LANGAN

CONSULTING ENGINEERS

SCHEME REPORT

COIS ABHAINN AND ASHWOOD FLOOD CELL

MAYO COUNTY COUNCIL

19092-RP-2605-FL01 | SEPTEMBER 2021

CIVIL
STRUCTURAL
ENVIRONMENTAL

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QUALITY CHECK SHEET

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1 INTRODUCTION

1.1 PROJECT BACKGROUND & CONTEXT

During an extreme flood event in 2015 residential properties in 2 no. residential estates, Cois Abhainn and Ashwood at Ballinrobe Rd, Westport, Co. Mayo. were subject to fluvial flooding from the adjacent Carrowbeg river. A total of 15 no. properties were affected. 6 no. dwellings (habitable basements only) in Cois Abhainn and 9 no. dwellings (ground floors) in Ashwood were affected.

The CFRAM assessment *UoM 32-33 Preliminary Options Overarching Report - Sept 2016 for Westport Town* concluded that a flood relief scheme is viable at this location. This conclusion was based on the mitigation benefits associated with the properties located in Cois Abhainn only. The funding criteria for the proposed flood cell scheme is to provide protection to residential properties subject to flooding during the 1 in 100-year event.

The OPW in conjunction with Mayo County Council as part of the CFRAM programme now propose to progress the development of a flood relief scheme at this address, [Cois Abhainn and Ashwood Flood Cell]. To confirm the scheme's viability, a preliminary design is required together with a greater assessment of project constraints.

The location of the proposed flood cell scheme is shown in Figure 1.1 and Figure 1.2 below.

