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1 INTRODUCTION

The Office of Public Works (OPW) commissioned RPS to undertake the Eastern Catchment Flood Risk Assessment and Management Study (Eastern CFRAM Study) in June 2011. The Eastern CFRAM Study is the second catchment flood risk management study to be commissioned in Ireland under the EC Directive on the Assessment and Management of Flood Risks (2007/60/EC) as implemented in Ireland by SI 122 of 2010, European Communities (Assessment and Management of Flood Risks) Regulations 2010.

The Eastern CFRAM Study covers an area of approximately 6,250 km² and includes four Units of Management, HA07 (Boyne), HA08 (Nanny-Delvin), HA09 (Liffey-Dublin Bay) and HA10 (Avoca-Vartry). There is a high level of flood risk within the Eastern CFRAM Study area with significant coastal and fluvial flooding events having occurred in the past.

1.1 OBJECTIVE OF THE INCEPTION REPORT

The Fingal - East Meath Flood Risk Assessment and Management Study (FEM FRAM) prepared by Halcrow Barry is presently nearing completion and covers Unit of Management HA08. The principal objective of this Inception Report is to provide a detailed method statement for undertaking a review of the FEM FRAM Study and a review of available material for Unit of Management HA08 to thus fulfil the requirements of Section 2.6 of the National Flood Risk Assessment and Management Programme, Eastern River Basin District Catchment-based Flood Risk Assessment and Management (CFRAM) Study, Stage II Tender Documents: Project Brief (hereafter referred to as the Eastern CFRAM Study Project Brief).

This objective will be met through the following phases:

- **Phase 1**: Review of the FEM FRAM study hydrological analysis, hydraulic modelling and flood mapping.
- **Phase 2**: Review of the FEM FRAM study recommended flood risk management options.
- **Phase 3**: Incorporating the findings, recommendations and proposed measures into the overall Eastern CFRAM Study Flood Risk Management Plan.

This document will also identify any issues that have been encountered in sourcing data and flag any that may affect the proposed methodologies or programme going forward. Phase 1 of this process has recently commenced and will complete by mid 2012. Phase 2 is planned to commence in late 2013 and will run in parallel with the development of flood risk management options for the remainder of the Eastern CFRAM Study area through 2014 to feed into the Flood Risk Management Plan development in 2014-15.
1.2 APPROACH TO PROJECT DELIVERY

RPS has established a project specific team for the Eastern CFRAM Study which includes a Project Management Board consisting of our nominated Project Director, Dr Alan Barr, assisted by the Project Manager, Grace Glasgow, and two Assistant Project Managers, Dr Malcolm Brian and Andrew Jackson. This senior management team are closely involved in all aspects of the study and will have responsibility for specific technical and geographic areas. All members of the RPS Project Board are based in the Belfast office of RPS as are many of the supporting technical staff, although the overall team includes staff from RPS offices in Dublin, Limerick, Cork and Galway as well as support from sub-consultants Compass Informatics and Hydrologic BV.

Within the overall RPS project team are a core group of staff who will remain involved in the project throughout its duration from initial data collection to reporting to ensure coherence and consistency in approach. Within this group we have identified a dedicated data manager, Stephen Neill, who is responsible for ensuring that all received data is logged and for maintaining a project specific inventory of datasets available to the project.
2 DATA COLLECTION

2.1 DATA COLLECTION PROCESS

RPS places a high importance on data collection throughout the lifetime of a project and considers sourcing, acquisition, quality checking and updating of information to be critical to the successful implementation of the CFRAM Studies.

The data collection process for the Eastern CFRAM Study started with a review of the lists of data sources and relevant reports identified in the study brief and generic tender. For the Fingal - East Meath study area, the data collected to date is listed in Section 2.2.1. RPS has completed an initial review of this data, and has made further requests to the appropriate Local Authorities where necessary. On 01/02/12, RPS sent requests to Fingal County Council and Meath County Council for an update on any flood relief or risk management measures which have been implemented since the completion of the FEM FRAM Study. Meath County Council confirmed that no works or risk management measures have been implemented either prior to or since the publication of the draft final FEM FRAM report.

Every request for information is logged in the Data Request Register and is followed up with further emails and phone calls as appropriate.

