An Bord Pleanála

Inspector's Report

Development:	**Dunkellin River and Aggard Stream Flood Relief Scheme**
Applicant:	**Galway County Council**
Type of Case:	**Application for approval under Section 175(4)(a) and Section 177AE(4)(a) of the Planning and Development Act, 2000 as amended**
Site Inspections:	**9th February and 25th October 2015**
Oral Hearing:	**27th and 28th October and 3rd November 2015**
Inspector:	**Mairead Kenny**

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INTRODUCTION

This is an application by Galway County Council (GCC) under section 175 of the Planning and Development Act 2000 as amended. Approval is sought to undertake works described as the Dunkellin River and Aggard Stream Flood Relief Scheme.

The application details included an EIS and NIS and were supplemented by further information presented following a request by the Board. All works will be undertaken by agreement with affected landowners and no compulsory purchase is involved.

The purpose of the scheme is to provide flood relief in the catchments of the Dunkellin River and Aggard Stream, which form part of the Dunkellin Drainage District. The relevant section of the Dunkellin River is between Craughwell and Kilcolgan villages in south Galway.

The Board is referred to all of the documentation on file.

I was assisted in the preparation of the further information request and during the hearing by Ms Teri Hayes who was appointed by the Board to report on hydrogeological aspects of the scheme. Her report is attached.

PROPOSAL

There are three distinct aspects to the scheme which may be broadly described as:

- Channel deepening and works to bridges between Craughwell and Rahasane Turlough, along the Craughwell / Dunkellin River (Zone 1)
- Two stage channel widening and works to bridges west of Rahasane Turlough, along the Dunkellin River (Zone 3)
- Channel maintenance and culvert replacement works along Aggard Stream.

No works are proposed in Zone 2 of the Dunkellin which encompasses the lands in the vicinity of and including Rahasane Turlough.

In more detail the scheme comprises the following elements, which are described in the Works Description Drawings, the EIS and in particular in the Tobin report of September 2014:

- Works to deepen 950m of the main river channel of the Dunkellin River in and to the west of Craughwell village – excavation will be between 0.6m and 1.0m depth
- Deepening of a Bypass Channel in Craughwell Village
- The above lead to a requirement for underpinning of the R446 Road Bridge, the Masonry Arch Pedestrian Bridge, the Bypass Channel Bridge and the Railway Bridge all of which are within Craughwell village

- No works within Rahasane Turlough (Ch.4247 – Ch.9426)
- Between Rahasane Turlough and Rinn Bridge works will be restricted to out of channel maintenance involving removal of terrestrial vegetation including trees, bramble and scrub
- Works to Rinn Bridge (Ch.4050) involving new flood eyes
- Out of channel maintenance works at Rinn Bridge and construction of two stage channel 20m wide for 100m at the bridge
- Other than removal of terrestrial vegetation, no works between Ch.3053 and Ch.3858 – the M18 is under construction at this location
- Construction of two stage channel 20m wide between Ch. 645 and Ch.3053 involving placing of embankment south of river (left bank)
- Works to Dunkellin Bridge involving replacement of flood eyes with box culverts
- Replacement of Killeely Beg Bridge and relocation of a salmon counter
- A drawing presented to the hearing revised Drawing no. 6408-2202-Rev G – clarified that a continuous embankment would not be constructed adjacent the Dunkellin for much of the land downstream of Killeely Beg Bridge
- For the 350m upstream of the N18 bridge – the floodplain is retained
- Further upstream to Ch1058 (less than 500m of river bank) there would be placing of spoil heaps to form a discontinuous embankment – Mr McDonnell stressed to the hearing that the original drawing showing a continuous embankment to the N18 was not clear as the proposal includes the area where no works are proposed and that the proposed spoil heaps are not water retaining structures but instead are simply a means of using excavated material not incorporated in the scheme
- For the length of the Aggard Stream works involve replacement of 14 culverts and channel maintenance
- The scheme includes an Environmental River Enhancement Programme prepared in conjunction with IFI and detailed in the Tobin report.

The scheme is stated to have been designed to maintain the existing hydrological regime at Rahasane Turlough SAC and to address a flood event of the scale which occurred in 2009. The estimated flood area which occurred that year is shown on drawing 6408-2201-Rev B. That flood is estimated to have been a 1 in 122 year event.

The works involve the excavation of about 70,000 m^3 of spoil which will be used where possible in the construction of embankments or spread in the vicinity of the scheme. The application drawings show the lands which are to be used for the spoil spreading. The location of access points for construction purposes are indicated on the application drawings.

Further details on the need for the scheme and its effects are set out in the assessment section of this report.

APPLICATION DETAILS

The following reports were included in the application received by the Board on 9th October 2014:

- *Dunkellin River and Aggard Stream Flood Relief Scheme – Description of the proposed works – Tobin report – this includes an Environmental River Enhancement Programme prepared in conjunction with IFI*.
- *Environmental Impact Statement (Volumes 1-3) – RPS – modelling undertaken included Flow Modelling and Salinity Modelling*
- *Natura Impact Statement - RPS.*

Submissions relating to the application were received from the following prescribed bodies and observers:

- Department of Communications, Energy and Natural Resources (DCENR)
- Department of Arts, Heritage and the Gaeltacht (DAHG)
- Geological Survey of Ireland (GSI)
- Inland Fisheries Ireland (IFI)
- Irish Rail (IR)
- Office of Public Works (OPW)
- Transport Infrastructure Ireland (TII)
- Bord Iascaigh Mhara (BIM)
- Clarinbridge Oyster Co-op / Michael Kelly Shellfish (referenced in this report as 'Kelly observation')
- Rahasane Turlough Shareholders
- Tom and Mary Forde.

The application was also referred to the following prescribed bodies:

- An Taisce
- Department of Agriculture, Food and the Marine
- Environment Protection Agency (EPA)
- Failte Ireland
- Irish Water
- The Heritage Council.

The Board issued a request for additional information on 2nd of March 2015. The applicant's response, which was accompanied by new public notices was received by the Board on the 10th of July 2015. This comprises two bound volumes and includes the results of additional surveys including geophysics and a draft construction management plan (CMP). It provides detailed written responses to the observations received.

Additional written submissions were received from the following prescribed bodies and observers:

- Department of Arts, Heritage and the Gaeltacht
- Transport Infrastructure Ireland
- Clarinbridge Oyster Co-op / Michael Kelly Shellfish
- Tom and Mary Forde.

A recording of the oral hearing is on the application file. A brief summary of the hearing is provided as an appendix to this report. Evidence to the oral hearing regarding the impact on shellfish is presented in more detail in the relevant section of the main report.

