, extending to the New Cork Road (R907) Bridge on the Owenacurra River.

The proposed works are located in the townlands of Broomfield West, Townparks, Knockgriffen and Glebe.

An overview of the layout of the proposed flood relief works in Area 2 is shown in Figure 5-7.

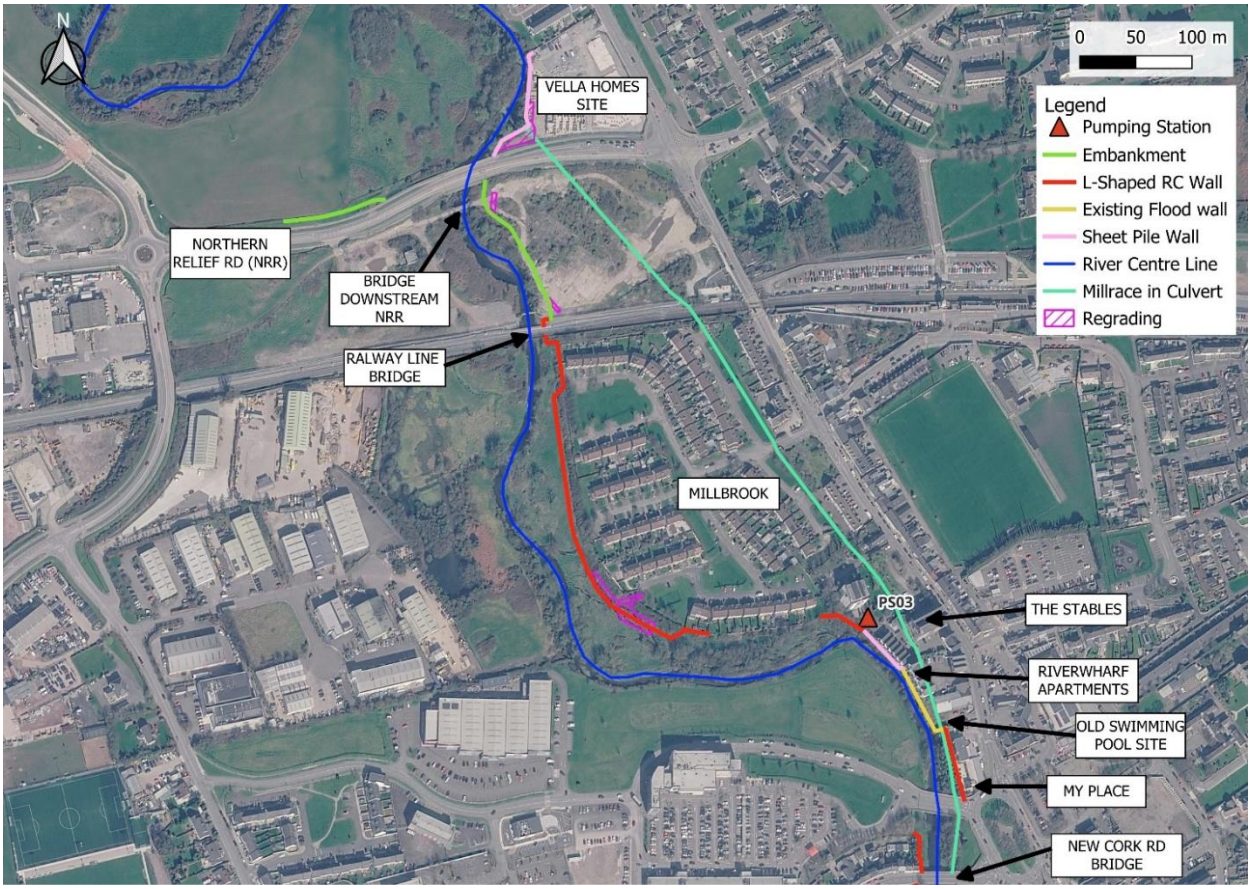


Figure 5-7 Overview of the proposed works in Area 2 (Not to scale. Extracted from Atlas Mapviewer)

A detailed description of the proposed works in Area 2 of the Proposed Scheme is provided below.

5.3.1 Upstream of Northern Relief Road (NRR)

Figure 5-8 presents the proposed flood relief works in the area upstream of Northern Relief Road. The following section of the report provides further detail on the proposed works in this area.

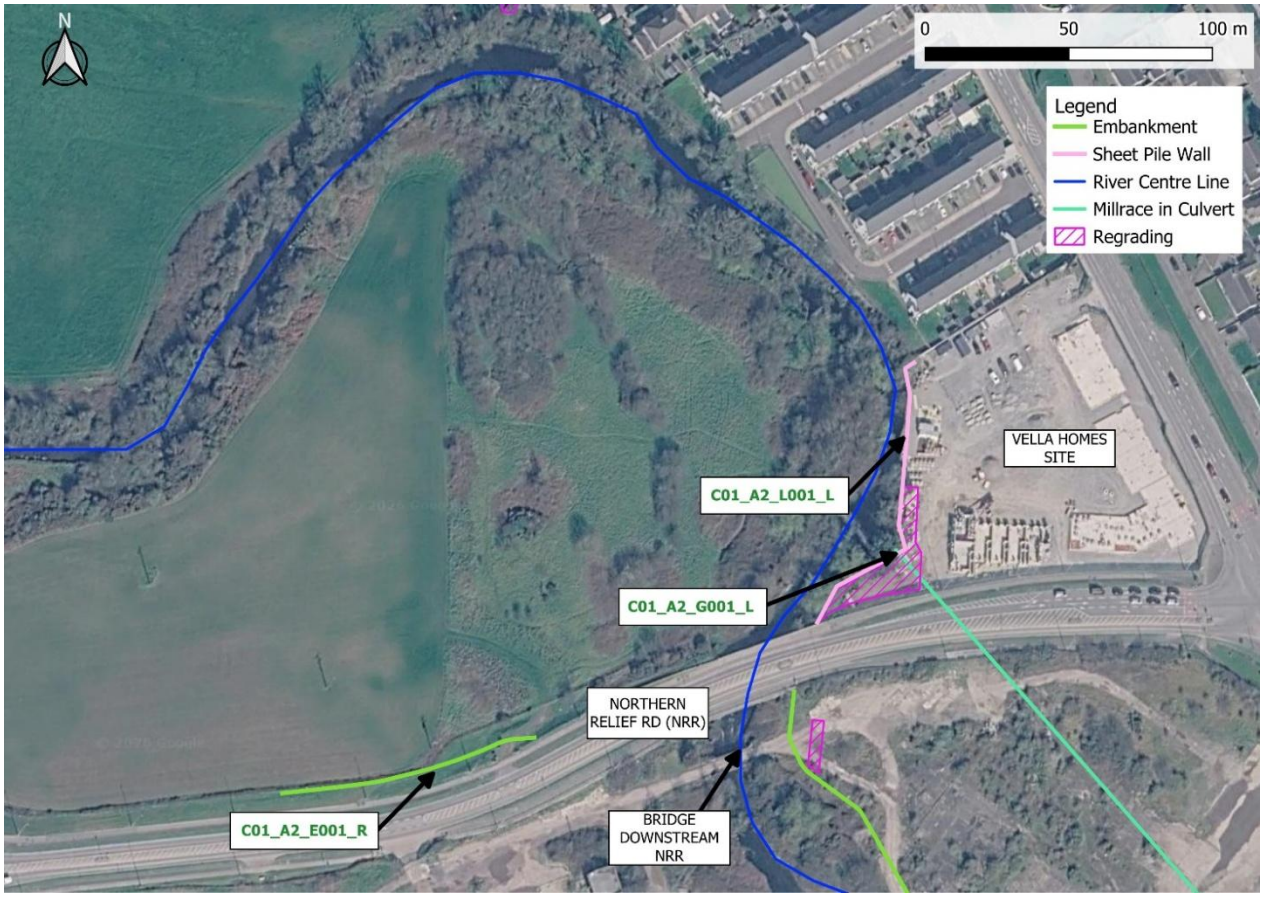


Figure 5-8 Layout of Proposed Flood Relief Works- Upstream of Northern Relief Road.

C01_A2_L001_L – Vella Homes Site

Upstream of the Northern Relief Road, at the Vella Homes site, the proposed works will involve the demolition of the existing block wall with associated concrete deck and piles, followed by the installation of a masonry clad (dry side) sheet piled flood defence wall with a reinforced concrete capping beam. The proposed defence will extend for approximately 108m with a typical height of 1.1m above existing ground level.

On the southern extent of the site, it is proposed to include ground reprofiling (raising of existing ground levels) to facilitate the proposed drainage network.

Drainage infrastructure will include a carrier drain with a filter drain adjacent which will run along the dry side of the defence and will discharge to the river under gravity through the proposed surface water outfall, which will have a headwall and will be fitted with non-return valve.

C01_A2_G001_L – Vella Homes Site

At the Vella Homes Site, there is an existing inlet for the Owenacurra millrace downstream of the weir.

The proposed works will comprise the construction of a flow control structure at the inlet to the Millrace. This structure will control flow entering the millrace. This will reduce flood risk along the open channel sections of the millrace downstream, at a site adjacent to the Mill Rd and within the Millrace Apartments complex.

C01_A2_E001_R – Upstream of Northern Relief Road (NRR)

Upstream of the Northern Relief Road (NRR) on the right bank, the proposed works will involve the construction of a flood defence embankment with associated ground regrading to tie into existing ground levels. The embankment will extend for approximately 90m and will have a typical height of 1.25m above existing ground level.

The embankment will have side slopes of 1:3 vertical to horizontal with a 4.0m wide flat crest at the top of the embankment to facilitate routine inspection and maintenance.

5.3.2 Downstream of NRR Bridge

Figure 5-9 presents the proposed flood relief works in the area downstream of Northern Relief Road. The following section of the report provides further detail on the proposed works in this area.

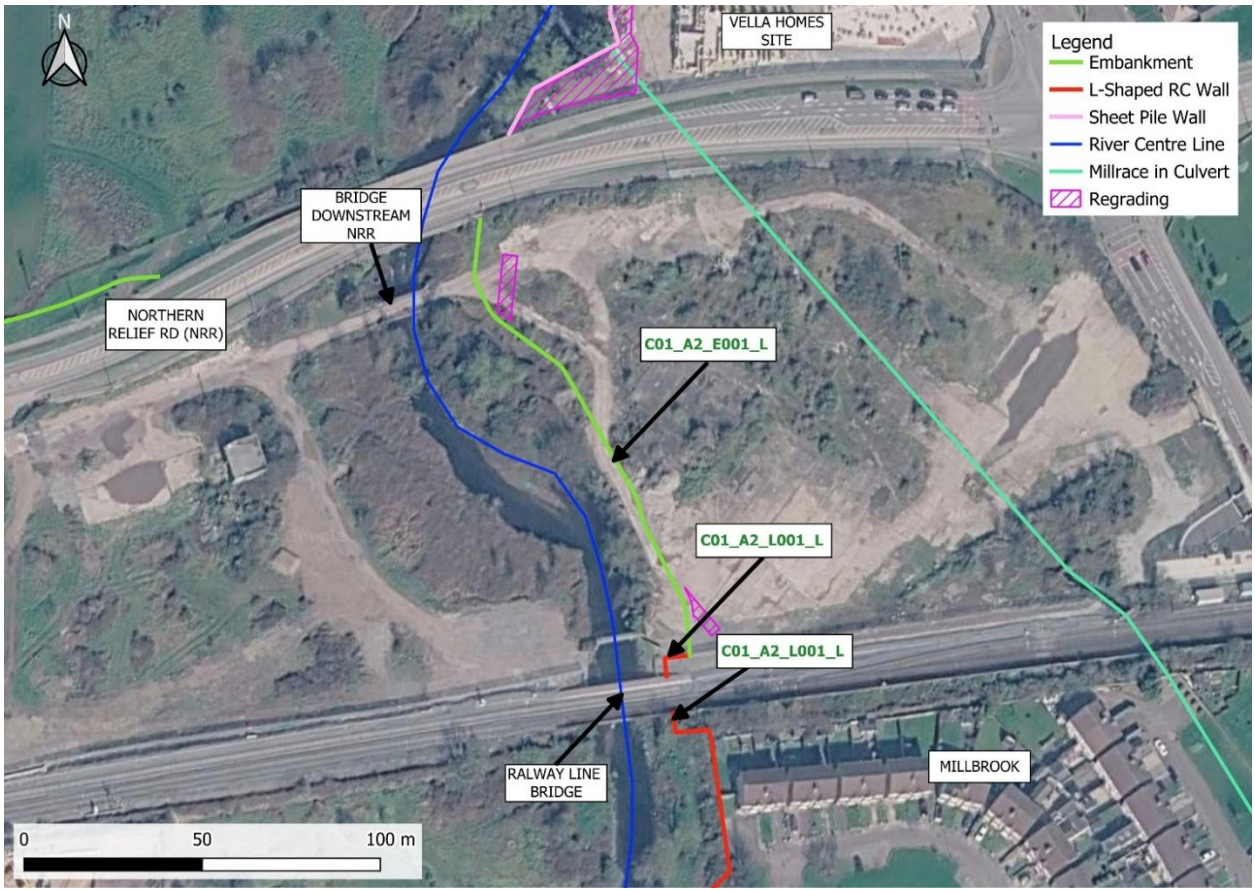


Figure 5-9 Layout of Proposed Flood Relief Works- Downstream of Northern Relief Road.

C01_A2_E001_L – Downstream of NRR Bridge

Downstream of the NRR Bridge, the proposed works will include the demolition of the existing bridge. This is a privately owned bridge, likely in poor condition, connecting two industrial sites which are no longer in use. During a flood event, it is surcharged and causes elevated water level upstream resulting in an increase in flood risk in the area. It is also a blockage risk, which has occurred in previous flood events and has caused flooding in the area.

On the left bank downstream of the NRR Bridge, the proposed works comprise construction of a flood defence embankment. The proposed embankment will extend for approximately 142m with a typical height of 1.25m above existing ground level. It will have side slopes of 1:3 vertical to horizontal with a 4.0m wide flat crest at the top of the embankment to facilitate routine inspection and maintenance.

A permanent fence, 1.2m in height, will be erected 3m offset along from the swale at the toe of the dry side of the embankment.

Drainage infrastructure will include a swale with a filter drain underneath which will run along the dry side of the defence and will discharge to the river under gravity through the proposed surface water outfall, which will have a headwall and will be fitted with a non-return valve.

C01_A2_L001_L – Rail Line Bridge Abutment (Upstream)

At the Rail Line Bridge abutment on the left bank upstream of the rail line bridge, the proposed works will involve the demolition of the existing modern wall and the construction of a new reinforced concrete L-shaped flood defence wall. This wall will be connected to the existing bridge structure through dowel connections.

It is proposed that this wall will tie into the embankment upstream at the proposed flood defence level.

C01_A2_L002_L – Rail Line Bridge Abutment (Downstream)

At the Rail Line Bridge abutment on the left bank downstream of the rail line bridge, the proposed works will include the demolition of the existing modern wall and the construction of a reinforced concrete L-shaped flood defence wall. This wall will be connected to the existing bridge structure through dowel connections.

It is proposed that this wall will tie into the proposed wall downstream at the proposed flood defence level.

5.3.3 Millbrook

Figure 5-10 presents the proposed flood relief works in the area around Millbrook. The following section of the report provides further detail on the proposed works in this area.