2.2 DATA REVIEW

2.2.1 Fingal East Meath Flood Risk Assessment and Management Study

RPS has obtained copies of the following reports and documents completed during the FEM FRAM study from the project website (http://www.fingaleastmeathframs.ie/documents.asp).


• Project Newsletters 01 to 08 (loaded from August 2008 to November 2011).

• Information leaflet on consultation on the Environmental Scoping Report (and the same report in Irish, both loaded in October 2009).

• Map of the high priority and medium priority watercourses (Loaded in December 2008).

• Map of surveyed flood defence assets (Loaded in December 2008).

• Map of hydrometric gauging stations (Loaded in May 2009).

• All digital deliverables of the FEMFRAM Study, including but not limited to, hydrological data, model files and mapping files.

2.2.2 Other Data Sources

RPS has requested details of any flood relief or risk management measures which have been implemented since the completion of the FEM FRAM study from Meath County Council, Fingal County Council and the Office of Public Works. Meath County Council has confirmed that they have not implemented any measures, and the Office of Public Works has advised that funding has been approved for Fingal County Council to progress some works at Aspen Drive and Rolestown. Fingal County Council has advised the works recommended in the FEM FRAM reports for Aspen Drive were completed in late 2011 although funding has not yet been drawn down. At Rolestown works have not been completed due principally to site conditions preventing the measures identified in through FEM FRAM study from being implemented. Fingal County Council is presently seeking quotations for a redesign of these works and hope to progress these in the summer of 2012.
As part of the Flood Event response requirement within the overall Eastern CFRAM Study, RPS visited Lady’s Finger Bridge, Mornington and Northlands Housing Development, Bettystown during the flood event which occurred (24/25th October 2011) following completion of the FEM FRAM study. RPS reported that there was no flooding to properties as a consequence of this event.

RPS representatives attended the Public Consultation held on Wednesday 9th November 2011 at Ashbourne Library in Ashbourne, Co. Meath. This was held to inform people of the findings and recommendations of the study and to seek their views and feedback on the draft Plan. This visit confirmed that the approach adopted by Halcrow-Barry to public consultation was in line with the proposed approach for the Eastern CFRAM study but was otherwise of no significant benefit to RPS.

As part of the flood risk review task in the overall Eastern CFRAM Study, (see reference 1 for the full report on this task) RPS has assessed four sites within HA08. The sites visited by RPS during the Eastern CFRAM Study Flood Risk Review (FRR) and the consequent RPS recommendations to OPW were as follows:

- **Balrothery** (Fingal): No history of flooding was reported by the Local Authority or OPW Regional Engineers, nor was any evidence of flooding observed at this location during the site inspection. Subsequent enquiries revealed that the watercourse in question, the Bracken Stream, had been modelled during the FEM FRAM study and the more detailed flood maps available from this source indicated the site of the residential home to be unaffected. Consequently Balrothery is not considered to be an Area for Further Assessment (AFA).

- **NUR Luttrells** (Fingal): No knowledge of flooding at this location was reported by either the Local Authority or OPW Regional Engineers. The site inspection confirmed the Nursing Home (NUR) to be located on the inside of a bend in the Ward River however no visible evidence of any flooding was observed. Enquires following the site inspection established that this part of the Ward River was modelled during the FEM FRAM study and the more detailed flood maps arising from this assessment indicated only the 0.1% AEP event to affect the site. Consequently when the Flood Risk Index (FRI) is adjusted to reflect the reduced flood risk, Luttrells should not be considered an AFA.

- **N2 Balrath** (Meath): The River Nanny at this point was modelled as part of the FEM FRAM study and the results show the road is at risk during the 0.1%AEP flood event only. The model used in the FEM FRAM study is considered to be significantly more accurate that that used for the PFRA analysis and should therefore be given more credence in the risk review. Balrath is therefore not considered an AFA.