SITE CHARACTER AND CONTEXT

The area in which the works are to be undertaken comprises a rural area in south County Galway, to the south-east of Galway City and including the villages of Craughwell to the east and Kilcolgan to the west. Kilcolgan village is not directly affected by the scheme. The Dunkellin River is a major watercourse in the area with a total catchment of 373km^2. In the vicinity of the village of Craughwell to the point where it is joined by the Aggard Stream the river is known as the Craughwell River. It flows largely in an east to west direction entering Galway Bay at Kilcolgan. In the upstream area east of Craughwell village the Dunkellin is composed of a dense network of smaller streams which merge close to Craughwell. The other main tributary of the Dunkellin is the Aggard Stream which joins the Dunkellin downstream of Craughwell. This is a very small watercourse. In Craughwell village is a bypass channel which takes some flow from the Dunkellin in times of high water levels.

The site context is noteworthy in terms of the strategic road network. The former N6, the Loughrea to Craughwell to Galway Road (now the R446) remains of importance to the region. The N18 Limerick to Galway route passes through the west of the study area at Kilcolgan. The Gort-Tuam extension to the M18 is under construction and traverses the study area between Dunkellin Bridge and Rinn Bridge. At the time of my second inspection of the area at the end of October 2015, the M18 Bridge over the Dunkellin was nearing completion. The Gort to Athenry railway line passes through Craughwell, where there is a station.

In terms of topography the overall area is generally flat and low-lying and dominated by agricultural uses, particularly improved grassland. The landscape character would not be described as scenic except in the immediate vicinity of the Dunkellin, particularly at Dunkellin Bridge where there are a few cottages in the vernacular style. Dunkellin Bridge is a stone structure as is the old bridge within Craughwell village, which is particularly ancient and now in use as a pedestrian bridge. To the west of Kilcolgan the river opens in to the estuary. This area, which is not subject to works is the most scenic part of the area within which the scheme is sited and includes wide views of the estuary and views to a castle.

The area around the Dunkellin has a long history of flooding. In the middle of the study area and just west of Craughwell is Rahasane Turlough. The Dunkellin and Aggard Stream form part of the Dunkellin Drainage District constructed around 1857 which involved widening and deepening of existing channels and removal of bends and creation of new cuts. Its purpose was related to drainage of agricultural lands. A further arterial drainage scheme was undertaken in the early 1920s and 1950. Flooding has regularly occurred notably in 2015, 2009 and 2005. At the time the 2005 flood was a record event and then the 2009 exceeded that event.

The legacy of an earlier Arterial Drainage Scheme in the 1850s is that Rahasane Turlough is ‘canalised’ for a significant portion of its length. The channel bed at this location is relatively flat (1:3000) and in low flow periods the channel width is between 10m and 30m. In low flow periods the turlough appears as two basins. To understand its history it is useful to note that the northern of the two basins, which is described as Rahasane Turlough proper was formerly the natural sink of the Dunkellin River. The artificial channel in place since the 1850s scheme takes some of the water further downstream. The second basin is referred to as Rinn basin, which begins to flood when the main basin overtops which occurs at a level of 14.7mOD.

During times of flood the two basins merge to form a single body of water. Rahasane Turlough at its greatest extent is 350 hectares in area and about 4km in length and up to 1km wide. Rahasane Turlough is one of the largest in Europe and is considered of particular ecological importance as it is one of only two large turloughs which function naturally according to the Site Synopsis of the candidate

Special Area of Conservation (Site Code 000322). The dynamic nature of turloughs is noted by the applicant[1].

Downstream of Rahasane Turlough the Dunkellin flows to Rinn Bridge in a well-defined canalised channel formed in a rock cut for a significant portion of its length. The bed gradient at this location is steeper at 1:200 approximately. There is another tulough in the area, Dunkellin Turlough which is between Rinn Bridge and Dunkellin Bridge. At Killeely Beg Bridge further west again is a karst feature which contributes to flooding of properties in the vicinity – this is referred to variously as a spring / karst feature / Castlegar Turlough. Other karst features in the study area have been investigated and are shown on the application documentation. The Dunkellin west of Rinn Bridge is canalised for much of its length and flows are normally retained within the river channel which is up to 15m wide and with a gradient of about 1:300. The scheme affects a length of the Craughwell / Dunkellin of about 11km.

The Aggard is a very small stream which discharges into the Dunkellin about 1km downstream of Craughwell. It rises in Cregaclare townland and at this point is often described as the Cregaclare Stream. The Cregaclare merges with another stream the Monksfield River and continues to flow in a northerly direction to merge with the Aggard Stream. In all the study area concerns 7.5km of stream at this location. None of it is designated as a European site. The stream flow is impeded in a number of locations by field boundaries and local access crossings. Further to the north there are more structures such as concrete culverts in place.

Regarding the functioning of the river the Tobin report notes that some of the bridges restrict flows. During the 2009 flood event the bridges in Craughwell were noted to be significant hydraulic restrictions – these comprise the old stone arched bridge and 2no. flat deck concrete structures i.e. the main road bridge and the bridge over a Bypass Channel. The railway bridge in Craughwell is also noted to be an influencing factor on upstream flooding in the village. Rinn Bridge, Dunkellin Bridge and Killeely Beg Bridges also have insufficient capacity to cater for events of this magnitude. One of the flood arches at the stone bridge at Dunkellin Bridge is partly blocked with piles of stones and a parked trailer. Killeely Beg Bridge is a small stone bridge with a single arch while Rinn Bridge is a simple concrete structure with a central pier. The Tobin report also observes that the channels exiting Rahasane Turlough and Rinn Bridge have insufficient capacity to cater for such events as has the main channel downstream of the railway bridge in Craughwell.

There is a high level of rural residential houses in this area. The drawings presented with the application indicate the location of dwellinghouses and farmyards close to the river and distinguish between those which were subject of flooding in 2009 and those which were unaffected. The properties which flooded are located in four

[1] Section 9.3.4 of the EIS refers to part of Rahasane Turlough for example where there is evidence of change including collapse.

groups, within Craughwell village, at locations north of Rahasane Turlough, at Dunkellin Bridge and at Killeely Beg Bridge. More details on the flooding and impacts on material assets including homes, agricultural property and infrastructure are provided in the assessment section of this report.