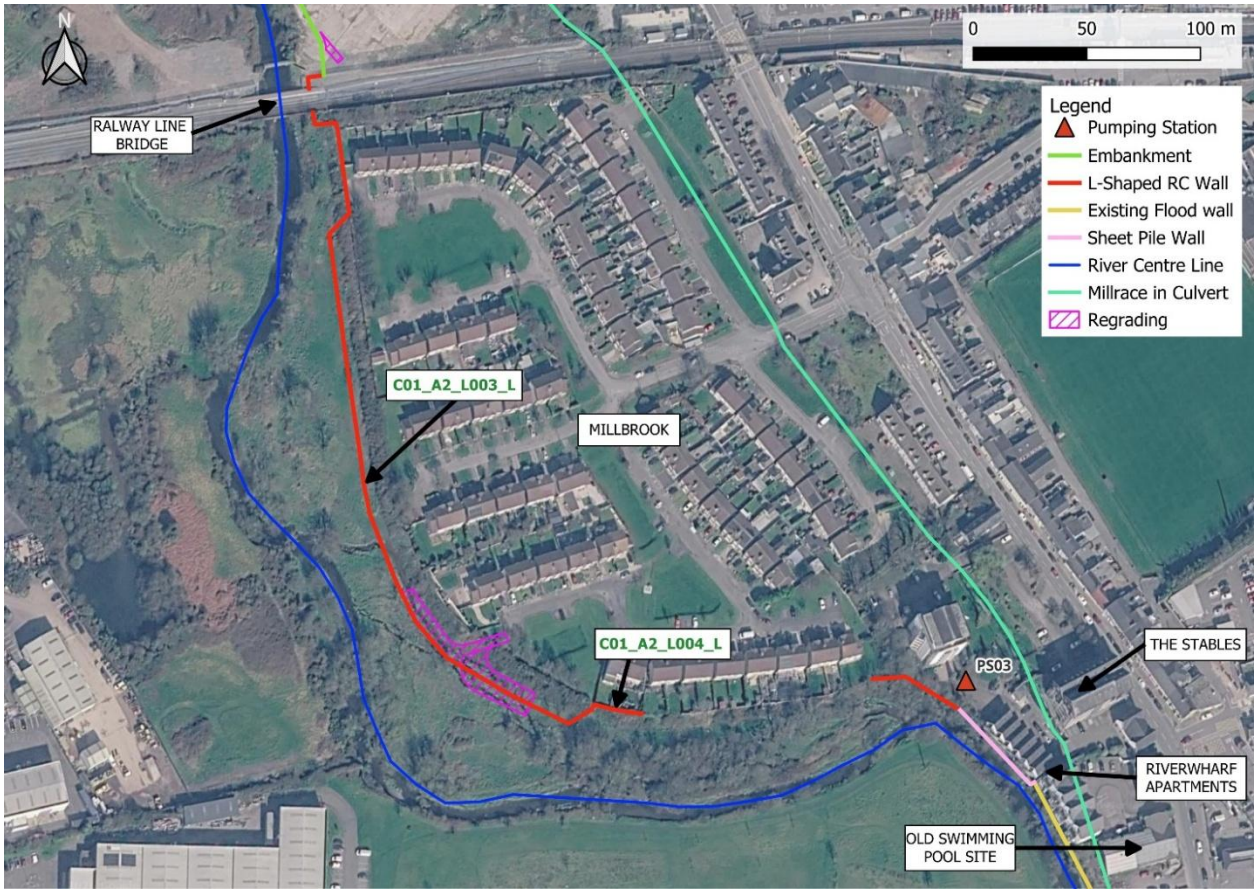


Figure 5-10 Layout of Proposed Flood Relief Works- Millbrook.

C01_A2_L003_L – Millbrook Wall

At Millbrook Housing Estate, the works will involve the demolition of the existing fence, followed by the construction of a reinforced concrete L-shaped flood defence wall. The proposed works will extend for approximately 321m with a typical height of 2.1m above existing ground level.

The wall will be accessed from the dry side via a short track from an entrance in front of 39 Millbrook Court. A maintenance vehicle access ramp will be provided on the wet side so that the wet side of the wall can be accessed. A 1.2m high safety railing will be provided on top of the flood defence wall adjacent to the access ramp.

It is proposed that a filter drain will be constructed on the dry side of the defence and will connect to a proposed surface water carrier drain which will run through Millbrook Court. It is proposed to connect to the existing stormwater network within the Millrace Apartments complex. At the existing downstream riverside manhole within the Millrace Apartments complex, it is proposed to construct an overflow diversion manhole.

During non-flood event conditions, the surface water will discharge to the river under gravity at this location.

During a flood event, flows will be directed to the proposed surface water carrier drain which runs through the Millrace Apartments complex and will terminate at pumping station PS03 which is located at MyPlace, described below.

C01_A2_L004_L – Millbrook Wall

An L-shaped reinforced concrete wall will be required to the rear of 29 and 28 Millbrook Court. The works will extend over approximately 22m with a typical height of 1.1m above existing ground level. The defence will tie into existing high ground to the east.

The works include the demolition of the existing fence and installation of a new 1.1m high panel and post fence on top of the proposed flood defence wall.

5.3.4 Millbrook to New Cork Road Bridge

Figure 5-11 presents the proposed flood relief works in the area from Millbrook to the New Cork Road Bridge. The following section of the report provides further detail on the proposed works in this area.

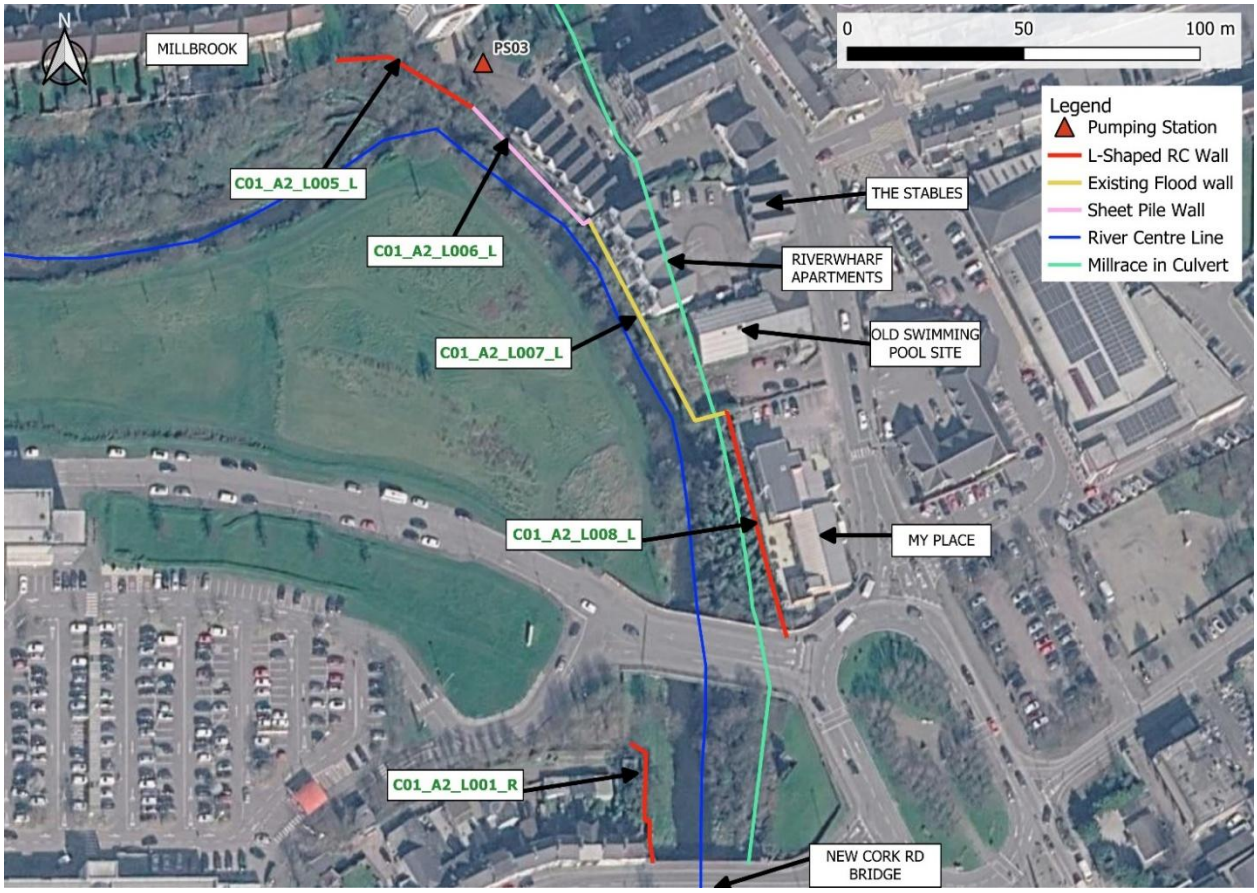


Figure 5-11 Layout of Proposed Flood Relief Works- Millbrook to New Cork Road Bridge.

C01_A2_L005_L – Downstream of Millbrook

An L-shaped reinforced concrete wall with masonry cladding (both sides) will be required from 15 Millbrook Court as far as The Stables. The works will extend for approximately 43m with a typical height of 1.1m above existing ground level.

Drainage infrastructure will include a carrier drain with a filter drain adjacent which will run along the dry side of the defence. This will connect to the proposed surface water carrier drain which runs through the Millrace Apartments complex and terminates at pumping station PS03, which is located at MyPlace, described in detail below.

C01_A2_L006_L – The Stables

At The Stables, the proposed works will involve the demolition of the existing wall and the installation of a masonry clad (both sides) sheet piled flood defence wall. The proposed flood defence wall will extend for approximately 47m with a typical height of 1.0m above existing ground level.

The construction of the sheet piled flood defence wall at this location will require in-stream works. The works will also include scour protection utilising riprap installed at the base of the sheet piled wall.

A filter drain will be constructed on the dry side of the defence wall which will connect to the surface water carrier drain which runs through the Millrace Apartment complex and terminates at pumping station PS03, described in detail below.

C01_A2_L007_L – River Wharf Apartments and Old Swimming Pool Site Wall

At the River Wharf Apartments and Old Swimming Pool Site, the proposed works will involve the cleaning and repointing of the existing river wall, along with the removal of vegetation and the installation of a scour beam on the wet side at the base of the wall.

These interventions will improve the structural condition and durability of the wall. The existing wall height varies along its length but is typically around 3.35m in height. This is sufficient in height to provide the target standard of protection.

At the old swimming pool site, a filter drain will be constructed on the dry side of the existing wall which will connect to the surface water carrier drain at MyPlace.

A flap valve will be installed at the downstream millrace outfall. The flap valve will prevent backwatering and prevent flooding from the open channel section.

C01_A2_L008_L – MyPlace Community Centre

At MyPlace Community Centre, the proposed works will involve the construction of a masonry clad (dry side) reinforced concrete L-shaped flood defence wall. The works will extend for approximately 65m with a typical height of 1.4m above existing ground level.

The northern section will tie into the old swimming pool site river wall, and the southern section will tie into the existing Market Green Plaza Bridge abutment.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at pumping station PS03. The pumping station is located on the dry side of the proposed wall, within the existing boundary of the MyPlace site. During non flood event conditions, this will discharge to the river under gravity through the proposed surface water outfall which is located in the vicinity of the pumping station. During a flood event, any run off will be pumped through the proposed rising main with non-return valve to the river.

There is an existing stormwater outfall at MyPlace, this will be diverted to the proposed Pumping Station PS03. During non flood event conditions, this will discharge to the river under gravity through the proposed surface water outfall described above. During a flood event, any run off will be pumped through the proposed rising main to the river described above.

C01_A2_L001_R – Upstream of New Cork Road Bridge

Upstream of the New Cork Road Bridge on the right bank, the proposed works will involve the construction of a masonry clad (both sides) reinforced concrete L-shaped flood defence wall. The proposed wall will extend for approximately 37m with a typical height of 1.4m above existing ground level.

The northern end will tie-into existing high ground level, while the southern end will tie into the New Cork Road Bridge.

It is proposed that a filter drain will be constructed on the dry side of the defence and will connect to a surface water carrier drain at the downstream end of the defence which will discharge into the river via a proposed surface water outfall, which will have a headwall and will be fitted with a non-return valve.

5.4 Area 3 North

The proposed flood relief works in Area 3 North are located in the centre of Midleton town. The works cover the downstream reaches of the Owenacurra and Dungourney Rivers. This corresponds to the extent from the Woodlands Housing Estate to Bailick Park (Choctaw Park) along the Owenacurra River and along the Dungourney River from Irish Distillers Limited (IDL) site on right bank and the GAA Grounds on the left bank to the confluence of the Dungourney and the Owenacurra River.

The proposed works are located in the townlands of Townspark, Park North, Glebe and Park South.

An overview of the layout of the proposed flood relief works in Area 3 North is shown in Figure 5-12.

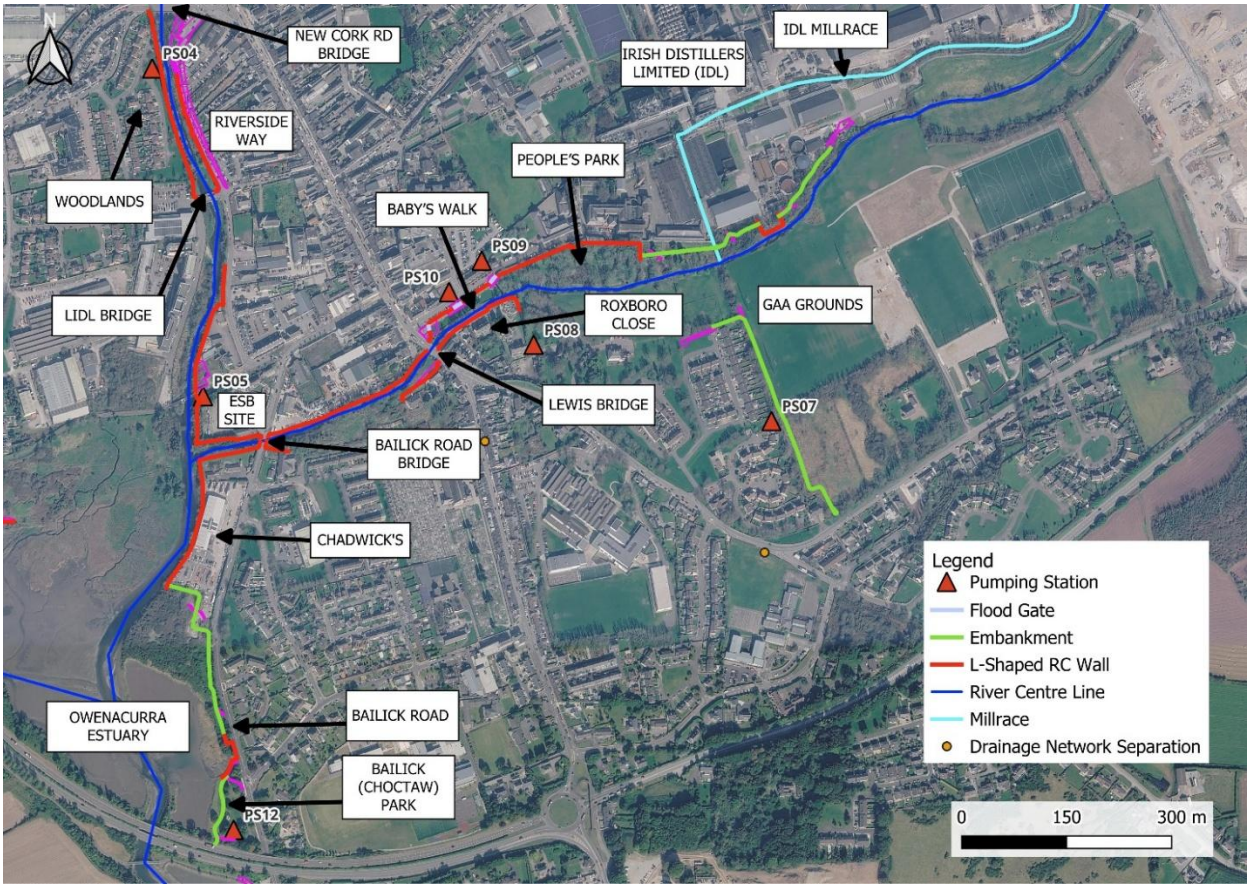


Figure 5-12 Overview of the proposed works in Area 3 North (Not to scale. Extracted from Atlas Mapviewer)

A detailed description of the proposed works in Area 3 North of the Proposed Scheme is provided below.

5.4.1 New Cork Road Bridge to ESB Site

Figure 5-13 presents the proposed flood relief works in the area from the New Cork Road Bridge to the ESB Site on the Owenacurra. The following section of the report provides further detail on the proposed works in this area.