- **SCH Kilbride** (Meath): The Local Authority had no knowledge of a flooding history at the school (SCH) but could not confirm that it had never flooded nor are there any records on www.floodmaps.ie. The site inspection confirmed that the Ward River runs along the boundary of the primary school site, and established that the flood plains on both sides of the...
watercourse are quite flat. It was also observed that the channel appeared to have been modified i.e. the channel section appeared trapezoidal which may indicate greater capacity than the Preliminary Flood Risk Assessment (PFRA) assumed $Q_{med}$. Review of the draft outputs of the FEM FRAM study indicates that this stretch of the Ward River was not modelled therefore no more detailed flood outlines are available at present. On balance it is likely that the school is subject to some degree of flood hazard, however given that the flood risk is primarily associated with a single receptor it is likely that this could be dealt with through the minor works procedure and consequently it is suggested that Kilbride Primary School is not an AFA.

The OPW have since finalised the list of AFAs and no additional areas have been identified within HA08 for inclusion in the Eastern CFRAM Study scope.

2.3 DATA OUTSTANDING

RPS believe that all available information on any flood relief or risk management measures which have been implemented by the Council since the FEM FRAM Study recommendations were produced have been received. RPS will continue to monitor this situation throughout the three phase review process in case further developments take place between flood mapping and options development for example.

2.4 DATA GAPS

At present RPS has not identified any significant data gaps that will impact on the completion of the FEM FRAM study review and hence overall Eastern CFRAM Study. However, this statement is made prior to commencing the detailed review of the FEM FRAM study reports.

It may be that as the study progresses through the next phases additional data needs will be identified, which will be addressed in so far as is possible through on-going data collection exercises. This may include a requirement to access documents such as Technical Notes, giving further details as to the assumptions made and the methodologies adopted during the study.

Another potential data source which may be required is spot gauge data at each hydrometric station, especially those that have recorded significant flood events since the completion of the FEM FRAM Study.

Thus it is not possible at this point in time to categorically state that there are no data gaps which will impact in some way on the completion of this element of the Eastern CFRAM Study.
3 DETAILED METHODOLOGY REVIEW

3.1 GENERIC SPECIFICATION METHODOLOGY

In accordance with Section 2.6 Eastern CFRAM Study Project Brief all services as set out in the National Flood Risk Assessment and Management Programme, Catchment-based Flood Risk Assessment and Management (CFRAM) Studies, Stage I Tender Documents: Project Brief can be assumed to have been undertaken for HA08, with the exception of those listed below. A brief summary is given on the current status of the tendered RPS methodology for these project tasks. The methodology for the remaining tasks listed in Section 2.6 of the Eastern CFRAM Study Project Brief is detailed in the Section 3.2 of this report.

- **General Requirements** – there has been no methodology change with regard to level of detail, management arrangements, project inception, web-based work platform, project website, use of digital media and GIS and health and safety requirements. These activities are all either complete or currently in place and ongoing during the study. Technical training and National Technical Coordination Group participation have not yet commenced awaiting delivery / procurement of other CFRAM study partners however these are not currently on the critical path and no associated methodology changes are proposed at present.

- **Data Collection** – Section 2 of this report details the collection of relevant datasets and the initial phase has concluded in accordance with the tendered methodology. Further data or updates will be pursued on an as needed basis as they emerge. Flood event response activities will remain ongoing in accordance with the project brief and a project specific flood event response plan is detailed in a Technical Note (Section 3.3.2).

- **Flood Risk Review** – this task is complete.

- **Preparation of Flood Risk Management Plans** – there is no tendered methodology change proposed in HA08 to date.

- **Reporting And Deliverables** – there is no tendered methodology change proposed in HA08 to date.
3.2 CONTRACT SPECIFIC METHODOLOGY

3.2.1 Phase 1: Hydrological Analysis, Hydraulic Modelling & Flood Mapping

RPS proposes to review the hydrological analysis undertaken during the FEM FRAM Study by conducting an initial high-level analysis of the study area. This will determine the areas where there have been potentially significant changes in the catchment since completion of the Study. This analysis will form the basis for selecting the hydrometric stations and sub-catchments to be assessed in accordance with the specification. Those selected will include areas where significant changes in the catchment have been identified, and a representative sample of the total of ten hydrometric stations listed in the brief and 270 sub-catchments located within the Study area. RPS will generate a pro-forma which will list all of the checks to be carried out, including:

- Assessment of the hydrometric gauging station rating review including a determination of the impact should data which has become available since the completion of this element of the FEM FRAM study will be included. Details of the potential impact on the modified annual maximum series and growth curve will be established;