Apart from its scenic and amenity value the bay into which the Dunkellin flows, Dunbulcaun Bay is of considerable importance on an economic, social and cultural level as part of the shellfish industry, particularly the oyster industry. Dunbulcaun Bay as the home of the native oyster supports a number of local commercial enterprises in the area, is part of the cultural and historic fabric of the area and is a strong part of the local tourist product. 'Morans The Weir' and 'Paddy Burkes' are well known premises in the area, which amongst others are intrinsically connected with the oyster industry. The Clarinbridge Oyster festival is long established and is now joined with another festival in Galway. The shellfish harvesting is stated to employ up to 150 people in the locality and to generate over €2 million per annum, mostly from export. The traditional focus on Native Oyster has spread in recent years to include significant increases in production of Pacific Oyster. In the outer bay there is also a wild clam fishery and in the area also there is harvesting of wild mussels, winkles and other shellfish. The Native Oyster stock has suffered in recent years in part due to the presence of the parasite *Bonamia,* which may have been brought in with oyster stock[2]. Growth in the industry in the amount of 40% is planned under 'Food Harvest 2020'. An application is being made to get the Clarinbridge Oyster listed in the EU Denomination de Origin.

Galway Bay in the vicinity of the scheme contains two European sites and Rahasane Turlough also is designated as a SAC and SPA. In the Dunkellin River and Aggard Stream there are a number of protected species including Lamprey (evidence for all three species), Salmon, Eel, Trout, White-clawed Crayfish. A number of other species of interest in relation to aquatic ecology are listed in the EIS and accompanying appendix, which provides a detailed description of the qualities of the habitat and use thereof by various species.

I attach photographs which were taken by me at the time of my inspections.

RELEVANT POLICY AND PUBLICATIONS

Galway County Development Plan 2015-2012

As set out in Chapter 8 the approach to flooding will be to avoid, reduce and/or mitigate, as appropriate in accordance with The Planning System and Flood Risk Management Guidelines 2009, the risk of flooding within flood risk areas. The plan indicates that in November 2009 337,000 hectares in the county were affected by flooding.

[2] I refer to page 26 of the book *Squires, Spalpeens and Spats – Oysters and Oystering In Galway Bay* which is lodged as part of the submission of Clarinbridge Oysters / Michael Kelly Shellfish.

A Stage 1 Strategic Flood Risk Assessment has been prepared for the County. This identifies flooding and surface water management issues that may warrant further investigation at plan level or at application stage. The report, which is presented as a background report to the GCDP 2015-2021 identifies the Preliminary Flood Risk Assessment Mapping for the county and includes a number of recommendations, which are incorporated into the GCDP. This document has regard to the EU Floods Directive and to the national *European Communities (Assessment and Management of Flood Risks) Regulations 2010 (S.I. 122 of 2010)* and to *The Planning System and Flood Risk Management Guidelines for Planning Authorities (2009)* issued by DEHLG and OPW. Figure AII.20 which shows the area covered by the scheme is attached.

Objective DS7 is to ensure that proposals for development in areas identified as at risk from flooding or which may exacerbate the risk of flooding elsewhere are assessed in accordance with relevant guidance and plans.

The Council will seek the improvement and/or restoration of the natural flood risk management functions of flood plains as part of its responses to flooding. The Council will continue to pursue flood mitigation.

Regarding the construction of embankments and similar structures the policy is not to normally permit them as they may increase the risk of flooding to property and land upstream. In exceptional cases such structures may be permitted in which case they should be design to minimise and / or compensate for any potential negative effects.

Dunkellin Bridge and Craughwell Bridge are protected structures.

The Planning System and Flood Risk Guidelines 2009

These acknowledge that flooding is a natural process which when it impacts on human activities can threaten people, property and the environment. Due to the uncertainty in relation to the potential effects of climate change a precautionary approach should be adopted.

Water Framework Directive

This requires the achievement of good status in all waters by 2015 – it applies to rivers, lakes, groundwater, estuaries and coastal waters. Prevention of deterioration of water shall also be achieved.

EPA Report on River and Lake Water Quality in County Galway 2013

Table 3.1 provides information on 'WFD river sites in unsatisfactory condition in County Galway'. The river station Kilcolgan is listed – for the year 2012 a Q value of 3 was recorded. The key pressures are 'unknown'.

Shellfish Water Directive

The aim of the directive relates to the improvements and protection of shellfish waters in order to support shellfish life and growth. The aim is to protect the aquatic habitat of certain species including oyster, mussels and clams. A requirement is the designation of waters that need protection in order to support shellfish life and growth by setting standards to be achieved in shellfish waters. The inner bay west of Kilcolgan is designated under the relevant regulations.

Marine Strategy Framework Directive

This requires that EU member states achieve good environmental status in the marine environment by 2020 at the latest. This means that seas are clean, healthy and productive and that human use of the marine environment is maintained at a sustainable level. A range of indicators have been identified for Ireland. This will be followed with programmes to achieve the required status.

Appropriate assessment guidance

Appropriate Assessment of plans and projects is required to ensure compliance with the Habitats Directive. National guidance on appropriate assessment is set out in the Department's publication Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities.

WRITTEN SUBMISSIONS

Observations received are summarised below.

Rahasane Turlough Shareholders Committee

A submission received on 24th November 2014 is accompanied by a petition signed by almost 400 people. The points made in the accompanying observation include:

- A flood relief scheme is needed and long overdue but we are opposed to the Council's attempt to fast track water from subsidiaries into the Dunkellin without having a plan in place to deal with this water
- The work from Rinn bridge to Kilcolgan is welcomed – the problem is the absence of work from Rinn bridge to Craughwell
- The fear is that this scheme may make our situation worse
- A derogation from the EU is required so that a proper plan can be put in place
- In excess of 20 homes have been flooded in the area and many roads blocked for more than six months at a time
- The plan is costly yet does not cater for the people worst affected – it should be rejected and a proper scheme prepared

- Enclosed are a number of photographs which show flooded houses in the townlands of Caherdevane and Caherfourvase, Craughwell.

Tom and Mary Forde

The main points of this observation include:

- The scheme fails to address the issues arising in relation to the Cregaclare stream which has affected the Forde's home at Ballyboy, Ardrahan for 25 years - flooding of the Ardrahan to Castledaly road and of houses has also occurred
- The EIS does not identify any reason why the recommendations of the *Cregaclare, Flood Protection Embankment and Drainage Channel to Aggard Stream* are not being implemented
- The first part of the above scheme involving construction of the Lackan embankment was carried out - it restricted the natural flood plain of the Cregaclare stream and resulted in higher flood levels
- The second part of the scheme was the regrading of the Cregaclare Stream to its confluence with the Monksfield stream
- The regrading of the Cregaclare was delayed pending an overall scheme and the submitted scheme fails to address stream bed deficiencies but only to replace existing culverts, which will have little or no impact on Ballyboy
- The scheme fails to address a large area within the study area
- An oral hearing is requested
- Enclosed drawings of the 2001 scheme.