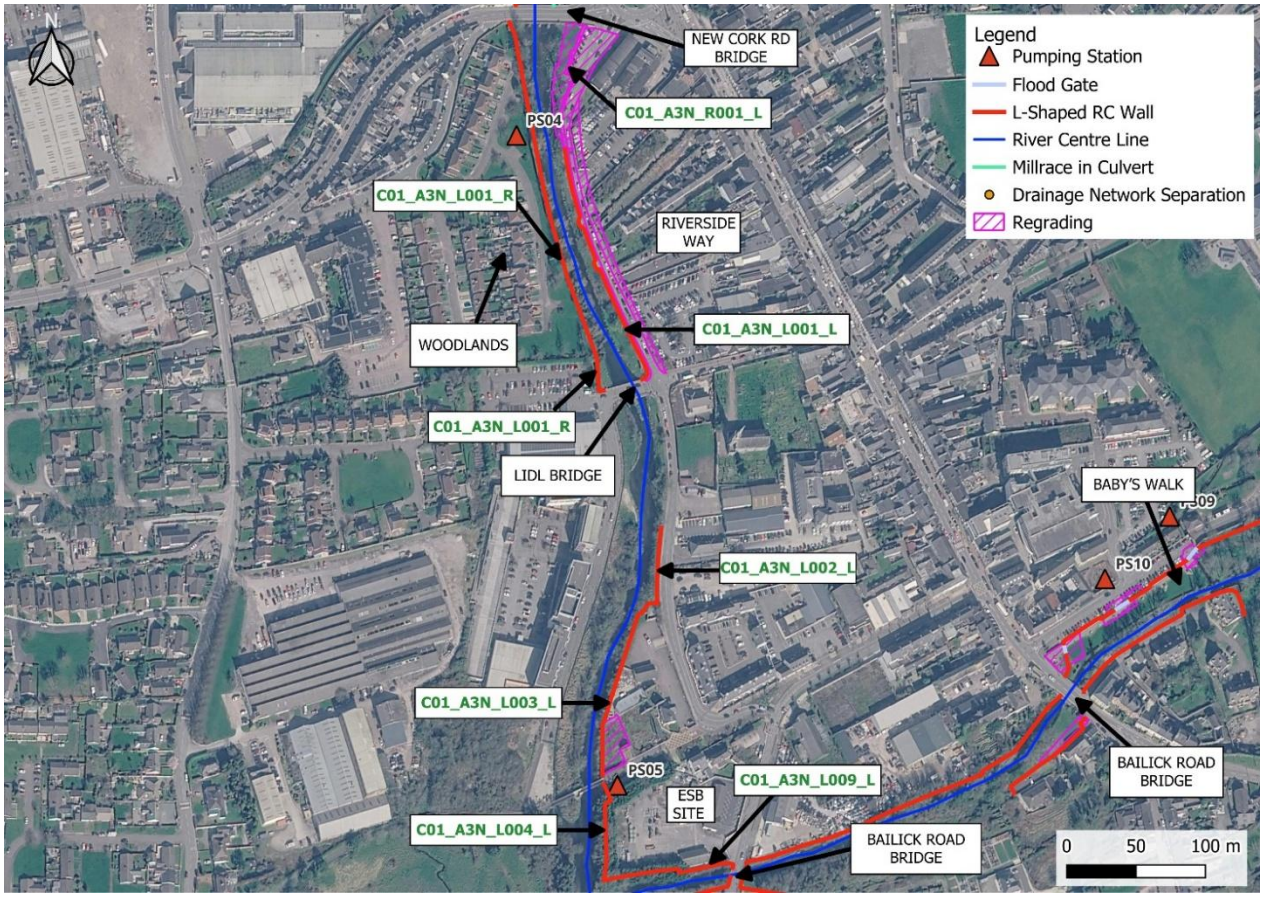


Figure 5-13 Layout of Proposed Flood Relief Works- New Cork Road Bridge to ESB Site.

C01_A3N_L001_R – Woodlands

At Woodlands housing estate, the proposed works will include the construction of a masonry clad (both sides) reinforced concrete L-shaped flood defence wall extending approximately 250m with a typical height of 1.1m above existing ground level. It will tie into the New Cork Road Bridge on the northern extent and to the Lidl carpark flood defence wall at the southern extent.

At the northern extent of the defences, a linear drainage channel will be constructed on the dry side of the defence which will connect into the surface water carrier drain.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the proposed pumping station PS04, located in the Woodlands housing estate green area.

During non flood event conditions, the surface water will discharge to the river under gravity through the proposed surface water outfall which is located in the vicinity of the pumping station. During a flood event, any run off will be pumped through the proposed rising main with non-return valve to the river.

There is an existing stormwater outfall at the southern end of the housing estate green area. This will be intercepted and connected to the proposed surface water carrier drain. At the existing downstream manhole, it is proposed to construct an overflow diversion manhole. During a non flood event, it will discharge through the existing outfall which will be fitted with a non-return valve.

During a flood event, it will be diverted into the carrier drain which will run along the dry side of the defence and will terminate in an overflow chamber at the proposed pumping station PS04, as described above.

It will also be necessary to divert an existing 225mm diameter foul gravity sewer to facilitate the works.

There is an existing derelict pump station house adjacent to the New Cork Road Bridge abutment that will be demolished as part of the works.

C01_A3N_L001_R – Lidl Carpark

At the Lidl Carpark, the proposed works will involve the construction of a masonry clad (both sides) reinforced concrete L-shaped flood defence wall extending approximately 28m with a typical height of 0.8m above existing ground level.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS04, described above.

C01_A3N_R001_L – Riverside Way Park

On the left bank, at Riverside Way Park, the proposed works do not include formal flood defence walls but will support flood resilience with localised raising of the ground, footpath and road levels.

At the northern end, the existing carriageway and footpath at Riverside Way will be regraded to tie into the existing New Cork Road Bridge abutment. Riverside Way will be regraded as far as Waters Edge (Lidl) Bridge.

A carrier drain with a filter drain adjacent will run along the dry side of the raised footpath and will terminate in an overflow chamber at the pumping station PS05 at Kennedy Park.

C01_A3N_L001_L – Riverside Way North of Lidl Bridge

At Riverside Way upstream of Lidl Bridge, the proposed works will include the construction of a masonry clad (both sides of the wall) reinforced concrete L-shaped flood defence wall extending approximately 183m with a typical height of 0.4m above existing ground level.

It is proposed to realign the road to the east to mitigate the impact of the flood defence wall on the riverbank and reduce number of trees that would have to be removed. The proposed works will require permanent land take of part of existing carparks on the other side of the road to allow the construction of the realigned road and flood defence wall. Works will also include demolition and reconstruction of existing boundary walls.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS05 at Kennedy Park, described below.

There are 4 existing stormwater outfalls along Riverside Way. These will all be intercepted and connected to the proposed surface water carrier drain. At each connection, it is proposed to construct an overflow diversion manhole. During a non flood event, they will discharge through the existing outfalls fitted with non-return valves. During a flood event, they will be diverted into the carrier drain which will run along the dry side of the defence and will terminate in an overflow chamber at the proposed pumping station PS05.

To facilitate the works, some utilities and services diversions are required. A gas distribution main and EIR telecom service will be diverted, and a 750 mm diameter combined foul/stormwater sewer will either be built over or diverted.

C01_A3N_L002_L – Riverside Way South of Lidl Bridge

At Riverside Way downstream of Lidl Bridge, the proposed works will include the construction of a masonry clad (both sides of the wall) reinforced concrete L-shaped flood defence wall extending approximately 54m with a typical height of 0.3m above existing ground level.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS05 at Kennedy Park.

C01_A3N_L003_L – O'Farrell's Funeral Home / Gasworks Site

At O'Farrell's Funeral Home / Gasworks Site, the proposed works will involve the construction of a masonry clad (both sides) reinforced concrete flood defence wall supported on rotary bored pile foundations extending approximately 137m with a typical height of 1.15m above existing ground level. The proposed works will also include scour protection utilising riprap in channel to ensure stability and durability.

The ground investigations of the Gasworks site have indicated contamination consistent with this historic land use, with elevated polycyclic aromatic hydrocarbons (PAHs) identified in soils within the Proposed Scheme footprint.

It is proposed to raise the existing ground levels of the river side of the Gasworks site by approximately 300mm with impermeable clay soil layers to retain the contaminated soils in situ and prevent direct contact and infiltration. The total area of ground regrading is 700m^2 (35m long x 20m wide) directly adjacent to the proposed wall.

A carrier drain will run along the dry side of the flood defence wall and will terminate in an overflow chamber at the pumping station PS05 at Kennedy Park. A filter drain is not proposed in this site so as to prevent a hydraulic connection from the contaminated site to the river. With the ground raising in place, seepage on the dry side of the defence is not considered a risk.

To facilitate the works, a 750mm diameter combined foul/storm sewer will be built over/diverted. Existing street lighting supply will also be diverted.

C01_A3N_L004_L – Kennedy Park / ESB Site (East)

At Kennedy Park / ESB Site (East), the proposed works will involve the construction of a masonry clad (wet side) flood defence wall on rotary bored pile foundations extending approximately 72m with a typical height of 2.5m above existing ground level.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS05 at in the green area of Kennedy Park. During non flood event conditions, the surface water will discharge to the river under gravity through the proposed surface water outfall which is located in the vicinity of the pumping station. During a flood event, any run off will be pumped through the proposed rising main with non-return valve to the river.

C05_A3N_L009_R – ESB Site (South)

At the ESB Site (South), the proposed works will involve the construction of a masonry clad (wet side) reinforced concrete flood defence wall supported on rotary bored pile foundations extending approximately 100m with a typical height of 2.4m above existing ground level.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS05 at Kennedy Park.

5.4.2 ESB Site to Choctaw Park

Figure 5-13 presents the proposed flood relief works in the area from the ESB Site to the Choctaw Park on the estuarine area of the Owenacurra. The following section of the report provides further detail on the proposed works in this area.

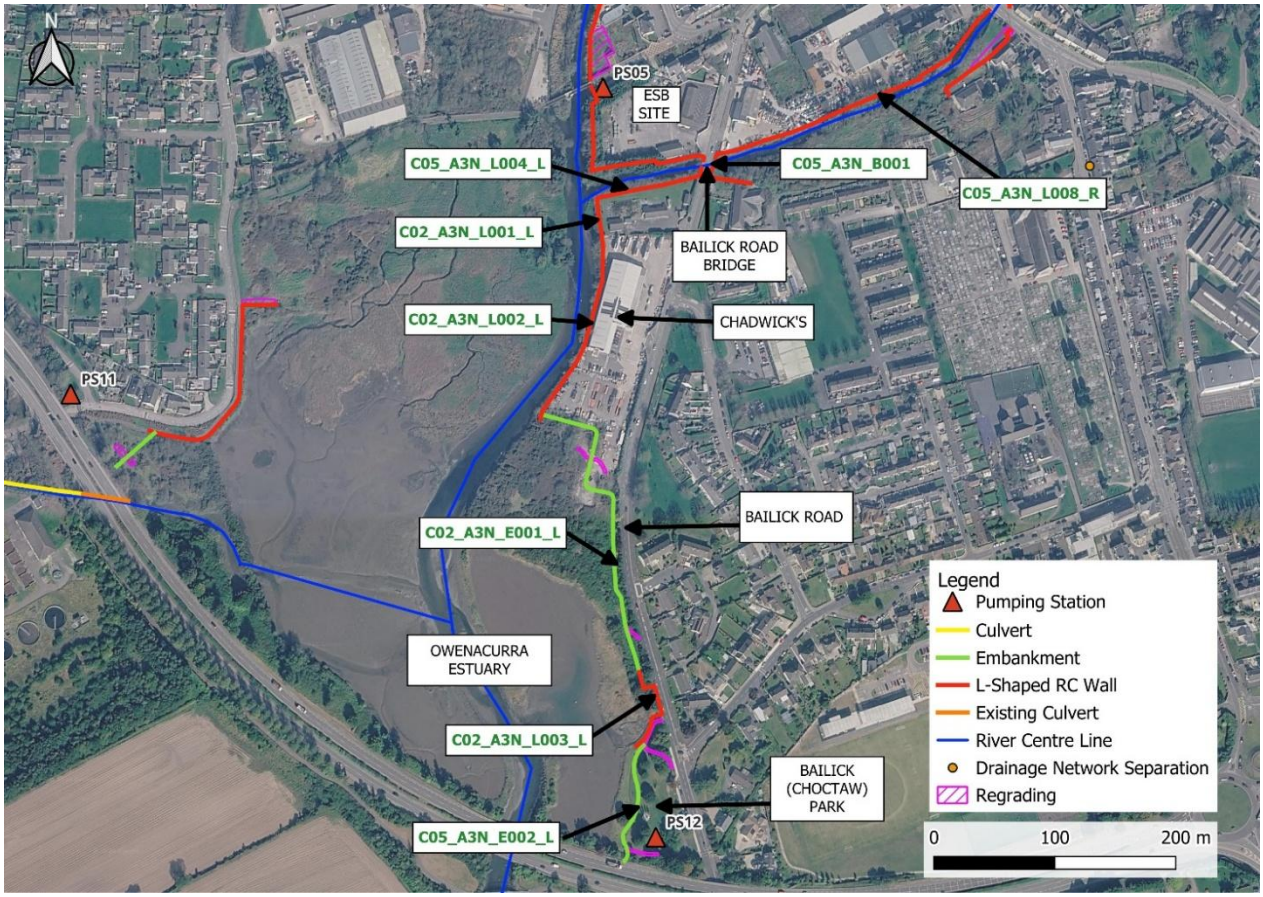


Figure 5-14 Layout of Proposed Flood Relief Works- ESB Site to Choctaw Park.

C05_A3N_L008_R – Hyde's Stonework / Cuddigan's Yard

At Hyde's Stonework / Cuddigan's Yard, the proposed works will involve the construction of a masonry clad (dry side) flood defence wall supported on rotary bored pile foundations extending approximately183m with a typical height of 1.0m above existing ground level.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS05 at Kennedy Park.

C05_A3N_B001 – Bailick Road Bridge

At Bailick Road Bridge, the proposed works will involve the removal of existing bridge railings and the construction of masonry clad (dry side) reinforced concrete flood defence parapet walls. The existing upstream and downstream wing walls and bridge piers will also be removed, and new reinforced concrete masonry clad (both sides) wing walls will be constructed.

C05_A3N_L004_L – Uisce Éireann Site (North)

At the Uisce Éireann site (North), the proposed works will involve the construction of a masonry clad (both sides) reinforced concrete L-shaped flood defence wall extending approximately 94m with a typical height of 0.6m above existing ground level.

A carrier drain will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS12 at Bailick Park.

C02_A3N_L001_L – Uisce Éireann Site (East)

At the Uisce Éireann Site (East), the proposed works will involve the construction of a masonry clad (both sides) reinforced concrete L-shaped flood defence wall extending approximately 31m with a typical height of 0.8m above existing ground level.

A carrier drain will continue along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS12 at Bailick Park.

C02_A3N_L002_L – Chadwick's

At Chadwick's, the proposed works will involve the construction of a reinforced concrete flood defence wall supported on rotary bored pile foundations extending approximately 164m with a typical height of 1.1m above existing ground level. It is proposed to install a fence on top of the wall to 2.4m above existing ground level.

A carrier drain will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS12 at Bailick Park.

An Eir telecom diversion is required to facilitate the works.

C02_A3N_E001_L – Bailick Road Embankment

At Bailick Road, the proposed works will involve the construction of a flood defence embankment extending approximately 270m with a typical height of 1.0m above existing ground level.

The embankment will have side slopes of 1:3 vertical to horizontal ratio. A permanent 4m wide access/maintenance ramp will be constructed along the embankment to facilitate future inspection and maintenance. It will be accessed via a short hardstanding track connected to the adjacent public road.

A carrier drain adjacent to a filter drain will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS12 at Bailick Park.

C02_A3N_L003_L – Bailick Road Wall

At Bailick Road, the proposed works will involve the construction of a masonry clad (dry side) reinforced concrete L-shaped flood defence wall, extending approximately 88m with a typical height of 1.0m above existing ground level.

A carrier drain adjacent to a filter drain will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS12 at Bailick Park.

C05_A3N_E002_L – Bailick (Choctaw) Park

At Bailick (Choctaw) Park, the proposed works will involve the construction of a flood defence embankment extending approximately 105m with a typical height of 1.0m above existing ground level.

The embankment will have side slopes of 1:3 vertical to horizontal ratio. A permanent 4m wide access/maintenance ramp will be constructed along the embankment crest to facilitate future inspection and maintenance. It will be accessed via a paved track connected to the existing tracks within the park which then connect to the adjacent public road on the north and southern extents of the embankment.