- Assessment of the impact in adopting the use of FSU as an alternative to other hydrological methods to enable comparison of site parameters and growth curves;

- Review of the hydro-meteorological data acquired within the chosen sample area, ensuring that all available data has been considered (including data in relation to any significant events which has become available since the completion of this element of the FEM FRAM study);

- Review the statistical analysis methods and conclusions of the hydro-meteorological data acquired for the sample area. Assessment will include data which has become available since completion of this element of the FEM FRAM study and a determination will be made if this changes the applicability of the methodology used and assumptions made;

- Review of the catchment boundaries and sub-catchment boundaries for each of the selected HEPs;

- Check to ensure that design parameters including peak flows, hydrographs and flood volumes have been determined for all design event probabilities and for all HEPs. A review of the number and location of HEPs will also be conducted;

- A review of the FSSR 16 and IOH124 input files for all sub-catchments within the sample area;

- Review of hydrological calibration and validation.
RPS may select additional sub-catchments for further assessment in the event that the above review is deemed inconclusive. Following review completion, RPS will report any recommendations deemed necessary, for updating the hydrological analysis in HA08 to the OPW.

RPS propose to review the **hydraulic modelling** undertaken during the FEM FRAM Study by assessing a representative sample (probably two) of the twenty individual river models in the FEM FRAM study area, in accordance with the specification. The method for selecting these models will initially include those areas identified as having undergone significant changes in the catchment (during the high-level analysis as part of the hydrological analysis). Further models to be assessed, if required, will be selected at random, however, a check will be made to ensure that at least one of the selected models is a 1D-2D model type, contains both HPWs and MPWs and requires a defence failure scenario to be modelled. Should this not be case, one model will be discarded and the random selection procedure will be repeated until the aforementioned criteria are met. RPS will generate a pro-forma which will list all of the checks to be carried out, including:

- survey information meets the requirements as set out in Appendix D of the CFRA specification, and recording of any flood risk management measures which have been implemented since the completion of the FEM FRAM Study surveys;

- a dynamic hydraulic model has been developed for all HPWs and MPWs, and their associated floodplains, and that 1D-2D models have been implemented where necessary using the required software;

- channel and floodplain roughness coefficients are appropriate, all hydraulically significant structures (as per the surveys) are included, model resolution and boundary conditions are appropriate (as specified by the hydrological analysis);

- calibration of models has been successfully carried out at HEPS and that design flood flows for each AEP are maintained along each watercourse. A check will be made that four previous flood events have been used, where data was available, and all flood events yielding potential calibration data since the completion of the FEM FRAM study modelling will be recorded.

- the required model design runs have been completed to meet the requirements of the flood mapping deliverables (see below);

- sensitivity tests have been undertaken for all forms of modelling, with a number of appropriate factors adjusted, with an indication given on the robustness and sensitivity of each model;

- two failure scenarios have been modelled for each of the existing flood defence assets present within the model area;
• assessment of the adequacy of the coastal modelling approach and the tidal boundary data used.

Following the above review, RPS will report any recommendations deemed necessary for updating the hydraulic modelling in HA08 to the OPW.

RPS proposes to review the flood mapping undertaken during the FEM FRAM Study by assessing each flood map in accordance with the CFRAM specification. RPS will generate a pro-forma which will list all of the checks to be carried out, including:

• Flood Map has been produced for each source of flooding for all AFAs, and for each scenario (current, MRFS and HEFS) as defined in the specification;

• Flood Extent Maps include an indicator of the degree of confidence, tables of peak flows for all modelled design event probabilities at each HEP, tables of peak flood levels for all AEP at all nodes and appropriate points within modelled coastal domains and indicate areas benefiting from flood defences;

• Flood Zone Maps show Flood Zones A, B and C (as per ‘Guidelines on the Planning System and Flood Risk Management’);

• Flood Depth Maps show the depths of flooding, with appropriate classifications;

• Flood Velocity Maps show velocities of floodplain flow, with appropriate classifications;

• Flood Hazard Function Maps show an appropriate function of flood hazard;

• Specific flood risk maps showing the indicative number of inhabitants, types of economic activity, economic risk density and general risk maps for all other risk indicators have been produced.