Irish Rail

The submission dated 21st November primarily concerns the detail of works at Craughwell River Bridge. Site investigations and more detailed design consideration is required. With respect to underpinning of this bridge to pass the Design Flood Flow it is not clear whether it is the 100 year November 2009 or the 100 year plus 20% flood. Pre and post comparisons use the November 2009 flood peak at 84.8 m3/s. The velocities are stated to be significant with potential for increased scouring post drainage works. GCC will demonstrate how to mitigate this. At Aggard Stream there is a need for agreement on the detail of replacement culverts.

National Roads Authority / Transport Infrastructure Ireland (TII)

The Authority's submission dated 17th November 2014 refers. The scheme does appear to have fully considered the potential impacts in particular in relation to the bridge over the Rack Stream. Referring to the river widening and bund construction,

which extends to the east end of the bridge scour protection measures are required. A full investigation is required of the adequacy of the existing structure to resist proposed new hydraulic forces and scour prevention measures need to be identified. The approved M17/M18 Gort/Tuam strategic road scheme needs to be safeguarded.

Office of Public Works

The submission dated 6th November 2014 notes its input into the project on an ongoing basis - no further submissions are offered in relation to the EIS or NIS.

Bord Iascaigh Mhara

In the submission dated 24th November 2014 the following comments are made:

- The works are likely to have a deleterious effect on the shellfish industry in the area which is currently worth €877,000 locally and employs 40 people
- Legislation requires that the quality of the waters is protected and enhanced
- The area is also home to one of the few remaining native oyster (*Ostrea edulis*) beds in the country as well as maerl and *Zostera* beds
- Despite efforts to prevent movement of silt downstream from several previous drainage works in the area serious siltation of oyster beds has occurred
- The additional volume and speed of fresh water entering the bay is of concern - a reduction in salinity in significant areas of the inner bay is likely which would have an effect on native and Pacific oyster populations, which are sensitive to decreases in salinity – especially due to *Bonamia ostreae*
- The extra speed of influent fresh water will also facilitate the carrying of extra suspended solids which will lead to extra siltation in the inner bay and is likely to further impair viability of native and pacific oyster beds and may also have the effect of carrying additional *E.coli* which would further worsen the bay's shellfish classification or of norovirus which would cripple the industry
- Additional measures need to be taken to ensure no extra pressures are put on this environmentally sensitive area
- This might include construction of holding ponds to divert fresh water from direct entry into the bay at periods of high rainfall, while also allowing for settlement of suspended solids – diverted waters could be released in a controlled way when freshwater inputs were lower
- The attached map shows the location of areas designated for Mussels, Oysters and Sea Urchins.

Department of Arts, Heritage and the Gaeltacht

Report dated 21st November 2014

The archaeological recommendation is as follows:

- All of the archaeological mitigation measures detailed to be carried out in full and included as conditions
- The applicant shall engage a suitably qualified archaeologist to monitor all riverbed and bank disturbance and the monitoring shall be licensed
- A detailed method statement shall accompany the licence application
- Should archaeological material be found work may be suspended.

The nature conservation comments are as follows:

- There is a lack of clarity about the objectives of the scheme and it is noted that further alternative and further localised measures may be required in the area of Rahasane Turlough

- Further information is required with respect to the project description, mitigation effects and cumulative or in combination effects

- It is unclear whether all lands required are assessed in the EIS and NIS

- Cumulative or in combination effects may arise from the N18/M17 road scheme - other plans and projects require consideration

- The nearby European sites and their qualifying / special conservation interests are noted

- A key concern relates to the impact of the scheme on the structure and function of Rahasane Turlough as a Turlough and Annex I priority habitat

- Scientific information to support the analysis that the hydrological regime of Rahasane Turlough will not be affected is not presented in the NIS– DAHG does not have expertise to advise the Board in this respect

- Other comments made refer to the assessment of impacts on otter, bat surveys, effects on otter holts and white clawed crayfish and on turloughs outside European Sites, bird surveys, lands for spreading, effect on mudflats and other Annex I species in relation to which the Department considers that limited information and assessment is provided in the EIS

- The potential for impact on downstream designations from the changed hydrodynamic regime – further information is required to examine the potential interaction with Annex I habitats *Mudflats and Sandflats not covered by seawater at low tide* and the noted communities in vicinity including *Intertidal sandy mud community complex* which might include some Reef habitats. The potential change to these habitats must be examined in terms of increased water flow, potential greater throughput volumes and the changed constituent load of the existing water.

- Mitigation measures are deficient in relation to requirements relating to the fish counter, handling concrete, fisheries enhancement, lands to be replanted, timing restrictions and how conflicts can be resolved.

Clarinbridge Oyster Co-op / Michael Kelly Shellfish

The main points of this submission include:

- Consideration of downstream impacts in the application was completely inadequate considering the impact of such works and the impact of similar works on shellfish in Dunbulcaun Bay
- The bay area is classified under the EU Shellfish Waters Directive
- Shellfish maps did not show the Oyster Fisheries Orders, the dominant form of licensing of shellfish production in the area - Figure 1 enclosed refers
- Impacts on the designated European Sites have also been ignored
- Dunbulcaun Bay is long recognised as the home of the Clarinbridge Oyster
- EIS omits the managed wild clam fishery in the outer bay
- There are two main commercial entities in the Clarinbridge area namely Clarinbridge Oyster Co-operative and Michael Kelly Shellfish Ltd
- The fishery was wiped out in the 1990s after drainage work was undertaken on the Dunkellin when suspended solids settled on the oyster beds – the mussel population was also adversely affected
- The remaining population succumbed to the *Bonamia* parasite only recovering in recent years in the inner bay
- Development of a Gigas oyster industry has been actively pursued for the last 16 years and would be significantly affected by a reduction in water quality
- Kelly oysters are very high quality and supplies restaurants around the world
- The company employs 10 staff and purchases shellfish from up to 100 locals
- Impacts are addressed under headings of salinity modelling, condition of the fishery, impact of the previous works undertaken at Rahasane and Clarin River, existing water quality issues.