A carrier drain adjacent to a filter drain will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS12 at Bailick Park. During non flood event conditions, this will discharge to the river under gravity through the proposed surface water outfall which is located in vicinity of the pumping station. During a flood event, any run off will be pumped through the proposed rising main to the river. The outfall will have a headwall fitted with non-return valve.

Irish Distillers Limited (IDL) to Confluence with Owenacurra River

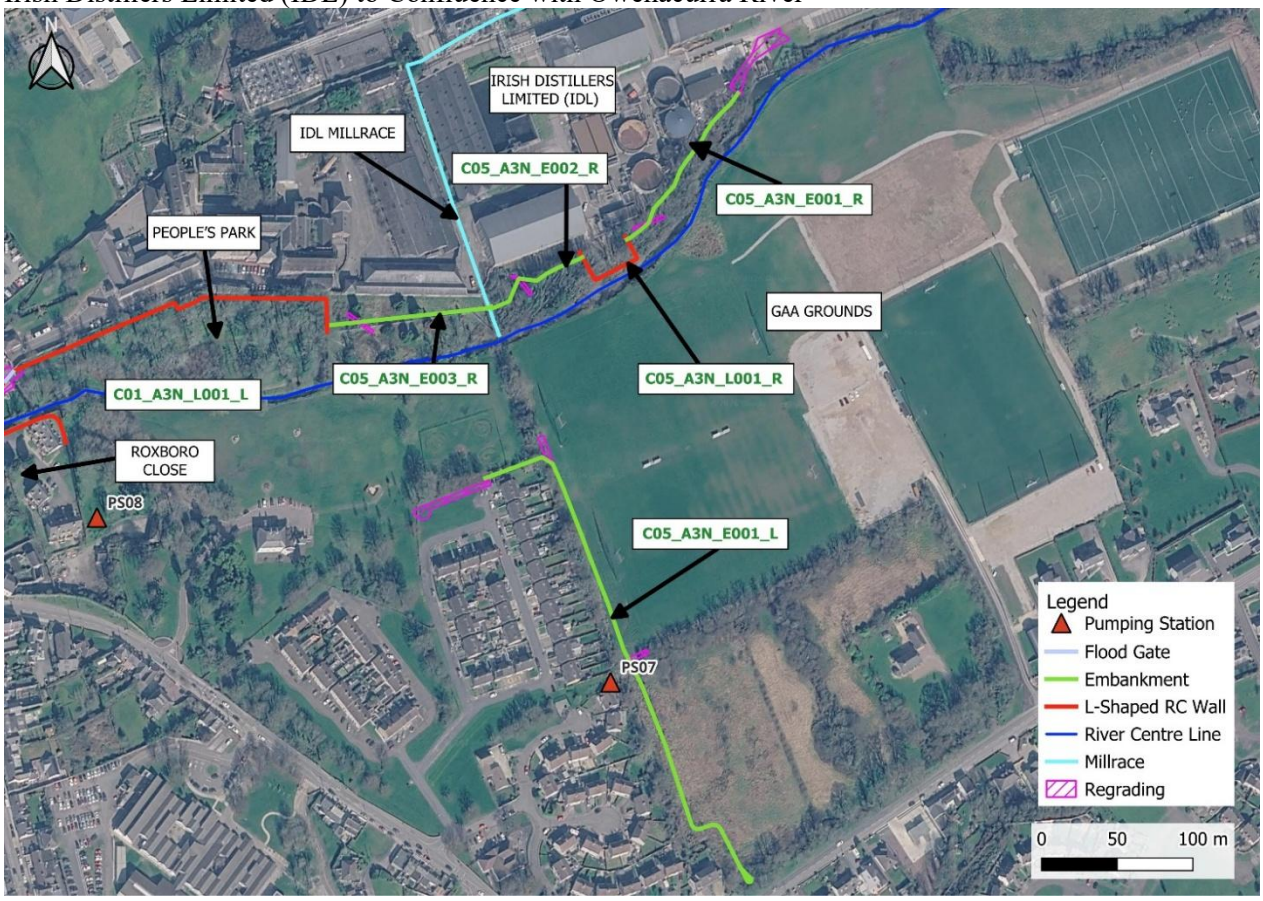


Figure 5-15 presents the proposed flood relief works in the area from Irish Distillers Limited (IDL) to on the Dungourney to the confluence with Owenacurra River. The following section of the report provides further detail on the proposed works in this area.

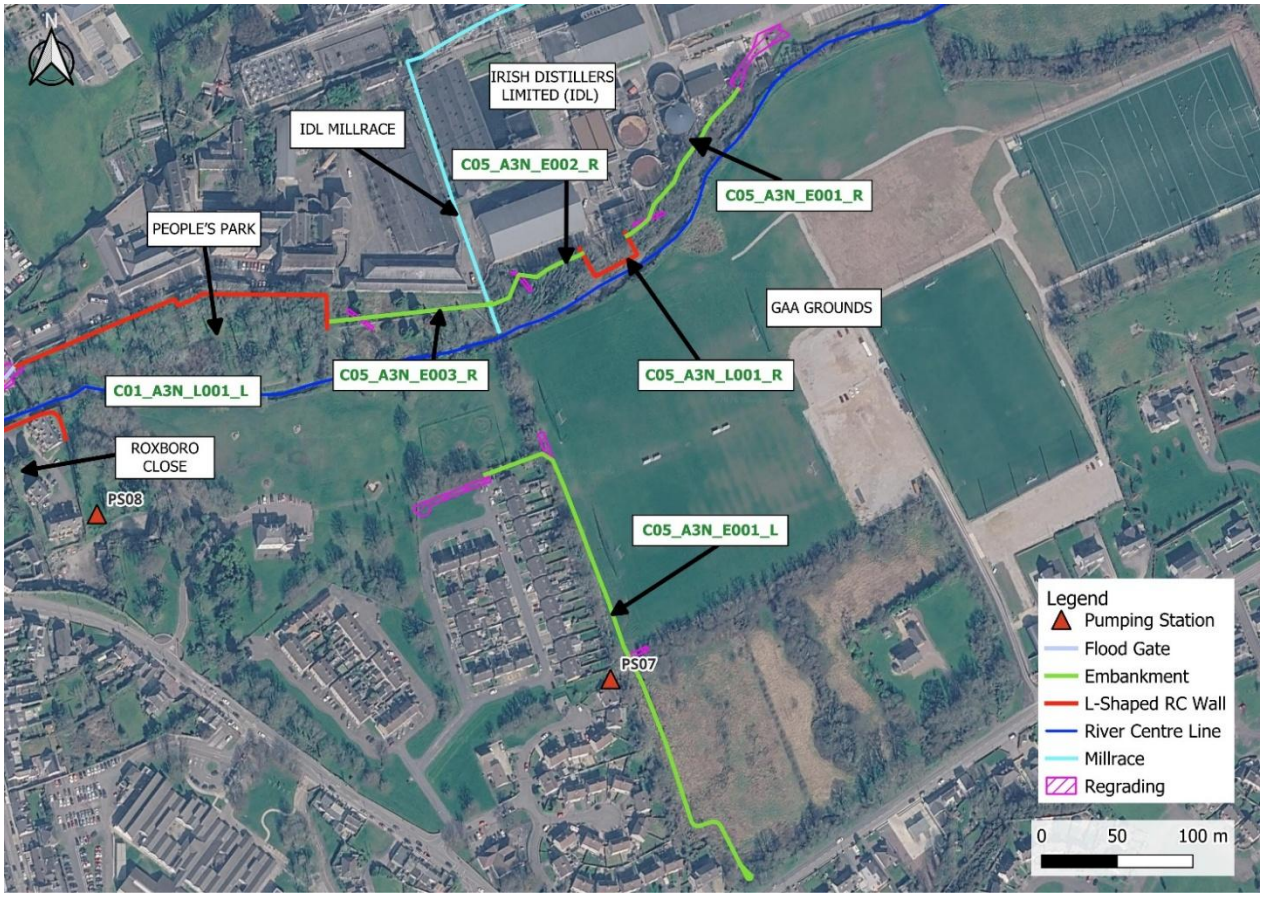


Figure 5-15 Layout of Proposed Flood Relief Works- Irish Distillers Limited (IDL) to Peoples Park.

C05_A3N_E003_R – Irish Distillers Limited (IDL) Embankment

At the Irish Distillers Limited (IDL) site, the proposed works will involve the construction of a flood defence embankment extending approximately 106m with a typical height of 1.6m above existing ground level.

The embankment will have side slopes of 1:2 vertical to horizontal ratio. A permanent 2m wide access/maintenance ramp will be constructed along the embankment crest to facilitate future inspection and maintenance. Access ramps over the embankment will be provided adjacent to the existing outfall.

A carrier drain adjacent to a filter drain will run along the dry side of the defence. It will then connect to a surface water carrier drain which will terminate at the IDL millrace at the IDL entrance as described above.

The existing outfall which services the IDL internal drainage network will be culverted and fitted with a non-return valve. During a non flood event, the flows will discharge to the river through the existing outfall. During a flood event, the flows will be diverted to the proposed carrier drain via a lateral spill weir which will terminate at the IDL millrace at the IDL entrance.

C05_A3N_L001_R – IDL Wall

At the IDL site, upstream of the works described above, the proposed works will involve the construction of a reinforced concrete L-shaped flood defence wall extending approximately 69m with a typical height of 1.1m above existing ground level.

A filter drain will run along the dry side of the defences. It will connect to the proposed surface water carrier drain downstream at the back of the adjacent flood defence embankment which will terminate at the IDL millrace.

C05_A3N_E001_R / C05_A3N_E002_R – IDL Embankment Northeast

At the IDL site, upstream of the works described above, the proposed works will involve the construction of flood defence embankments extending approximately 123m with a typical height of 0.5m above existing ground level upstream of the IDL wall, described above, and approximately 75m with a typical height of 1.3m above existing ground level downstream of the IDL wall to terminate at the existing outfall.

The embankment will have side slopes of 1:2 vertical to horizontal ratio. A permanent 2m wide access/maintenance ramp will be constructed along the embankment crest to facilitate future inspection and maintenance. Access ramps over the embankment will be provided adjacent to the existing millrace outfall.

A filter drain will run along the dry side of the defences. It will connect to the proposed surface water carrier drain downstream at the back of the adjacent flood defence embankment which will terminate at the IDL millrace.

The proposed works will also include ground regrading to tie into existing ground levels at the upstream extents.

C05_A3N_E001_L – Midleton GAA Grounds / Park South

At Midleton GAA Grounds / Park South, the proposed works will involve the construction of a flood defence embankment extending approximately 354m with a typical height of 1.2m above existing ground level. The proposed works will also include ground regrading to integrate the embankment with the surrounding area.

At the southern extent of this defence, the existing land drain will be reconstructed as a swale with a filter drain underneath it. This terminates at the overflow chamber of pumping station PS07, located within Beechwood Drive housing estate green area.

At the northern extent of the defence, a filter drain will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS07. In a non flood event, all flows discharge via gravity through a carrier drain to the river. In a flood event, all flows are pumped through the rising main from pumping station PS07 laid alongside the carrier drain to the river. The outfalls will have a headwall fitted with non-return valves.

There is an existing stormwater network outfall that discharges from the southern end of the Oakwood Lodge housing estate northwards to the river along Youghal Road which can get tide locked and cause flooding. It is proposed to intercept and connect it to the overflow chamber of PS07.

C05_A3N_L003_R – People's Park

At People's Park, the proposed works will involve the construction of a masonry clad (wet side) reinforced concrete L-shaped flood defence wall extending approximately 243m with a typical height of 3.6m above existing ground level, offset approximately 3m from the existing wall to mitigate impact on the existing historic Irish Distillers Limited (IDL) boundary wall.

A filter drain will run along between the existing wall and the dry side of the defence for 113m east of the Baby's Walk entrance gate. For the remainder of the defence, a carrier drain adjacent to a filter drain will run along between the existing historic wall and the dry side of the defence. The carrier drain will cross under the existing historic wall, run along the Distillery Heritage Centre carpark and will terminate in the IDL millrace adjacent to the IDL entrance gate. In a non flood event, the flows will discharge to the Dungourney River along the existing millrace.

In a flood event, the existing millrace outfall non return valve will close and any flow from the IDL millrace will be diverted to pumping station PS09 located within the Distillery Lane carpark, described above, via a lateral spill weir and will be pumped through the proposed rising main to the river in Baby's Walk. The outfall will have a headwall fitted with non-return valve.

In order to facilitate the works, a crossing above an existing 150mm Gas Network Ireland Transmission Main is required.

C05_A3N_L001_L – Roxboro Close

At Roxboro Close, the proposed works will involve the construction of a limestone random rubble clad (both sides) reinforced concrete flood defence wall supported on rotary bored pile foundations extending approximately 155m with a typical height of 1.1m above existing ground level.

In order to maintain the riparian zone and the existing tree line along the river at Roxboro Close, the proposed flood defence wall will be constructed on the roadside of the existing car spaces. This will result in the removal of 18 of the 25 car parking spaces due to the alignment of the proposed wall.

A carrier drain adjacent to a filter drain will run along the dry side of the defence and will terminate in an overflow chamber on the dry side of the defence in Roxboro Close. Pumping station PS08 is located in People's Park due to space constraints and existing ground conditions (shallow rock shelf) at Roxboro Close. During non flood event conditions, this will discharge to the river under gravity through the proposed surface water outfall which is located in vicinity of the overflow chamber. During a flood event, any run off will be pumped from the pumping station through the proposed rising main to the river outfall in vicinity of the overflow chamber. The outfall will have a headwall fitted with non-return valve.

The proposed works will also include cleaning, repointing and grouting of existing river walls along the riverside of Roxboro Close.

To facilitate the works, a number of utilities and services diversions are required. This includes existing streetlighting to be moved as well as building over an Uisce Éireann 80mm and 225mm foul sewer and a 125mm watermain. An underground ESB MV Network diversion is also required.

C05_A3N_L004_R / C05_A3N_L005_R / C05_A3N_L006_R – Baby's Walk

At Baby's Walk, from Lewis Bridge to the People's Park entrance, the proposed works will involve the construction of a limestone random rubble clad (both sides) reinforced concrete L-shaped flood defence wall extending approximately 158m with a typical height of 2.1m above existing ground level.

It is proposed that the existing wall at Baby's Walk will be reduced in height to approximately 0.3m high and will be adapted to provide public seating with proposed planting between the existing and new wall.

In order to maintain flood storage within the park and also the alignment of the existing wall in Baby's Walk as seating and incorporating it into the landscape design of the Baby's Walk Park, the proposed flood defence wall will be constructed on the road side of the existing wall along the existing car parking spaces. This will result in the removal of 30 of the 44 car parking spaces due to the change of the perpendicular parking to parallel parking.

To the north and at the centre of the Baby's Walk Park, it is proposed to construct a raised and paved junction connecting the park with the Distillery Park on the other side of Distillery Lane, to promote pedestrian priority and expand public open space amenity.

The ground will be raised to provide universal access at the existing entrances to the Baby's Walk, and three flood gates will be installed to maintain access to the park while providing continuity of protection.

The localised raising of ground levels is provided so as to reduce the frequency of the flood gates' deployment.

A filter drain will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS10 located in Distillery Park, on the north side of Distillery Lane. A carrier drain is proposed to pick up all existing outfalls and will also terminate at pumping station PS10 at Distillery Park. During non flood event conditions, this will discharge to the river under gravity through the proposed surface water outfall which is located in Baby's Walk. During a flood event, any run off will be pumped through the proposed rising main to the river at the same location. The outfall will have a headwall fitted with non-return valve.

PS09 is located within the Distillery Lane carpark and during a flood event, PS09 will pump diverted flows from the IDL millrace through the proposed rising main to the river in Baby's Walk. The outfall will have a headwall fitted with non-return valve.

The proposed works will include installation of a flap valve on the IDL millrace to ensure flows cannot back up into the IDL site.

To facilitate the works, a 150mm foul network diversion and an Eir telecom diversion are required at Distillery Park.

C05_A3N_L007_R – Midleton House

At Midleton House, the proposed works include the construction of a limestone random rubble clad (both sides) reinforced concrete flood defence wall supported on rotary bored pile foundations extending approximately 82m with a typical height of 1.2m above proposed ground level. It is proposed to include ground reprofiling (raising of ground levels within the garden) to maintain maximum flood defence height at 1.2m.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS05 at Kennedy Park.