Following the above review, RPS will report any recommendations deemed necessary, for updating the flood mapping in HA08 to the OPW. This will include a discussion on the likely influence of the findings of the hydrological and hydraulic review on the flood mapping.

3.2.2 Phase 2: Flood Risk Management Options

Following the completion of Phase 1 (Section 3.2.1), RPS will undertake a review of the recommended flood risk management options for the FEM FRAM study area in parallel with the development of flood risk management options for the remaining areas of the Eastern River Basin District. The review will reflect work undertaken since the publication of the FEM FRAM Study reports, and other changes in timings or prioritisations to the recommendations as required by OPW and / or Local Authorities.
RPS will ensure that the recommendations and proposed measures (reviewed and updated as necessary) are in line with the overall strategy for HA08 and the Eastern River Basin District where relevant. RPS will incorporate these findings, recommendations and proposed measures and other material as necessary into the overall Flood Risk Management Plans that are to be developed for all the Hydrometric Areas within the Eastern River Basin District.

RPS proposes to further develop the methodology for reviewing the flood risk management options following completion of the review of the hydrological analysis, hydraulic modelling and flood mapping as the detailed methodology will be dependent on the outcome of these tasks. For example, in the event that the flood mapping is concluded as being accurate, it may be the case that the flood risk management options will still alter due to the availability of new social data-sets.

Any updated methodology will be issued as a Technical Note, expanding on the proposed methodology presented above.

### 3.2.3 Phase 3: Flood Risk Management Plan

Following the completion of Phase 2 (Section 3.2.2), RPS will incorporate the findings, recommendations and proposed measures and any other material as necessary into the Flood Risk Management Plan for Unit of Management 08 of the Eastern River Basin District.

RPS propose to give further details on the methodology for reviewing the flood risk management plan following completion of the review of the flood risk management options as the final methodology will to a degree be dependent on the outcome of this task. For example, should the flood risk management options conclude that additional measures are required; the Plan will have to incorporate details on the subsequent SEA measures required.

The proposed final methodology will be issued as a Technical Note, expanding on the outline methodology given above.

### 3.3 RISKS AND OPPORTUNITIES

The discussion regarding data collection, gaps and outstanding information, presented in Section 2 of this Eastern CFRAM Study Inception Report for Unit of Management 08 (Nanny – Delvin), informs the methodology risks and opportunities review.

The following general mechanisms are available for methodology amendments:

- Technical notes – used to expand or update methodology at appropriate project planning stages;

- Inception report (this report) – used to expand or update methodology in response to formal data review six months into the contract; and
• Agreed changes to scope of services (under Clause 2.6.2 of the National Flood Risk Assessment and Management Programme, Eastern River Basin District Catchment-based Flood Risk Assessment and Management (CFRAM) Study Stage II Tender Documents: Instructions to Tenderers – used to add or remove specified contract items.

RPS maintains a live project risk and opportunities register to consider implications for programme, quality and budget for the Eastern CFRAM Study, which is reviewed at regular project working group meetings. This process has identified a small number of risks and opportunities that have a direct bearing on task methodology which are discussed in the following report sections.

3.3.1 Risks and Proposed Methodology Amendments

Flood Risk Review – Technical Note 1 (IBE0600 TN0001) details an updated methodology for flood risk review (FRR) in the Eastern study area based on the progress with the Preliminary Flood Risk Assessment (PFRA) between time of generic specification and tender and the Eastern CFRAM Study FRR. Updated consultation, scoring and modelling approaches were set out in the document in order to progress the task in the absence of some data sets (such as flood defence databases) which were not available at the time of the FRR due to the delayed start date of the overall project.

There are no further risks and associated methodology amendments identified at present in the HA08 Unit of Management.

3.3.2 Opportunities and Proposed Methodology Amendments

Data Collection – Technical Note 2 (IBE0600 TN0002) details RPS’s proposed Flood Event Response Plan so that the response team members are appraised of requirements before an event occurs. The plan was available before first reported potential flooding to properties which occurred in the Fingal East Meath study area since commissioning of the Eastern CFRAM Study (24/10/11). Flooding was limited to the coastal zone (Bettystown) and the plan was successfully enacted with two RPS team members attending.

There are no further additional opportunities and associated methodology amendments identified at present in the HA08 Unit of Management.
4 REFERENCES