Salinity modelling is considered in the report of Numerics Warehouse Ltd prepared by Dr Marcel Cure. The shortcomings in the model setup are identified as:

- Horizontal model resolution unknown, vertical mixing scheme unknown, lack of clarity regarding whether there is a grid scale horizontal diffusion

- Accurate bathymetry is critical – was LIDAR used - if other data used it may be very old and not relevant – was the Shannon plume included

- Have any temperature / salinity variations at the boundaries incorporated – has a wetting-drying scheme been included and what is the minimum depth

- What initial conditions were used and was a realistic temperature / salinity distribution used and if so based on what data

- How long was the model spun up for before generating data and were 8 tidal constituents included at the model boundaries as would be expected

- How was the model forced – was wind stress, heat fluxes and precipitation used for a weather model and how often was it updated – if the 2009 event was not subject to surface forcing model results are not likely to be accurate

- The biggest omission from the salinity modelling is the lack of model validation against measured temperature and salinity data – without proving that the model is able to properly reproduce a few weeks of measured data it is of little worth – we recommend that at least two calibrated self-recording temperature-salinity recorders are deployed for a minimum of 1 month (two spring-neap cycles) in the Dunkellin estuary be used for model validation – the report should show a comparison of the model results against this data and then some regression statistics to quantify the model's accuracy – without proper validation we do not know the errors and results must be disregarded

- Modelling the 2009 period is a good choice but probably does not represent the most onerous conditions affecting the oyster beds due to the increased riverine discharge – the scheme will result in a higher initial pulse of freshwater which will affect the circulation of freshwater in the estuary – selection of periods from when there is a strong and sustained west or north-west wind which would hold up freshwater in the estuary would be appropriate – such conditions are not uncommon – a range of different conditions should be modelled –selecting one period only is severely limiting to the conclusions of the report – the selection of the periods to model could be taken from the last 30 years when there was a combination of significant rainfall and wind from different directions, speeds and stages of a spring-neap tide

- The specification of the oyster beds in the model is reproduced in Figure 3.5 – this shows the locations chosen for detailed analysis as denoted by the red hatched area but only one area was chosen for detailed presentation of a time series of salinity in the report – the actual area of fisheries is quite different however and in particular the salinity modelling does not represent the wild oyster farmed areas or the areas around Mweenish island – a there is considerable variation in seabed salinity between these varied sites and the EIS should show this

- No attempt has been made to quantify the suspension and transport of sediment along the Dunkellin into the estuary – once the clays and silts reach higher salinity water they will quickly fall out of suspension and this is likely to occur where the oyster beds are

- Regarding section 11.6.1 of the EIS – how is the assessment of 'long-term neutral' justified when it comes to the transport of sediment into the estuary – the modellers should show how much extra sediment will be deposited during construction and the likely mortality that will result

- The statement that the time to peak flow will be reduced from 95 to 93 hours and that there will be less than a 1% increase in the rate for the equivalent 2009 event is noted – no curves are shown from their model to show how the volume flux changes with time for the 2009 event or a comparison of the pre and post construction regimes – in particular what is the duration of the slightly increased rate – is it for much longer than for the pre-construction modelled event – a sustained high rate of flux into the bay could transport significantly more sediment and freshwater to the oyster beds and this should all be modelled

- Regarding the suggested approach to sediment modelling the sediments in the river courses need to be characterised – then the critical shear stresses required to resuspend the sediments should be calculated – in addition the quantity of lose matter which will enter the river courses during construction will have to be estimated property and the locations of these extra inputs estimated – once these steps are achieved the transport of all of the sediment into the estuary can be modelled for peak river flows due to different rainfall scenarios such as the 2009 event for both the construction phase and during 2, 5 and 100 year return events

- Sediment transport models should have been used – that would show where the sediments will be deposited and will include all effects such as wind and tides

- In conclusion the salinity model is not well founded or the range of conditions modelled not wide enough – we cannot endorse the conclusions of the modelling study – the modelling study should be conducted again following a proper measurement campaign.

Marine Institute

The submission from the Marine Institute prepared by Dr Oliver Tully includes the following comments:

- The marine communities are not properly mapped – the NPWS maps of 2013 show the presence of seagrass and maerl habitats that are sensitive to changes in salinity and in particular to increased turbidity and siltation

- Native Oyster is listed as a constituent species of sedimentary habitats in the area – changes that would detrimentally affect Native Oyster or other marine species in these habitats and the structure and function of these marine communities would be contrary to the conservation objectives for these communities

- The role of Native Oyster and oyster beds in the ecology of marine communities including in relation to the provision of a solid surface for settlement by other species, provision of cryptic habitat to serve as nursery ground for small fish and other species and stabilising of sediments which may reduce shoreline erosion and by filtration of large quantities of water maintain good light penetration to the seabed. A high degree of certainty with respect to avoidance of risk to Native Oyster is appropriate given the unique contribution of the species in the marine communities that are now subject to conservation objectives.

- Changes in salinity and siltation following drainage of the Dunkellin should be assessed in relation to the distribution of marine communities shown on Figure 1 below

- The oyster beds are mapped annually by the Marine Institute – the main beds are between Eddy Island and Dunbulcaun estuary and maps from 2011- 2013 refer

- Native Oyster is in decline in Europe and in Ireland is mainly concentrated in Tralee Bay (90% of National biomass) – due to its limited distribution the species is at risk in Ireland

- Annual recruitment to oyster stocks is affected by the temperature, salinity and substrate conditions which are not suitable every year – any change in conditions (temperature, salinity, siltation) that would reduce the frequency of recruitment would put the populations at further risk

- For oysters the critical issues are the change in duration of exposure to critically low salinity or sub optimal salinities resulting from increases in freshwater discharge rates in general and exceptional conditions and increased siltation resulting from increases in suspended solid loads in freshwater discharge waters which will settle out when reaching lower flow conditions in the inner bay

- The scientific literature on these parameters is not considered other than in terms of the letter from Dr Cave which mentions a critical level of 12 ppt for salinity but is not specific about native oyster – there is a lack of a critical risk analysis and additional analysis is required

- The salinity modelling is limited to a single scenario while the EIS notes that each particular flood event will have a different potential impact depending on the phasing of tidal cycle and the EIS notes that the comparative study noted only one such event

- It is necessary to consider the additional scenarios in particular the salinity distribution during average flow conditions before and after drainage – different meteorological conditions should be modelled

- No modelling of changes in suspended solids transport resulting from increased discharge rates is considered – increased transport of solids is probable if the flow rates are increased by the scheme – modelling of changes in siltation of marine habitats should be undertaken

- Drainage works on the Dunkellin upstream of Rinn bridge in summer 1992 caused significant short and long term damage to shellfish stocks in the bay