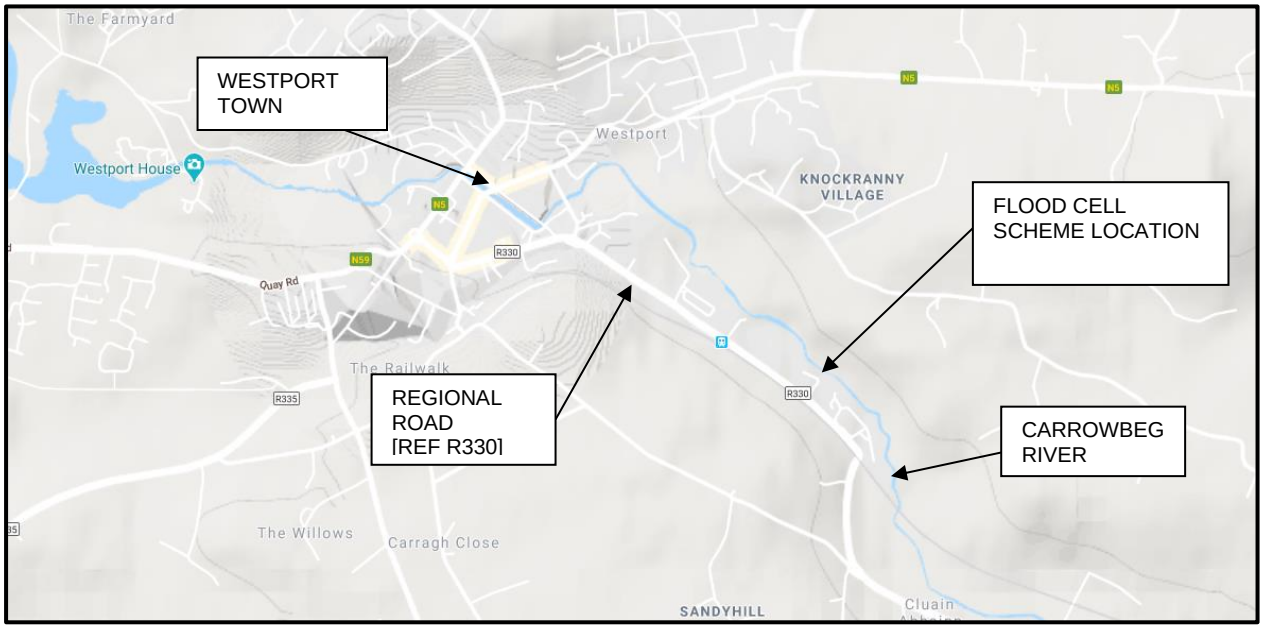

Figure 1.1 Scheme location

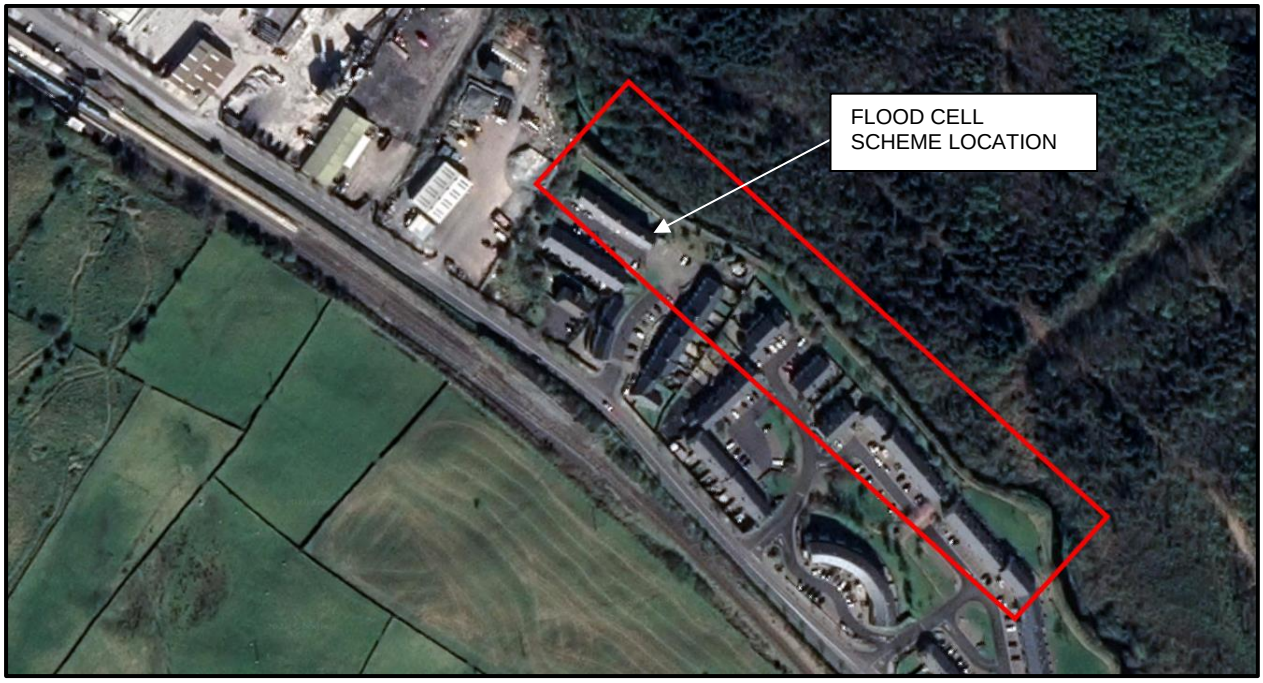

Figure 1.2 Scheme location, (Aerial image).

1.2 FLOOD DESIGN BRIEF

Langan Consulting Engineers are appointed as Civil/ Structural Consultants by Mayo County Council for the project. The design brief comprised of the following elements.

A. Scheme Options Report. [Doc Ref: 19092-RP-2601]
   i. Scheme Assessment & Constraints Study (Baseline Surveys).
   ii. Preferred Scheme Option(s).

B. Strategic Benefit Cost analysis (BCR) Report, [Doc Ref: 19092-RP-2602]
   i. Hydrology.
   ii. Hydraulics – [hydrological analysis & hydraulic modelling].
   iii. AA Screening.
   iv. Ecological Impact Assessment.
   v. EIA Screening.
   vi. Construction Environmental Management Plan (CEMP).

C. Buildability/Construction/Maintenance. [Doc Ref: 19092-RP-2603]

D. Draft & Final Report – work undertaken and outcomes.

This final report summarises the design services provided by LCE.

2 SCHEME OPTIONS REPORT

2.1 SCHEME ASSESSMENT

A site walkover was carried out. The condition of the following topographical features were inspected.

- The external areas of the properties effected by flooding during the 2015 in Cois Abhainn and Ashwood.
- The channel of the Carrowbeg River, including the existing large vegetation and some sedimentation areas.
- The condition of the mature conifer forestry on the northern side of the Carrowbeg River and the trees/ branches which have collapsed into the river channel.
- the pedestrian access located between the residential estates and the Carrowbeg River.
- the wastewater pumping station serving the estates.

2.2 SCHEME CONSTRAINTS

The following site development constraints were identified.

- There is limited space available between the existing residential properties and the riverbank.
- There is an SAC downstream of the flood cell.
- The existing pedestrian access path will need to be retained.
- The existing civil infrastructure, [storm outfalls, foul and water services, electrical services].
- Existing landscaping to be retained if possible.
- Space for a construction compound.
- The development will be carried out in the vicinity of occupied residential properties.
- Access for the construction works is via live residential access roads.