The proposed works will also include demolition of existing pillars and railings at river boundary of garden.

C05_A3N_L002_L – Rock House

At Rock House, the proposed works will involve the construction of a limestone random rubble clad (dry side) reinforced concrete L-shaped flood defence wall extending approximately 82m with a typical height of 0.7m above existing ground level. To minimise any potential visual impact of the defence wall in this location, it is proposed to raise the existing ground on the wet side of the defence.

A filter drain with a linear drainage channel will run along the dry side of the defence and will terminate in an overflow chamber at Roxboro Close for pumping station PS08,.

To facilitate the works, a 150mm diameter foul sewer diversion is required.

Drainage network separation at St. Mary's Road and Youghal Road (west)

It is proposed to construct a new surface water drainage system on Youghal Road (west) and St. Mary's Road, with pipe sizes ranging from 225mm diameter at the start of the network to 600mm diameter at the end of the network.

On the Youghal Road, this will extend from the Cork County Council Area Office entrance to the Lewis Bridge. On St. Mary's Road, this will extend from the Rosary Place junction entrance to the Lewis Bridge.

Manholes from the intersection of Youghal Road and St. Mary's Road to Lewis Bridge will be sealed to prevent surcharging during flood events Existing gullies upstream of intersection of Youghal Road and St. Mary's Road will be disconnected from the existing combined sewer system and reconnected to the new surface water drainage system.

The new system will discharge to a proposed outfall downstream of Lewis Bridge. The outfall will have a headwall fitted with non-return valve.

To facilitate the works, a number of utilities and services diversions are required. This includes the diversions of an existing Uisce Éireann 225mm diameter foul sewer. Incoming domestic foul connections may also have to be diverted as needs arise.

In addition, a 127mm diameter watermain will need to be locally diverted. An existing Gas Networks Ireland (GNI) gas distribution main also needs to be diverted, as does an existing Telecoms network (EIR/Virgin Media) service.

Drainage network separation at Youghal Road (east)

It is proposed to construct a new surface water drainage system on Youghal Road (east), with pipe sizes ranging from 225mm diameter at the start of the network to 900mm diameter at the end of the network. This will extend from the Cork County Council Area Office entrance to approximately 400m from the Youghal Road/N25 junction.

Existing gullies will be disconnected from the combined sewer system and reconnected to the new surface water drainage system.

The new system will discharge to the proposed swale on the dry side of the proposed embankment in Park South described above which in turn discharges to the overflow chamber of pumping station PS07.

To facilitate the works, a number of utilities and services diversions are required. This includes the diversions of an existing Uisce Éireann 375mm diameter foul sewer. Incoming domestic foul connections may also have to be diverted as needs arise.

In addition, a 127mm diameter watermain will need to be locally diverted. The diversion of an existing GNI gas distribution line and an existing Telecoms (EIR/Virgin Media) service is also required.

5.5 Area 3 South

The proposed works in Area 3 South are located in the southern part of Midleton town, downstream of the N25. The defences extend along the Owenacurra estuary left bank from the Ballyannan Woodland Walk Bridge down to South Quay along the estuary.

The proposed works are located in the townlands of Castleredmond and Ballynacorra West.

An overview of the layout of the proposed flood relief works in Area 3 South is shown in Figure 5-16.

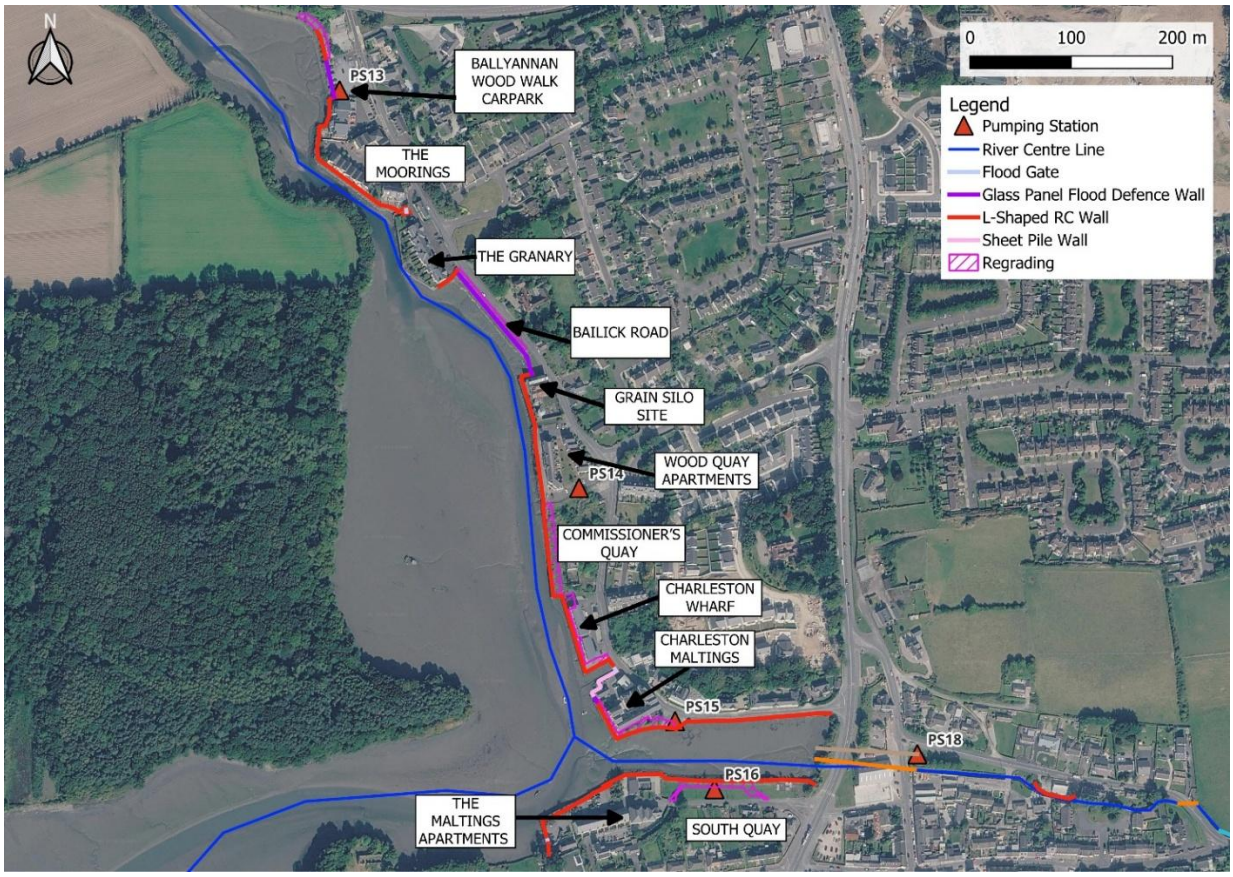


Figure 5-16 Overview of the proposed works in Area 3 South (Not to scale. Extracted from Atlas Mapviewer)

A detailed description of the proposed works in Area 3 South of the Proposed Scheme is provided below.

5.5.1 Ballyannan Woodland Walk Bridge to Grain Silo Site

Figure 5-17 presents the proposed flood relief works in the area from the Ballyannan Woodland Walk Bridge to the Grain Silo Site in the Owenacurra Estuary. The following section of the report provides further detail on the proposed works in this area.

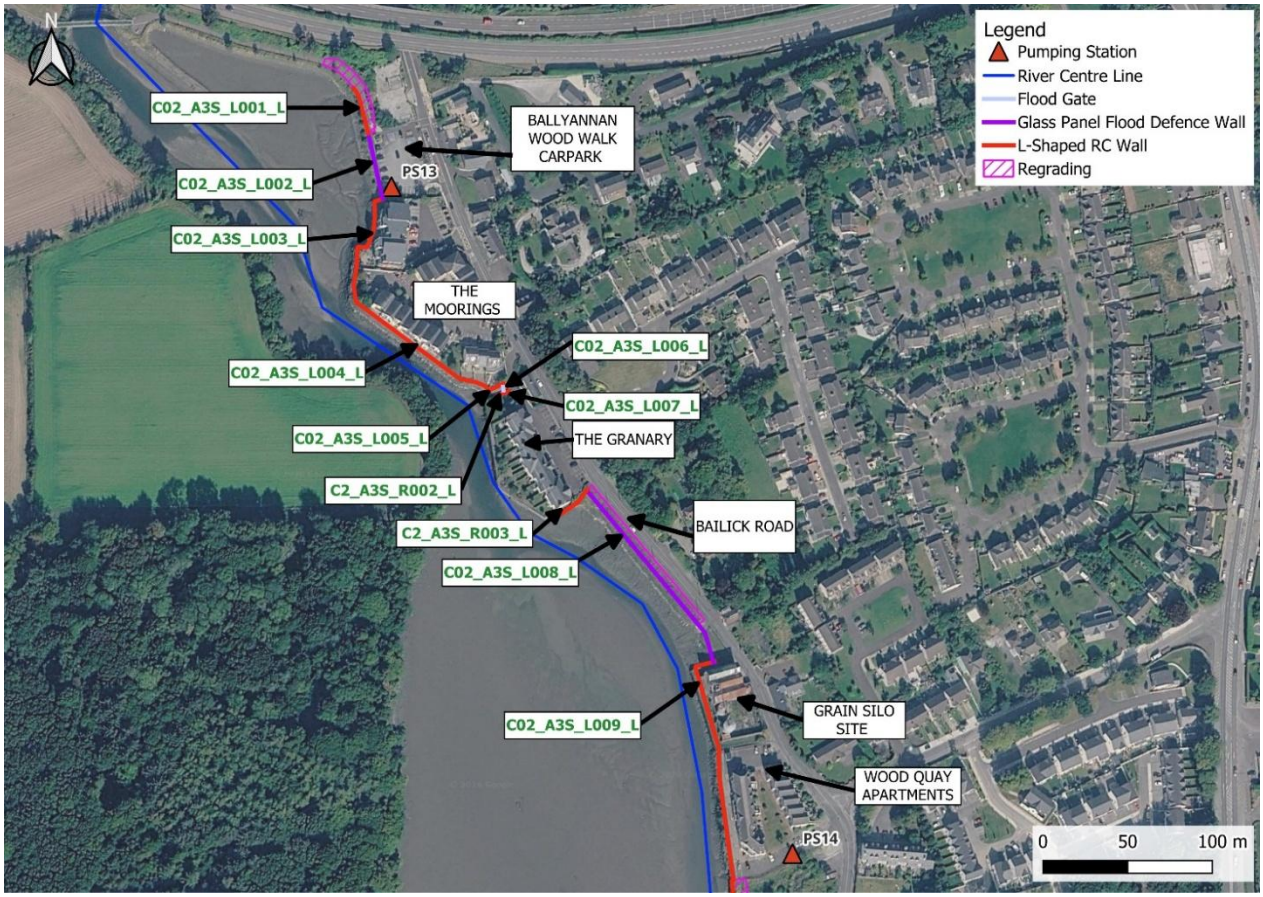


Figure 5-17 Layout of Proposed Flood Relief Works- Ballyannan Woodland Walk Bridge to Grain Silo Site.

C02_A3S_L001_L / C02_A3S_L002_L – Ballyannan Wood Walk Carpark

At the Ballyannan Wood Walk greenway/carpark interface, the proposed works will involve the construction of a reinforced concrete L-shaped flood defence wall, 28m in length with a typical height of 1.1m above existing ground level. This wall will be clad in limestone random rubble to respect its surrounding context.

On the dry side of the flood defence wall defence, ground regrading is proposed which ties into existing high ground at flood defence level on the dry side, this is to maintain the existing greenway path over the flood defence level. The existing greenway will be raised and reinstated. A 1.4m high railing will be installed along the flood defence wall for pedestrian and cyclist safety.

At the Ballyannan Wood Walk Carpark, the proposed works will involve the construction of glass panel flood defences supported on a reinforced concrete wall (limestone random rubble clad) with rotary bored pile foundations. The proposed flood defences will extend for approximately 39m and will have a typical height of 1.1m above existing ground level.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS13, located within the carpark. During non flood event conditions, this will discharge to the river under gravity through the proposed surface water outfall which is located in the vicinity of the pumping station. During a flood event, any run off will be pumped through the proposed rising main with non-return valve to the river.

The proposed works will also include paving to integrate the flood defence measures with the surrounding carpark and pedestrian areas.

C02_A3S_L003_L – Cois Na hAbhann

At Cois Na hAbhann, the proposed works will involve the demolition of the existing parapet wall and the construction of a reinforced concrete L-shaped flood defence wall extending approximately 49m with a typical height of 0.7m above existing ground level, with a proposed railing, 0.4m in height, to be provided on top of the wall. The proposed works will also include cleaning, repointing and grouting of the existing rock armour walls.

A linear drain will run along the dry side of the defence and will connect into a carrier drain which will discharge to an overflow chamber at the pumping station PS13 located within the Ballyannan Wood Walk carpark.

C02_A3S_L004_L – The Moorings

At The Moorings, the proposed works will involve the demolition of the existing parapet wall and the construction of a reinforced concrete L-shaped flood defence wall extending approximately 117m with a typical height of 0.4m above existing ground level, with a proposed railing, 0.7m in height, to be provided on top of the wall.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will discharge to an overflow chamber at the pumping station PS13 located within the Ballyannan Wood Walk carpark.

C02_A3S_L005_L – The Moorings

At the downstream extent of The Moorings, the proposed works will involve the construction of a reinforced concrete L-shaped flood defence wall extending approximately 10m with a typical height of 0.7m above existing ground level, with a proposed railing, 0.5m in height, to be provided on top of the wall. This will replace an existing block wall.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS13 located within the Ballyannan Wood Walk carpark.

C02_A3S_L006_L – Existing river access

At the northern extent of the Granary complex, the proposed works will involve the construction of a reinforced concrete L-shaped flood defence wall extending approximately 5m with a typical height of 0.8m above existing ground level.

The proposed works will also include a flood gate to maintain access to the existing river access steps while providing continuity of protection.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS13 located within the Ballyannan Wood Walk carpark.

C02_A3S_L007_L – The Granary (North)

At the northern extent of the Granary complex, the proposed works will involve the construction of a reinforced concrete L-shaped flood defence wall and retaining wall extending approximately 7m with a typical height of 1.2m above existing ground level, with a proposed timber fence to be provided on top of the wall.

On the dry side, this wall will support the raised ground which will tie into the existing building at the flood defence level.

C2_A3S_R002_L – The Granary (North)

Adjacent to the Granary complex, the proposed works will include localised ground regrading to tie the flood defence wall into the adjacent existing building at the required flood defence level. The finished level will be approximately 0.7m above the existing ground level.

C2_A3S_R003_L – The Granary (South)

At the southern extent of the Granary complex, the proposed works will involve the demolition of the existing wall, construction of a masonry clad (both sides) reinforced concrete L-shaped flood defence wall extending approximately 20m with a typical height of 0.5m above existing ground level, with a proposed railing, 0.7m in height, to be provided on top of the wall. The proposed works will also include cleaning, repointing and grouting of the existing river wall.

The proposed works will include localised ground regrading to tie into the required flood defence level. The finished level will be approximately 0.5m above the existing ground level.

C02_A3S_L008_L – Bailick Road

At Bailick Road, the proposed works involve the construction of a limestone clad (both sides) reinforced concrete wall supported on rotary bored pile foundations. A 0.35m high glass panel flood defence on top of a 0.85m reinforced concrete section will alternate with a full height glass panel flood defence wall, 0.9m high, on top of a 0.3m reinforced concrete section, every 20m approximately.

The proposed flood defences will extend for approximately 127m with a typical height of 1.2m above existing ground level.

As part of a separate Cork County Council project, in Q3/Q4 2026 a greenway will be constructed along Bailick Road and the existing slipway will be closed. It is proposed that this greenway will be reinstated once the flood defence wall is constructed.

A carrier drain will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS14 at Wood Quay.

There are 4 existing stormwater outfalls along Bailick Road. These will be intercepted and connected to the proposed surface water carrier drain. At each connection, it is proposed to construct an overflow diversion manhole. During a non flood event, they will discharge through the existing outfalls fitted with a non-return valve. During a flood event, they will be diverted into the carrier drain which will run along the dry side of the defence and will terminate in an overflow chamber at the proposed pumping station PS14 located at Wood Quay.