- Short term impacts were high levels of silt and organic loading which when combined with increased flows and lowered salinity levels led to the complete destruction of shellfish in Dunbulcaun Bay

- Reference to other schemes including south of Loughrea recently which had the effect of severe canalisation of the river leading to extreme flood and drought events and during which significant oyster mortalities occurred

- No aspect of the scheme proposed prevents a similar occurrence

- The long-term impacts of these drainage works (Dunkellin 1992) altered the flow regime and lead to changes in the speed and pathways transfer – the works resulted in peak flows being increased by 100% and similar trends in salinity with far greater ranges evident post-1992

- Under the scheme silt will be re-suspended in extreme flow and bacterial and viral contaminants will reach the shellfish beds in a matter of hours – in this regard the WWTP at Loughrea and other sources are listed

- Water classification has dropped from A to B and there is a strong likelihood of it declining to C – the scheme would exacerbate an already acute problem by increasing transfer rates of microbial pollutants into the bay with major commercial significance

- In addition to the Shellfish Water Directive the works are contrary to the objectives of the WFD and the MSFD. The project is not compatible with the aims of these directives.

Inland Fisheries Ireland – submitted under cover of Department of Communications, Energy and Natural Resources

The main points of this observation include:

- The coastal and estuarine waters need to be protected so that they do not impede through physical or chemical means the movement of salmon, eel, trout or lamprey
- The fisheries resource also includes the designated shellfish waters
- The primary concern relates to possible interference with salmon, sea trout or eel movement as well as deterioration of water quality within the catchment and the shellfish waters of the estuary during the works
- Potential effects of sedimentation are noted including smothering of fish eggs, fish mortality, interference with food and movement of fish, prevention of flow of water through the oysters that permits respiration, feeding and removal of water – decrease in salinity of the waters could also affect the survival, growth and shell properties in juvenile oysters and causes losses in oyster and mussel areas
- The Dunkellin is assigned 'poor' status under the Water Management Unit Plan and the marine waters is 'good' for the coastal waters and 'moderate' for the transitional waters – these status classifications however do not reflect monitoring data from these particular waters but are extrapolated
- Under the Shellfish Directive and Shellfish Water Regulations the development of Pollution Reduction Programmes is required for designated shellfish areas
- There are water quality issues related to *E.Coli* which have resulted in downgrading of water classification
- No in-stream works should occur between October 1st and April 30th to protect spawning salmonoids
- The contractor should ensure that dredging and placement of material is undertaken in a single operation over the shortest possible period within weather constraints
- Control of invasive species needs to be ensured
- Free passage of fish shall be ensured and clear span structures put in place where possible and after consultation with IFI
- Diversion of the 350m of the Craughwell river through the Bypass Channel will require fish de-stocking and prior consultation with IFI is advised

- Activities which disrupt fishing and angling activities need to be controlled to minimise impacts and access to waters needs to be maintained
- Consultation on the proposed relocation of the fish counter is required
- The proposed Environmental River Enhancement Programme (EREP) is to be confirmed in detail and should include baseline and post-work fisheries surveys to gauge the effectiveness of measures
- Matters are to be agreed prior to construction between IFI and the contractor including pollution mitigation measures, pollution incident reporting mechanisms and Emergency Response Plan and a water quality monitoring programme.

Geological Survey of Ireland – submitted under cover of Department of Communications, Energy and Natural Resources

The submission identifies Rahasane Turlough as a Geological Heritage Site. The submission references the various datasets available and requests that the GSI be notified of any geological heritage site or karst data and details of site investigations.

Further comments – received subsequent to the significant further information

TII

In a submission dated 28th August 2015 the following points are made:

- The Authority remains seriously concerned that the issues are unresolved.
- The M17/M18 under construction needs to be safeguarded.

In a submission dated 17th September the above comments are re-iterated. The Authority does not propose to be represented at the oral hearing.

Tom and Mary Forde

The applicants submission on the decision not to regrade the Cregaclare Channel is is contradicted by the report of Jennings O'Donovan 2001 and the Tobin report 2010 and by previous reports prepared by RPS. The Cregaclare Stream contributes just 1.6% of the predicted flow rate through Rahasane Turlough and taking into account the predicted difference in surface water profile at that location arising from the scheme (Table 6.4 of Tobin's report 2010) there is no justification to omit the regrading of the Cregaclare Channel as previous proposed. The stream needs to be re-graded to ensure access to the Forde's house and other houses is maintained and to ensure access to Ballyglass School does not require a detour of several kilometres in times of flood. The extent of road closure is shown on a map.

Department of Arts Heritage and Gaeltacht

The main points of this submission are:

- Need to ensure archaeological monitoring which shall comprise engagement by the developer of a suitably qualified archaeologist to undertake monitoring under licence, application for licence to be accompanied by specified details, suspension of works if necessary and report of monitoring to DAHG on completion

- Regarding nature conservation the site context includes 4 no. named European sites and there are linkages with another (Creganna Marsh SPA is used by Greenland White-fronted Goose population of Rahasane Turlough SPA)

- The further information does not contain any significant additional ecological information or scientific analysis

- Regarding the full extent of the project a number of matters should be taken into account including whether there is sufficient information regarding likely effects of all parts of project as itemised, whether there will be a need for future consents taking into account all parts of the project and potential changes at detailed design and in combination effects, whether the mitigation measures are demonstrated to be effective, whether residual effects can be established and their implications for conservation objectives established, whether precise conclusions can be reached in relation to the implications of the project for Rahasane Turlough cSAC in particular

- In addition all effects should be considered including the effects on natural habitats and protected species and wetlands particularly turloughs inside and outside designated sites, Otter, White-clawed Crayfish, Lamprey, Salmon, on river floodplains and estuarine areas, on semi-natural grasslands, on karst features and associated habitats

- In relation to Annex I marine habitats the information requested is still outstanding.