2.3 POTENTIAL FLOOD RELIEF SOLUTIONS

The following potential flood relief solutions were proposed for each location based on existing site constraints:

- A flood wall.; and
- An earth embankment

An appraisal of the preferred options was carried out based on the following principal parameters:

- Site geometry impact
- Civil/ structural impact
- Hydraulic impact
- Environmental impact
- Visual impact

Preferred design solutions were identified for both estates as follows.

- Cois Abhainn: A flood wall, [1-2m high]
- Ashwood: An earthwork embankment, [1m hight]

3 STRATEGIC BENEFIT COST ANALYSIS (BCR) REPORT

3.1 ASSESSMENT OF STRUCTURAL METHODS

All potential flood relief options were considered during the initial screening stage. Each option was assessed with regard to their viability in terms of the following criteria: Technical, Economic, Health and safety, Environmental, Social and cultural and Adaptability to climate change. The viable methods were assessed economically, and the preferred methods were established through an MCA analysis.

All preferred methods were then re-assessed in greater detail using the above criteria, with all key constraints were noted. This screening assessment identified flood containment methods as the sole viable method. As a result, this method became the preferred method.

3.2 PREFERRED FLOOD CONTAINMENT METHOD - PRELIMINARY DESIGN

3.2.1 HYDRAULIC MODELLING

The hydraulic modelling output from Westport AFA study was enhanced with updated design parameters. Hydrological and flood data recorded since the AFA were included. More detailed topographical surveying of river channel at the flood cell location was carried out.

Calibration of the CFRAM hydraulic model could not be achieved with the updated design parameters. Additional topographical data of the river channel downstream of the flood cell was recorded. A natural conveyance restriction was identified approximately 75 metres downstream of flood cell, [large rock located centrally in channel]. This is currently reducing channel conveyance by 40% and also increasing risk of channel blockage significantly. Calibration of the CFRAM model, such that flood levels witnessed during previous flood events were replicated in model simulations was achieved with the inclusion of this additional survey data.

The hydraulic model was then simulated for the 1 in 100-year storm event. It showed that flood waters encroach floor areas in 6 no. residential properties in Cois Abhainn and in a further 30 no. properties in Ashwood during the 1 in 100-year event. The original CFRAM assessment *UoM 32-33 Preliminary Options Overarching Report - Sept 2016* had not included residential properties in Ashwood within the approved flood relief scheme extents.

3.2.2 PRELIMINARY ECONOMIC ASSESSMENT OF PREFERRED METHOD

A review of current property values affected by flooding, using property values capped as per UoM 32-33 Preliminary Options Overarching Report was carried out. The value of properties subject to flood risk in the flood cell was estimated to be €10m.

The indicative construction cost estimate for the preferred flood relief scheme was prepared. Costings of €414,792 and €128,885 were estimated for the flood wall and embankment respectively. The total indicative construction cost was estimated to be €543,677.

The indicative damage value estimates for the flood cell were prepared for both the original CFRAM model and for the CFRAM model as updated as part of this assessment. The indicative economic viability for the proposed flood containment method is presented as an Economic

Benefit-Cost Ratio (BCR) to be 1.31. As this cost ratio is greater than 1.0, the preferred containment method option was deemed viable at the initial screening stage.

3.3 FURTHER ASSESSMENT OF PREFERRED FLOOD RELIEF METHOD

The preferred option's viability was assessed further in terms of the same criteria as the initial screening stage. Greater assessment was required to meet the economic and environmental criteria's,

3.3.1 ECONOMIC ASSESSMENT

3.3.1.1 ESTIMATED VALUES

Present Day value of damages in Cois Abhainn and Ashwood properties were estimated separately for both the existing and proposed scenarios.

The estimated present value benefit of the proposed flood cell scheme is €4,744,198.

Sensitivity analysis on this estimate were carried out to ensure that the scheme would still be viable if the frequency of deep internal property flooding has been overestimated. The analysis shows that if we exclude any damages from the 50%, 20% and 10% AEP events the total damage or benefit available for the scheme Cost Benefit Ratio is € 1,804,944. This is a lower bound estimate for the benefit available. The analysis provides confidence that the benefits available are above this value. The highest level of benefits that could be available is € 4,774,198, however there was less confident in this estimate.

3.3.1.2 ESTIMATED CONSTRUCTION COSTS

A detailed breakdown of the estimated costs for flood relief scheme was prepared. Project construction costs were estimated based on unit rates for flood defences and a recently publicly tender project of similar scale and nature. Maintenance costs were also estimated and the Net Present Value (NPV) of the maintenance costs over 50 years discounted at 4% was calculated.