The diversion of Eir Telecom service will be required to facilitate the works.

C02_A3S_L009_L – Grain Silo Site

At the Grain Silo Site, the proposed works will involve the construction of a masonry clad (both sides) reinforced concrete L-shaped flood defence wall supported on rotary bored pile foundations extending approximately 63m with a maximum height of 1.85m above existing ground level.

There is an existing masonry quay wall along this length. The masonry wall will be taken down to the foundation level of the proposed reinforced concrete wall and pile cap, and the reinforced concrete L-shaped flood defence wall will be constructed on top of existing masonry quay wall. The piles supporting the new wall will be installed on the dry side of the existing quay wall. The retained masonry wall will be repointed and grouted.

A carrier drain will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS14 located at Wood Quay.

5.5.2 Wood Quay Apartments to Charleston Maltings

Figure 5-18 presents the proposed flood relief works in the area from the Wood Quay Apartments to Charleston Maltings in the Owenacurra Estuary. The following section of the report provides further detail on the proposed works in this area.

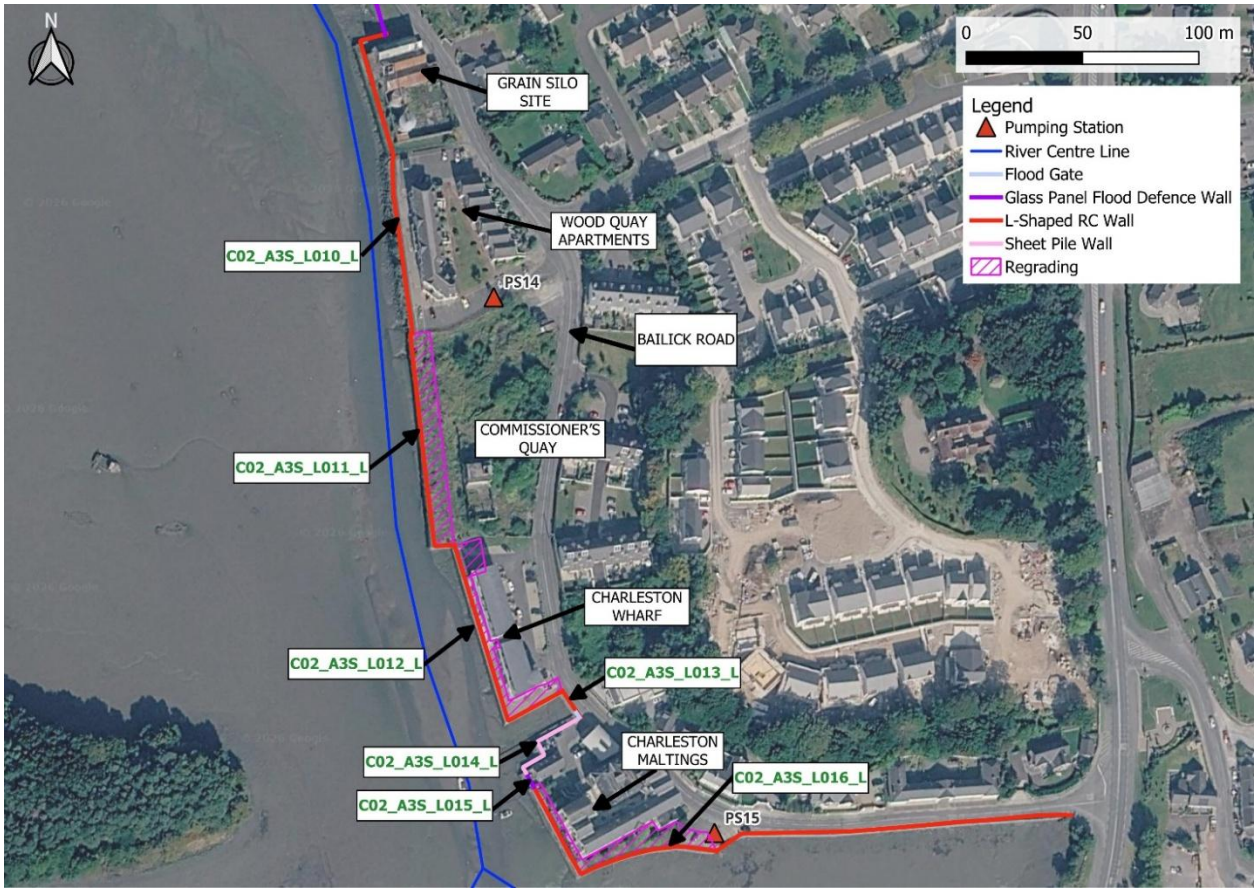


Figure 5-18 Layout of Proposed Flood Relief Works- Wood Quay Apartments to Charleston Maltings.

C02_A3S_L010_L – Wood Quay Apartments

At Wood Quay Apartments, the proposed works will involve the construction of a reinforced concrete L-shaped flood defence wall extending approximately 76m with a typical height of 0.4m above existing ground level, with a proposed railing, 0.7m in height, to be provided on top of the wall. It is proposed that the flood defence parapet wall will be masonry clad on both sides.

A carrier drain will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS14 at Wood Quay, adjacent to Commissioner's Quay. During non flood event conditions, this will discharge to the river under gravity through the proposed surface water outfall with non-return valve which is located in the vicinity of the pumping station. During a flood event, any run off will be pumped through the proposed rising main with non-return valve to the river.

There is an existing 900mm diameter surface water outfall at Wood Quay, this will be intercepted and diverted to the proposed Pumping Station PS14. Connection between the existing surface water network and the new proposed pumping station at Wood Quay is required as part of the works.

C02_A3S_L011_L – Commissioner's Quay

At Commissioner's Quay, the proposed works will involve construction of a masonry clad (both sides) reinforced concrete L-shaped flood defence wall supported on rotary bored pile foundations extending approximately 101m with a typical height of 1.1m above proposed ground level.

There is an existing masonry quay wall along this length. The masonry wall will be taken down to the foundation level of the proposed reinforced concrete wall and pile cap, and the reinforced concrete L-shaped flood defence wall will be constructed on top of existing masonry quay wall.

The piles supporting the new wall will be installed on the dry side of the existing quay wall. The retained masonry wall will be repointed and grouted.

The proposed works also include raising of existing ground levels on the dry side of the wall to maintain maximum flood defence height at 1.1m.

A carrier drain will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS14 located at Wood Quay.

C02_A3S_L012_L – Charleston Wharf

At Charleston Wharf, the proposed works will involve the construction of a reinforced concrete L-shaped flood defence wall supported on rotary bored pile foundations extending approximately 105m with a typical height of 1.1m above proposed ground level.

The proposed works will also include demolition of the existing balcony structure and railing prior to the construction, and reinstatement following construction of the proposed flood defence wall.

There is an existing masonry quay wall along this length. The masonry wall will be taken down to the foundation level of the proposed reinforced concrete wall and pile cap, and the reinforced concrete L-shaped flood defence wall will be constructed on top of existing masonry quay wall. The piles supporting the new wall will be installed on the dry side of the existing quay wall. The retained masonry wall will be repointed and grouted.

A carrier drain will be laid on the roadside of the existing building and will terminate in an overflow chamber at the pumping station PS14 at Wood Quay.

C02_A3S_L013_L – Charleston Wharf (South)

At Charleston Wharf (South), the proposed works will involve the construction of a reinforced concrete L-shaped flood defence wall supported on rotary bored pile foundations extending approximately 4m with a typical height of 1.1m above proposed ground level.

There is an existing masonry quay wall along this length. The masonry wall will be taken down to the foundation level of the proposed reinforced concrete wall and pile cap, and the reinforced concrete L-shaped flood defence wall will be constructed on top of existing masonry quay wall. The piles supporting the new wall will be installed on the dry side of the existing quay wall. The retained masonry wall will be repointed and grouted.

The proposed works will also include a flood gate at the existing slipway to maintain access whilst ensuring continuity of defence.

C02_A3S_L014_L – Charleston Maltings (North)

At Charleston Maltings (North), the proposed works will involve the installation of a sheet piled flood defence wall extending approximately 41m with a maximum height of 1.3m above proposed ground level. It is proposed that sheet piled wall will be masonry clad.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS15 located south of Charleston Maltings.

The proposed works will also include demolition of the existing concrete block wall, and repair of the existing slipway at the interface with the flood defence.

C02_A3S_L015_L – The Boathouse Charleston Maltings

At The Boathouse Charleston Maltings, the proposed works will involve the construction of a reinforced concrete flood defence stub wall, approximately 0.3m high, with a glass panel at the upper section, approximately 1.0m high, supported on rotary bored pile foundations.

The proposed flood defences will extend for approximately 7m with a typical height of 1.1m above proposed ground level. The existing timber decking will be replaced on the dry side of the wall.

There is an existing masonry quay wall along this length. The masonry wall will be taken down to the foundation level of the proposed reinforced concrete wall and pile cap, and the reinforced concrete L-shaped flood defence wall will be constructed on top of existing masonry quay wall.

The piles supporting the new wall will be installed on the dry side of the existing quay wall. The retained masonry wall will be repointed and grouted.

Existing step access to the river at this location will be removed and decommissioned.

C02_A3S_L016_L – Charleston Maltings (South)

At Charleston Maltings (South), the proposed works will involve the construction of a reinforced concrete L-shaped flood defence wall supported on rotary bored pile foundations extending approximately 100m with a typical height of 1.1m above proposed ground level.

There is an existing masonry quay wall along this length. The masonry wall will be taken down to the foundation level of the proposed reinforced concrete wall and pile cap, and the reinforced concrete L-shaped flood defence wall will be constructed on top of existing masonry quay wall. The piles supporting the new wall will be installed on the dry side of the existing quay wall. The retained masonry wall will be repointed and grouted.

The proposed works will also include demolition of the existing balcony structure and railing prior to the construction, and reinstatement following construction of the proposed flood defence wall.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS15. During non flood event conditions, this will discharge to the river under gravity through the proposed surface water outfall with non-return valve which is located in vicinity of the pumping station. During a flood event, any run off will be pumped through the proposed rising main with non-return valve to the river.

PS15 will have a permanent and backup power supply via connection to PS16 located in South Quay through underground ducting located along Bailick Road and the Midleton/Whitegate Road (R630).

It is proposed to divert an existing 750mm diameter treated effluent pipeline to accommodate the proposed pumping station PS15.

5.5.3 Bailick Road (South) to Quay House

Figure 5-19 presents the proposed flood relief works in the area from the Bailick Road (South) to Quay House in the Owenacurra Estuary/ Ballinacurra Estuary. The following section of the report provides further detail on the proposed works in this area.

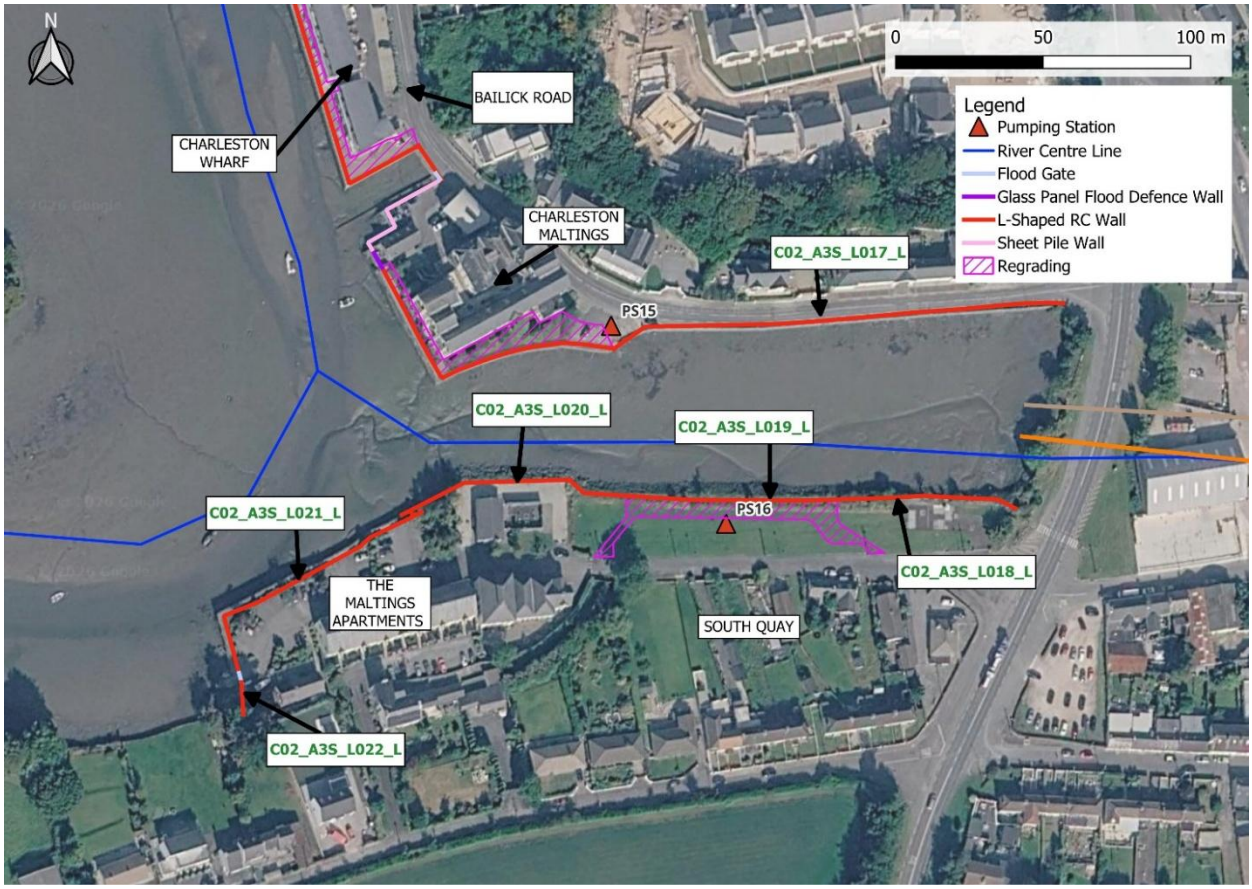


Figure 5-19 Layout of Proposed Flood Relief Works- Bailick Road (South) to Quay House.

C02_A3S_L017_L – Bailick Road (South)

At Bailick Road (South), between Charleston Maltings and the Midleton/Whitegate Road (R630), the proposed works will involve the construction of a reinforced concrete L-shaped flood defence wall supported on rotary bored pile foundations extending approximately 155m with a typical height of 1.4m above existing ground level.

There is an existing masonry quay wall along this length. The masonry wall will be taken down to the foundation level of the proposed reinforced concrete wall and pile cap, and the reinforced concrete L-shaped flood defence wall will be constructed on top of existing masonry quay wall. The piles supporting the new wall will be installed on the dry side of the existing quay wall. The retained masonry wall will be repointed and grouted.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS15 at Charleston Maltings.

To facilitate the works, a number of utilities and services diversions are required. This includes the diversion of an Eir telecom service and a GNI gas distribution main. The works also require the building over of an existing Uisce Éireann 225mm diameter foul sewer.

C02_A3S_L018_L – South Quay Uisce Éireann Pump Station

At the existing South Quay Uisce Éireann wastewater pump station, the proposed works will involve the construction of a limestone random rubble clad (both sides) reinforced concrete L-shaped flood defence wall extending approximately 41m with a typical height of 0.6m above existing ground level, with a proposed railing, 0.5m in height, to be provided on top of the wall.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS16 adjacent to existing Uisce Éireann Pump House, described below.

It is proposed that two existing outfalls, with diameters 525mm and 750mm, in this location are fitted with non-return valves.

There is also an existing 350mm diameter stormwater outfall at this location. This will be connected to the proposed surface water carrier drain. At the connection, it is proposed to construct an overflow diversion manhole. During a non-flood event, it will discharge through the existing outfall fitted with a non-return valve. During a flood event, it will be diverted into the carrier drain which will run along the dry side of the defence and will terminate in an overflow chamber at the proposed pumping station PS16, as described below.

C02_A3S_L019_L – South Quay

At South Quay, the proposed works will involve the construction of a limestone random rubble clad (both sides) reinforced concrete L-shaped flood defence wall extending approximately 112m with a typical height of 0.5m above existing ground level, with a proposed railing, 0.6m in height, to be provided on top of the wall.