Clarinbridge Oyster Co-op / Michael Kelly Shellfish

The comments of Clarinbridge Oyster Co-op / Michael Kelly Shellfish (c/o Mary Mullins) include:

- As advised at a meeting on 6/3/2015 Dr Cave has never worked in Dunbulcaun Bay and was not present when the modelling techniques used to examine the impact of the scheme on Shellfish and salinity in Clarinbridge Oyster Fisheries

- The Co-op does not agree with RPS or NUIG on their findings

- In 1994 an unauthorised drainage of the Rahasane Turlough almost devastated the native oyster stocks

- Four years later a flood relief scheme on the Clarin was carried out without any consultation
- In 2013-2014 we suffered the loss of a large stock of saleable oysters due to freshwater and silt flowing from the Clarin
- An area of the Fishery is now silting up and is unusable
- Five years ago the Clarin was adjudged the dirtiest river in Ireland and this has not changed
- The SFI indicates that areas not included in the main scheme will be considered for remedial flood relief, which is of concern to us
- Remedial works going on in the south Galway area over the last few years (Athenry, Loughrea, Ardrahan) are only learnt about in the newspapers and are causing damage to the Oyster Fisheries through pollution from land and wastewater treatment plants and in the case of Ardrahan have contaminated the local water supply
- The Dunkellin River is no longer clean according to the EPA and if the scheme goes ahead how will the control of silt be achieved
- particularly what will be the contingency plans to deal with errors or accidents during flood relief work
- the report of OPW on the South Galway Flood Study 1994 / 95 which warned about construction in flood plains was ignored and pollution from septic tanks and wastewater treatment plants finds its way down the Clarin and Dunkellin into the Clarinbridge Oyster Fisheries
- Once Class A Shellfish Industry has been polluted and is now downgraded to a Permanent B
- There is an obligation on the state to maintain a Class A Shellfish water as A and the Clarinbridge Oyster Co-op Society has worked hard to maintain the native and Gigas Oyster Fishery but this is becoming increasingly difficult due to pollution from houses, flood relief schemes and agricultural pollution and we are not getting the necessary support form state or public bodies
- The Clarinbridge Oyster is world famous and supports two annual festivals
- The scheme will result in the fisheries being wiped out.

An enclosed newspaper cutting dating to February 2015 refers to the publication by the EPA of three Integrated Water Quality Assessments for 2013. In the Western

River Basin District only Clarinbridge and Kilcolgan Rivers in Galway displayed 'less than good' compliance standards.

An independent wide ranging study should be carried out to establish the baseline conditions to model the Inner Bay under various scenarios in view of the level of concern amongst the shellfish fishery community. The conclusions of RPS that the salinity levels would experience minimal effect due to the scheme for Nov 2009 event is not accepted and the modelling is flawed as set out in the report of Numerics Warehouse Ltd.

Further detailed comments are made in response to the applicant's submissions – these were re-iterated in the oral hearing.

Applicant comment

By way of a letter dated 21st September the applicant requested an adjournment of the oral hearing in order to resolve issues prior to the hearing (including submissions of TII) thereby shortening the duration of the hearing.

ASSESSMENT

I propose to consider this application under the following headings –

1. Planning assessment
2. Environmental Impact Assessment
3. Appropriate Assessment
4. Mitigation, monitoring and conditions.

PLANNING ASSESSMENT

I consider that the key issues in this application relate to:

- the benefits and limitations of the scheme
- the impact on the marine environment and in particular on shellfish
- the impact on Rahasane Turlough.

The Planning Assessment below sets out the benefits and limitations of the scheme. It essentially examines the principle of the development and whether the scheme design is generally appropriate.

The specific matter of the impact on shellfish and the marine environment remains subject of most concern after the hearing and is also.

I address the impact on Rahasane Turlough under the Appropriate Assessment section of this report. Rahasane Turlough lies in the centre of the scheme and the Dunkellin River flows through it. It is the country's second largest turlough and is a SAC and SPA.

Benefits and limitations

The scheme is not explicitly listed in the County Development Plan. However I consider that the policy context in general is not unfavourable. There is a general reluctance to construct embankments in view of the possible contribution to upstream flooding. As will be evident later in this report, the scheme is demonstrated not to add to upstream flooding and in this context I consider that the scheme accords with the prevailing policy.

The applicant states that the scheme has been considered thoroughly and I note that it has been through various iterations. The scheme before the Board is significantly modified compared with earlier designs. The engineering evidence and other submissions before the Board make it clear that the scheme has limitations and benefits and that overall the scheme can be justified.

I note the applicant's comments particularly as presented to the hearing by Mr McDonnell in relation to scour protection to bridges, reduced emergency costs and recreational benefits in addition to the main benefits being reduction in water levels in specified areas. The main objective relates to protection of property. Benefits to lands are a welcome consequence of the scheme, but not its purpose.

The application drawings indicate the location of houses subject to flooding including in November 2009[3]. In all 21 homes were affected by flooding or risk of flooding. The event is estimated by OPW to have been a 1 in 122 year event. The houses are in four groups.

1. Within Craughwell village three houses at the R446 road bridge were inundated. Two commercial properties were flooded. These buildings are grouped in the centre of the village, which is generally on elevated lands except at the bridge which is low-lying. A flood depth of up to 1.0m was recorded. The area flooded was 1.2 hectares. The R446 was closed for 4 days.

2. At the northern shore of Rahasane Turlough a number of one-off houses were flooded by up to 0.5m. These houses are positioned both sides of the county road. Water level reached 18.9mOD. The Kilcolgan Road was closed for 10 days.

3. In Dunkellin townland houses were flooded to a depth of 0.85m. The location of these houses is not clear from the relevant drawing 6408-2201 but I infer from other submissions that they are to the north-east of the bridge and two houses were involved.

[3] Drawing No. 6408-2201 Revision B. Pages 19 to 23 of the Tobin report describe the 2009 event and includes aerial photographs.

4. The final group of buildings subjected to serious flooding is at Killeely Beg Bridge. The map shows a very large grouping of buildings at this location. The Board is advised that a number of these buildings are agricultural sheds. Three are old two storey farmhouses, one is a bungalow and there is another house also. The Tobin report states that 'a total of five dwellings were threatened by flood waters ….when the Dunkellin River broke its left bank and travelled along what appears to be the natural contour of an old channel'.

Although it is outside the scheme the Forde observation concerns a fifth area which is prone to inundation during extreme events and that is the Ballyboy area to the south where the Cregaclare, the upper reaches of the Aggard Stream flows. The Forde observation refers to the limitation of the current scheme and the exclusion of the Cregaclare channel. As the Fordes made a valid observation and attended the hearing I address this area also. I refer also below to the impact on agricultural lands and comment on the potential for downstream flooding being exacerbated.

Further information submission

The applicant was requested to outline by way of additional information the benefits of the scheme in terms of effects on material assets. The response includes Drawing 6408-2300 which shows the properties to be protected from a flood event with a return period of 1 in 100 years. This drawing shows the benefiting lands outlined in green hatching. I have prepared some copies of this drawing magnified by 400% showing the three sections of benefiting lands. These are at Craughwell village, Rinn Bridge and Killeely Beg Bridge. The Board is referred to the close alignment between the red and blue lines for much of the lands in the vicinity of the scheme – these lines show the flood extent before and after the scheme.