Total costs were estimated by adding allowances such as construction preliminaries, engineering fees, specialists etc. to the construction costs. These costs along with the applicable percentage rates were included. An allowance for optimum bias was taken to be 40%. No allowance was given to Art as the embankment will be landscaped into its existing environment. A nominal fee of €50,000 was estimated for the completion of site investigations.

The construction cost is estimated at €692,950. An economic benefit to cost ratio (Economic Benefit – Cost Ratio (BCR)) of 2.6 was estimated for the flood cell only, designing to Current Scenario 1% AEP.

3.3.2 ENVIRONMENTAL ASSESSMENT

The following environmental assessments were carried out to clarify all project environmental constraints.

- Environmental Impact Assessment screening report.
- Appropriate Assessment screening report.
- Ecological impact assessment report.

The reports concluded that the proposed works were unlikely to have a '*significant effect on the environment', will not have* a significant effect on any European Site and will not have any significant effect on the biodiversity of the area.

3.3.3 SUNDRY ASSESSMENT CRITERIA

3.3.3.1 CONSTRUCTION AND ENVIRONMENTAL MANAGEMENT PLAN

It is recommended a comprehensive construction and environmental management plan is on file to control the construction phase of the proposed development.

No significant social, cultural, and environmental issues were identified relating to the preferred method.

A future adaptability assessment recommended that the proposed height of the defences should take an assumptive approach, incorporating a freeboard.

An assessment of operational requirements recommended an inspection regime is prepared to ensure that there is no deterioration in the structural integrity of the defences. It is expected the flood defence wall will have minimal maintenance requirements. It is expected that the flood defence embankment will be relatively low maintenance, mainly through mowing of the grass on a regular basis through the growing season.

A design health and safety risk assessment has been completed for the project which has been included in the project safety file.

An assessment of possible construction methods noted the main constraints were the size of the works area and proximity to watercourse and were manageable. An assessment of the operation stage recommends regular maintenance to ensure defence integrity.

3.4 NON-STRUCTURAL FLOOD RISK MANAGEMENT METHODS

Non-structural flood risk management methods were identified, assessed, and recommended as part of the structural method proposed.

3.5 MULTI CRITERIA ANALYSIS

A Multi-Criteria Analysis (MCA) was carried out in accordance with the OPW guidance document '' *National 'CFRAM' Programme Technical Methodology Note – Option Appraisal and the Multi-Criteria Analysis (MCA) Framework''*[1].

The flood risk management objectives were categorised as follows:

- Technical.
- Economic.
- Social.
- Environmental.

3.6 BCR CONCLUSION

MCA Benefit Score: The sum of the scores for the economic, social, and environmental criteria was found to be 2414 for this study.

Option Selection MCA Score: The sum of the scores for all four of the criteria was found to be 3314 for this study.

MCA Benefit – Cost Ratio (BCR): The MCA Benefit - Cost Ratio was calculated to be 3.48 per invested thousand euro.

[1] National 'CFRAM Programme Technical Methodology Note – Option Appraisal and the Multi-Criteria Analysis (MCA) Framework. Flood Risk Assessment & Management Section. OPW. Version Rev. B. (September 2018).

The Economic Benefit – Cost Ratio (BCR): was calculated as 2.60.

The project is considered viable.

4 BUILDABILITY REPORT

A constructability report was prepared for the scheme.

It outlines the resource requirements.

Construction preliminaries, sequencing and long-term operations were identified and a summary of requirements for each is detailed.

5 CONCLUSION

The CFRAM assessment *UoM 32-33 Preliminary Options Overarching Report - Sept 2016 for Westport Town* identified that a flood relief scheme is viable at this location. The OPW in conjunction with Mayo County Council as part of the CFRAM programme now propose to progress the development of a flood relief scheme at this address, [Cois Abhainn and Ashwood Flood Cell]. To confirm the scheme's viability, a preliminary design is required together with a greater assessment of project constraints.

A scheme options report was carried out to assess all potential flood relief options. It identified the preferred design solution were identified for both estates as follows.

- Cois Abhainn: A flood wall, [1-2m high].
- Ashwood: An earthwork embankment, [1m high].

A strategic benefit cost analysis (BCR) report was carried out to assess the preferred solutions in accordance with the design brief. It estimated values for the following key industry standard viability parameters.

- **MCA Benefit Score:** The sum of the scores for the economic, social, and environmental criteria was found to be 2414 for this study.
- **Option Selection MCA Score:** The sum of the scores for all four of the criteria was found to be 3314 for this study.
- **MCA Benefit – Cost Ratio (BCR):** The MCA Benefit - Cost Ratio was calculated to be 3.48 per invested thousand euro.
- **The Economic Benefit – Cost Ratio (BCR):** was calculated as 2.60.

The result of the BCR report confirms the viability of this flood relief scheme.