The proposed works will also include ground raising to install a 3m wide raised walkway on the dry side of the wall.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS16 located in the green area on South Quay. During non flood event conditions, this will discharge to the river under gravity through the proposed surface water outfall which is located in the vicinity of the pumping station. During a flood event, any run off will be pumped through the proposed rising main with non-return valve to the river.

PS16 will have a permanent and backup power supply (mobile generator) and will feed PS15 at Charleston Maltings through underground ducting located along Bailick Road and the Midleton/Whitegate Road (R630).

C02_A3S_L020_L – Uisce Éireann Pump House

At the Uisce Éireann Pump House, the proposed works will involve the construction of a limestone random rubble clad (both sides) reinforced concrete L-shaped flood defence wall extending approximately 56m with a typical height of 1.6m above existing ground level.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS16 located in the green area on South Quay, described above.

C02_A3S_L021_L – The Maltings Apartments

At The Maltings Apartments, the proposed works will involve the construction of a masonry clad (both sides) reinforced concrete wall supported on rotary bored pile foundations extending approximately 102m with a maximum height of 1.2m above proposed ground level.

There is an existing masonry quay wall along this length. The masonry wall will be taken down to the foundation level of the proposed reinforced concrete wall and pile cap, and the reinforced concrete L-shaped flood defence wall will be constructed on top of existing masonry quay wall. The piles supporting the new wall will be installed on the dry side of the existing quay wall. The retained masonry wall will be repointed and grouted.

It is proposed that a 1.5m wide walkway be provided on the existing quay to facilitate boat mooring. Access steps will be provided over the proposed flood defence wall to the walkway. It is proposed that the walkway will be paved.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS16 adjacent to existing Uisce Éireann Pump House, described above. Existing gullies and outfalls will be connected to the proposed drainage system.

C02_A3S_L022_L – Quay House

At Quay House, the proposed works will involve the construction of a masonry clad (both sides) reinforced concrete L-shaped flood defence wall extending approximately 11m with a typical height of 1.2m above existing ground level.

The proposed works will also include a flood gate at the existing slipway to maintain access while ensuring continuity of the flood defence line.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS16. Existing gullies and outfalls will be connected to the proposed drainage system.

5.6 Area 4

The proposed flood relief works in Area 4 are located to the east of Midleton town. The works extend from Lauriston Housing Estate on the east of Midleton town eastwards along the Greenway to an area east of the Irish Distillers Ltd (IDL) site.

The proposed works are located in the townland of Townparks, Broomfield East, Park North and Killeagh.

An overview of the layout of the proposed flood relief works in Area 4 is shown in Figure 5-20.

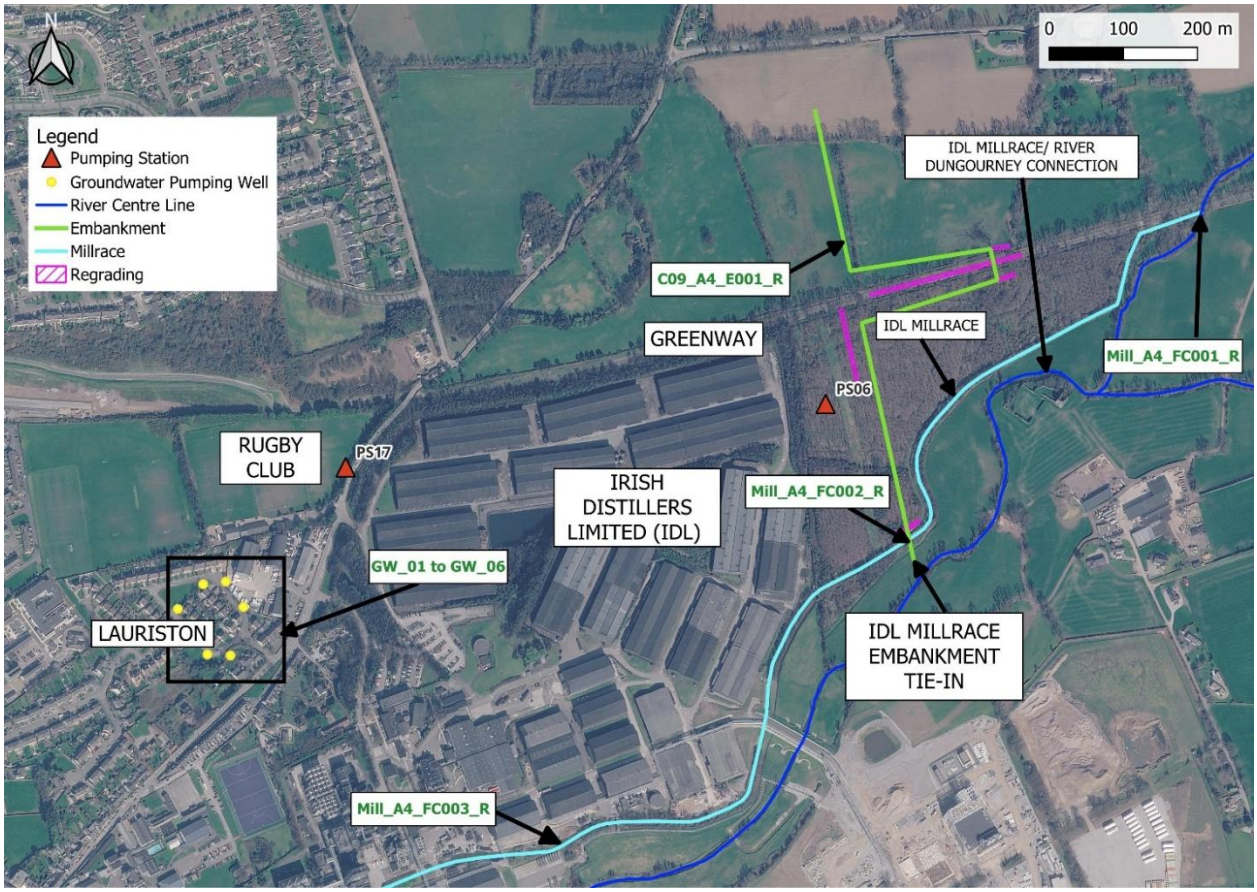


Figure 5-20 Overview of the proposed works in Area 4 (Not to scale. Extracted from Atlas Mapviewer)

A detailed description of the proposed works in Area 4 of the Proposed Scheme is provided below.

C09_A4_E001_R – Greenway

At the Greenway, to the east of the Irish Distillers Limited (IDL) site, the proposed works will involve the construction of a flood defence embankment extending approximately 950m with a typical height of 3.0m above existing ground level.

The embankment will have side slopes of 1:3 vertical to horizontal with a 4.0m wide flat crest at the top of the embankment to facilitate routine inspection and maintenance. The embankment will tie into the existing high ground to the north and south. A permanent livestock proof fence, 1.2m in height, will be erected at a 3m offset from the toe of the wet and dry side of the embankment.

Localised regrading of ground levels will also be required at different areas to provide access ramps onto the embankment crest. The ramps will be accessed from the existing greenway and the southern section of the embankment.

The proposed alignment of the embankment is informed by a number of constraints. It is proposed that the existing Greenway will be regraded to pass over the proposed flood embankment resulting in a passive solution, i.e. demountable defences will not be required to defend the area to the west from flooding.

The embankment will extend parallel to the Greenway on the north and south of the Greenway. The offset positioning of the embankment crossing the Greenway will facilitate the proposed Cork County Council Northern Relief Road Extension project (NRRE) (not part of this scheme) without impacting on its vertical alignment.

The regrading of the Greenway on the western approach will have a maximum gradient of 0.7% on the vertical alignment as per Irish Rail standards, in case the use of the Greenway reverts to a railway line at any point in the future. This arrangement also allows future construction of the Northern Relief Road Extension (NRRE) project (not part of this scheme) without impacting the greenway or flood relief defences. On the eastern approach the maximum gradient will be 5% to comply with universal access requirements. There is sufficient space for Irish Rail to regrade the Greenway on the eastern side in the future if required.

North of the Greenway on the wet side it is proposed to construct a swale to divert an existing land drain. This will connect to a proposed culvert which will be installed under the proposed flood embankment and on the south side of the Greenway will connect to a swale which discharges into the Dungourney River. This is for non flood event conditions, to adapt the existing drainage arrangement in the area.

A swale with a filter drain underneath will run along the dry side of the embankment, with a piped culvert proposed under the Greenway, which will terminate in an overflow chamber at the pumping station PS06. During non flood event conditions, this will discharge to the river under gravity through the proposed surface water outfall at the nearest point of the Dungourney River. During a flood event, any run off will be pumped through the proposed rising main to the river adjacent to the proposed surface water outfall. The outfall will have a headwall fitted with non return valve.

A 4.0m wide hardstanding access track will connect the proposed pumping station to the Greenway. The access track is approximately 100m long.

Mill_A4_FC001_R – IDL Millrace Upstream

At the upstream section of the IDL Millrace, the proposed works will involve the construction of a water diversion structure to ensure the millrace flows into the Dungourney watercourse.

Mill_A4_FC002_R –Embankment Tie-in to IDL Millrace

At the embankment tie-in to the IDL Millrace, the proposed works will involve the backfilling of the millrace with impermeable clay material to flood defence level.

Mill_A4_FC003_R – IDL Millrace Downstream

At the downstream section of the IDL Millrace, the proposed works will involve the construction of a flow control structure to block flows from entering the IDL millrace.

GW_01 to GW_06 – Lauriston

At Lauriston housing estate, the proposed works will involve the construction of six groundwater pumping wells within the Lauriston housing estate to provide localised control of groundwater levels. The pumping wells will have a permanent power supply. It is also proposed to locate a hardstand area for a permanent back up generator which is to provide power if there is a power outage.

The six groundwater pumping wells will connect into a common rising main. From here there are two options to discharge the collected groundwater.

Option 1 involves the rising main discharging to an underground geocell attenuation tank located within the rugby club grounds. There will be proposed swale with filter drain underneath along the southern boundary which also will terminate at the underground geocell attenuation tank.

Option 1 also requires the construction of a pumping station, PS17 which will be constructed adjacent to the attenuation tank with flows being pumped to the Dungourney River. The rising main from the pumping station would run along the north side of the Greenway, cross under the Greenway and run adjacent to the rising main from PS06 to the outfall on the Dungourney River.

Option 2: The common rising main from the groundwater pumping wells will run along the southern boundary of the rugby club and discharge to a proposed Uisce Éireann stormwater network located within Suncourt housing estate.

The selection of the option will be informed by the programme of Uisce Éireann stormwater network upgrade and agreement between Cork County Council and Uisce Éireann.

5.7 Area 5

The Proposed Scheme in Area 5 consists of an upstream storage area in combination with a new pump station, rising main and flap valve maintenance works, in order to discharge flow from the Ballinacurra Stream into the estuary during periods of tide locking. The general overview of the proposed works in Ballinacurra are presented in Figure 5-21.

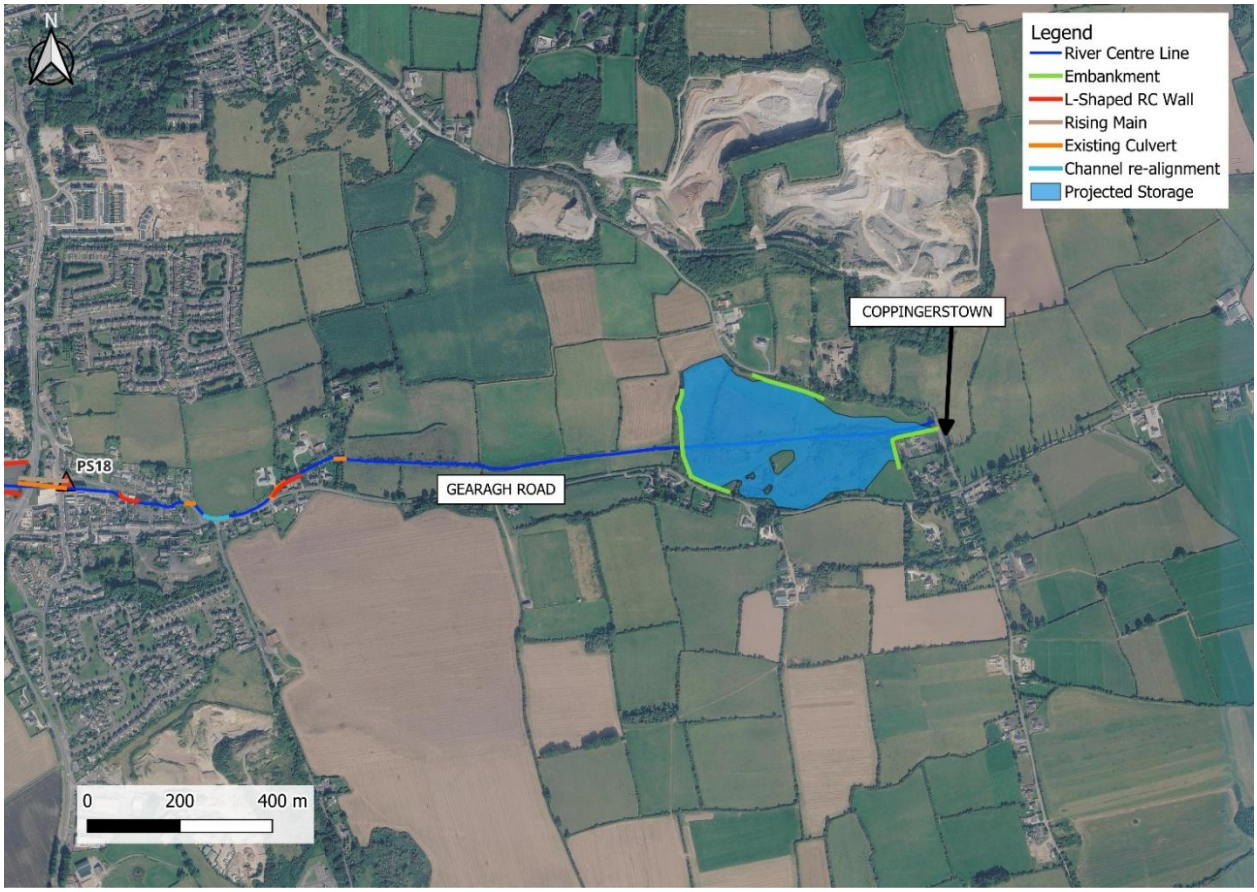


Figure 5-21 Overview of the proposed works in Area 5

5.7.1 Ballinacurra Storage Area

It is proposed that the assumptive approach be adopted in the present day in Area 5. The upstream storage will therefore be designed to accommodate the High-End Future Scenario (HEFS) required standard of protection. The final design level of +7.1mOD in the proposed storage area is based on a maximum Q100 HEFS water level of +6.6mOD plus a freeboard of 500 mm.

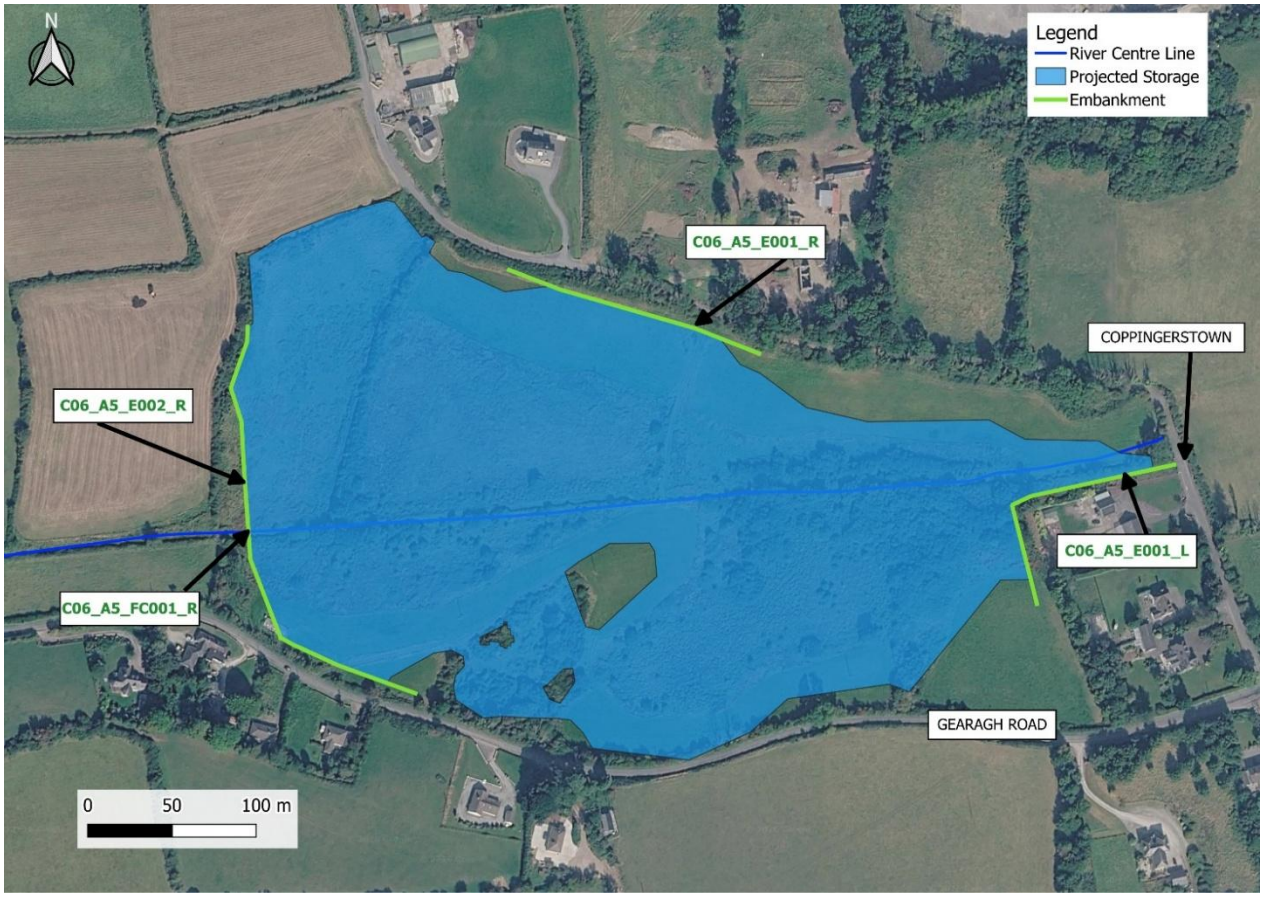


Figure 5-22 Layout of Proposed Flood Relief Works- Ballinacurra Storage Area- +7.1mOD design level (+6.6mOD Q100 HEFS water level + 500mm freeboard)

C06_A5_E001_L– Storage Area

Downstream of Coppingerstown the proposed works will involve building an embankment to protect the two houses nearby.

C06_A5_E001_R– Storage Area

At the north of the storage area the proposed works will involve building an embankment where the soil is lower than 7.1 mOD.

C06_A5_E002_R– Storage Area

At the east of the storage area, the proposed works will involve building an embankment where the flow control structure will be located.

C06_A5_FC001_R– Storage Area

Located at the east of the storage area, the proposed works will involve building a flow control structure that will limit the flow reaching the urban area of Ballinacurra.

5.7.2 Flood defences at Ballinacurra

Proposed Flood Defence Works – Culverts

Two flood defence walls may be required to mitigate the risk of flooding to the properties at the left bank of Ballinacurra near the Gearagh Road. Both properties already have a boundary wall along the bank of stream which may explain why it has not been regularly affected by flooding. The required wall alignment of the proposed wall can be seen in Figure 5-23.

It is proposed to clean and maintain the culverts (in orange) as shown in Figure 5-23.

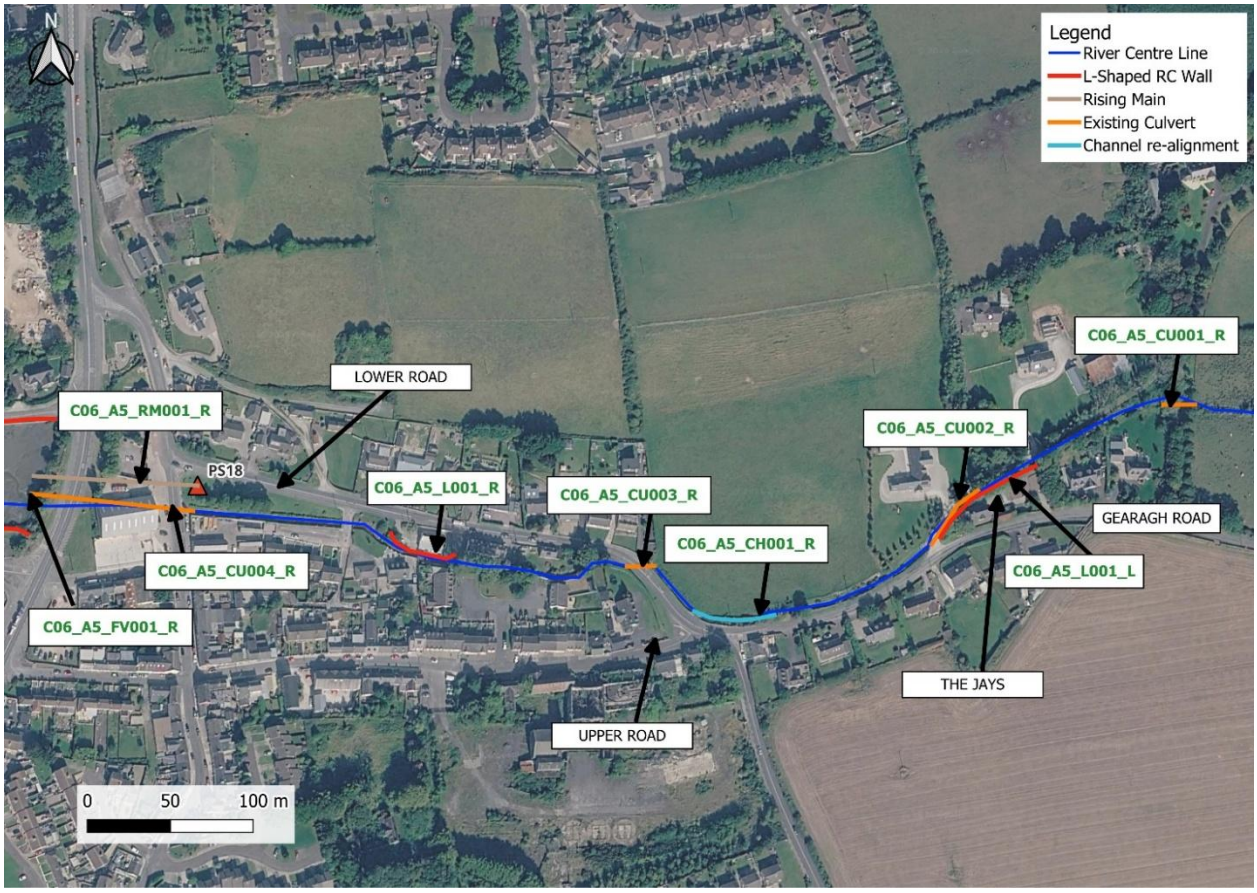


Figure 5-23 Layout of Proposed Flood Relief Works-Ballinacurra Downstream

C06_A5_CU001_R– East from "The Jays"

Maintenance works are proposed on the east culvert located east from the "The Jays".

C06_A5_CU002_R– "The Jays"

Maintenance works are proposed on the culvert located parallel to the "The Jays".

C06_A5_L001_L– "The Jays"

As part of the proposed works, a defence wall at "The Jays" will be built to reduce the flood risk. There is currently an existing wall at the "The Jays". This existing wall might explain why there is a lower threshold in the hydraulic model.

C06_A5_CH001_R– Geragh Road bifurcation.

The proposed works involve realigning the channel DS before Geragh Road bifurcation.

C06_A5_CU003_R– Lower Road

It is proposed to perform maintenance works on the culvert located near Geragh Road bifurcation. It is noted that is likely that culvert will be replaced to reduce blockage risk.

C06_A5_L001_R– Ballinacurra Lower Road

It is proposed to build a wall 120m upstream of the culvert inlet that connect Ballinacurra with the estuary.

C06_A5_CU004_R/C06_A5_FV004_R/ C06_A5_RM004_R – Ballinacurra Estuary

A new pump station, rising main and flap valve maintenance works will need to be carried out at the discharge of the Ballinacurra Stream into the estuary during periods of high tide.

5.8 Area 6

The proposed flood relief works in Area 6 are located to the west of Midleton town. The works are on the Water rock/ Oatencake stream and are adjacent to Dwyer's Road. The N25 national road divides the proposed works with the Midleton Wastewater Treatment Plant (WWTP) to the south and Riversfield estate north of the N25.

The proposed works are located in the townland of Garyduff and Oatencake.

An overview of the layout of the proposed flood relief works in Area 6 is shown in Figure 5-24.

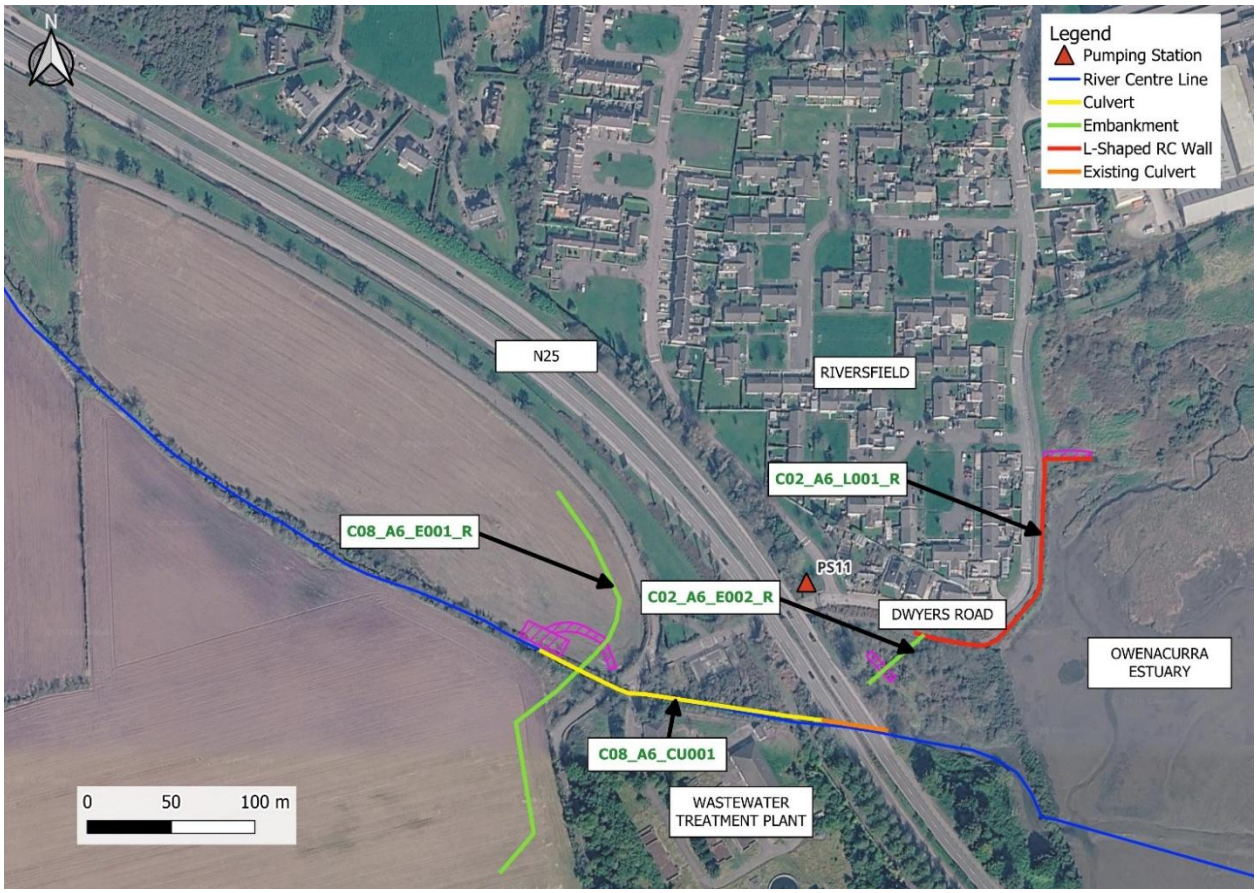


Figure 5-24 Overview of the proposed works in Area 6 (Not to scale. Extracted from Atlas Mapviewer)

A detailed description of the proposed works in Area 6 of the Proposed Scheme is provided below.

C08_A6_E001_R – Upstream of Wastewater Treatment Plant (WWTP)

To the northwest of the Wastewater Treatment Plant (WWTP) site, the proposed works will involve the construction of a flood defence embankment extending approximately 270m, with a typical height of 2.3m above existing ground level. The proposed embankment will have side slopes of 1:3 vertical to horizontal with a 4.0m wide flat crest at the top of the embankment to facilitate routine inspection and maintenance.

The purpose of the embankment is to provide a flood storage area to attenuate flows during a flood event.

A permanent livestock proof fence, 1.2m in height, will be erected at a 3m offset along the toe of the wet and dry side of the embankment to prevent access to the area.

The proposed works will include the construction of a culvert inlet structure, see below details for the proposed culvert, and installation of a trash screen on the wet side of the embankment, which will facilitate controlled flow conveyance and management of debris entering the culvert.

An access ramp connecting to the existing road will allow maintenance access to the culvert trash screen in a hard stand area at the toe of the embankment. An existing fence will be demolished to access the site.

C08_A6_CU001 – Downstream of Storage Area to N25

Downstream of the storage area embankment, the proposed works will involve the construction of a 2m wide x 1.2m high reinforced concrete culvert, 176m in length, to facilitate flow of the Oatencake stream through this area.

The proposed culvert will tie into the existing culvert which traverses under the N25 road.

Sealed maintenance covers will be provided to prevent surcharging during flood events.

A carrier drain will be constructed from the WWTP entrance along the road which will terminate at the overflow chamber for pumping station PS11, which is located adjacent to the entrance to the Bonnog housing estate.

Existing gullies will be disconnected from the existing outfalls to the Oatencake Stream and will connect to the proposed carrier drain.

C02_A6_E002_R – Dwyer's Road (South)

At Dwyer's Road (South), the proposed works will involve the construction of a flood defence embankment extending approximately 42m with a typical height of 1.0m above existing ground level. The embankment will have side slopes of 1:2 vertical to horizontal with a 4.0m wide flat crest at the top of the embankment to facilitate routine inspection and maintenance.

The proposed works will tie into the existing N25 embankment at flood defence level at the eastern extent. An access ramp will be provided over the embankment to access the wet side of the embankment.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS11 which is located adjacent to the entrance to the Bonnog housing estate. During non flood event conditions, this will discharge to the estuary under gravity through the proposed surface water outfall which is located in the vicinity of the pumping station. During a flood event, any run off will be pumped through the proposed rising main an outfall located at the estuary. The outfall will have a headwall fitted with non-return valve.

There is an existing 525mm diameter surface water outfall at Dwyer's Road, this will be diverted to the proposed Pumping Station PS11.

It is also required to build over the existing Uisce Éireann 450mm diameter foul sewer to facilitate the works.

C02_A6_L001_R – Dwyer's Road (North)

At Dwyer's Road (North), the proposed works will involve the construction of a masonry clad (dry side) reinforced concrete L-shaped flood defence wall extending approximately 195m with a typical height of 1.1m above existing ground level. On the northern end of the defence, the wall will tie into existing high ground, and an access embankment will be constructed adjacent to the wall.

The existing cycle / pathway is elevated above the adjacent roadway. It is proposed to raise the existing cycle / pathway further and construct a retaining wall between it and the existing carriageway. This will reduce the relative wall height and allow for views from the cycle / pathway towards the estuary.

A carrier drain with a filter drain adjacent will run along the dry side of the defence and will terminate in an overflow chamber at the pumping station PS11.

There is an existing stormwater outfall at Dwyer's Road. This will be connected to the proposed surface water carrier drain. At the downstream connection, it is proposed to construct an overflow diversion manhole. During a non flood event, it will discharge through the outfall fitted with a non-return valve. During a flood event, the flow will be diverted into the carrier drain which will run along the dry side of the defence and will terminate in an overflow chamber at the proposed pumping station PS11.