Craughwell

It is in the vicinity of Craughwell village that most benefit clearly arises. For an event similar to the November 2009 event the scheme would reduce water levels by 1.19m in Craughwell. A major benefit of the scheme is that is ensures free passage along the R446 as well as protecting a number of properties which have been prone to regular flooding. Closure of this road requires diversions of up to 10km.

The road is particularly vulnerable to disruption even during less extreme flood situations. The hydraulic controls within the village are identified in the Tobin report as comprising four bridges and a bypass channel, the effectiveness of which is limited as it is incomplete. The design of one of the bridges clearly impedes water flow. I am satisfied that the scheme design for this area, which focuses mainly on channel deepening is reasonable and is warranted.

The bridges in the village centre include historic structures, which are likely to be prone to flood damage. Under the scheme all will benefit from scour protection measures which are also part of the scheme.

I am satisfied that the scheme presented would be a significant benefit to Craughwell village and environs in terms of the protection of rail and road infrastructure as well as commercial benefits to Craughwell and the protection of individual properties.

Effect on lands north of Rahasane Turlough

The applicant acknowledges that the channel and Rinn Bridge west of Rahasane Turlough restrict water flow significantly. The failure to resolve all potential flooding issues in this area is the subject of the observation of Rahasane Turlough Shareholders and a petition signed by 400 people. The applicant acknowledges that this area is not fully addressed. The provision of access to these houses by way of Rinn Bridge will be protected.

The Board may wish to consider whether the scheme could be amended so that it provides greater flood relief in the area. I set out some considerations below.

The applicant states clearly that due to environmental constraints around the Rahasane Turlough and the requirement to maintain winter flood levels there is no feasible engineering solution to offer 100 year flood protection to six homeowners on the northern edge of the Turlough.

Ms Hayes refers to the significant additional benefit which would have arisen from a scheme involving channel widening between Rahasane Turlough and Rinn Bridge. Lowering of the peak flood level of Rahasane Turlough to 15.7m would have provided flood relief to a number of additional houses north of Rahasane Turlough. This was addressed in the additional information request and during the hearing. The applicant's submission is that the maintenance of the area of the European Site is necessary in order to ensure that the scheme does not adversely affect site integrity. I agree with this conclusion and further address the basis for so concluding in the Appropriate Assessment section of this report.

Based on the available data I agree that the conservative approach taken, which remedies only some of the issues arising is necessary in this case. A solution for some houses will have to be resolved on a case by case basis, possibly through construction of measures within / bounding those individual properties or indeed through re-location. The Craughwell to Kilcolgan Road will remain liable to flooding also during extreme flooding.

Finally I note the reference in the observation of Rahasane Turlough Shareholders Committee that the scheme will 'fast track water from subsidiaries without having a plan in place to deal with this water'. I consider that the submissions on file including the comments of OPW to the hearing demonstrate that the effect on downstream flood levels is neutralised by the greater available storage and has to be considered in the context of the area of Rahasane Turlough. There is no overall increase in water volume. Regarding the works to Aggard Stream there is no perceived change in the quantities of water expected to discharge to the Dunkellin. At Rahasane Turlough the water level increase predicted is of the order of 5mm, which has to be

considered negligible. I consider that it is demonstrated in the applicant's submission that the scheme would not give rise to significant consequences for downstream properties by reason of increased flooding.

Dunkellin and Rinn Bridges

In the vicinity of both bridges there are benefiting lands. The captions on drawing 6408-2300 states 'Rinn Bridge passable during flood conditions' and 'Properties at Killeely beg and Dunkellin Bridge protected by channel widening and flood embankments'. The maintenance of free passage at Rinn Bridge and Dunkellin Bridge will benefit the local community and agriculture. Two houses at Dunkellin Bridge will be relieved from flooding.

Killeely Beg Bridge

I have referred above to the number of non-residential buildings at this location. The extent to which the scheme addresses the flood risk of the large cluster of buildings at Killeely Beg Bridge is addressed in section 3.1 of Ms Hayes' report.

Section 9.4.2.5 of the EIS states 'The new embankment may prevent surface runoff of flood waters into the river which may *extend*[4] the duration of flooding at this location'. The additional information[5] presented by the applicant clarified that there is a karst feature at this location, which contributes to flooding. In existing conditions the applicant notes that the land and field boundary walls in place now prevent the groundwater from overflowing to join other springs before ultimately discharging to the Dunkellin – thus a pond is formed. The question therefore arises as to whether the placing of an embankment could trap groundwater which presently travels across land into the river[6] and could the extent of the flooding widen?

Mr McDonnell indicated that the pond is within a localised depression of land that allows water to move downstream towards the N18 and the embankment proposed extends only 600m downstream of Killeely Beg Bridge in any case. The applicant made it clear that the contribution of groundwater at this location is small relative to the main source, which is the river. The scheme design does incorporate an open toe drain / swale at the base of the embankment, which will minimise risk through conveyance of groundwater or surface water away from the pond and to the main channel. Groundwater pumping will be utilised if necessary.

[4] My emphasis.

[5] Page 36 provides a good description of this karst feature.

[6] The further information states 'there appears to be an overflow channel from the pool which flows north into the river' and 'when the hydraulic head in the aquifer is sufficiently high the water from the pond will rise to overflow down the channel into the river'.

I submit that the extent to which the scheme resolves the problems experienced by householders at Killeely Beg Bridge is not clearly stated in the application documents. However, as the embankment will prevent overland flow from the Dunkellin I agree with the conclusion presented by Ms Hayes, that there will be a significantly improved flood protection for residents (and for farm holdings) in this area. Elimination of flooding of farm-holdings is welcomed including in the interest of protection of water quality in the river and bay.

In conclusion, the scheme will alleviate the extreme flood events at Killeely Beg Bridge which are related to overland flow from the Dunkellin through the protection provided by the embankment. The scheme will also ensure that time is available to react to any extreme flood events and undertake any emergency measures.

Ballyboy – Cregaclare Stream

Regarding the road infrastructure the vulnerability of a minor road at Ballyboy was subject of significant concern to one observer. Previous flooding of the county road had separated the Fordes home from their farm lands for weeks, resulting in considerable nuisance and costs and had required significant diversions by pupils and teachers of a nearby school for weeks on end. The written submissions refer to the previous studies undertaken which included proposals that the Cregaclare be re-graded as part of the overall Dunkellin scheme. The Board is advised that the table referenced does not in fact relate to the application, but to an earlier scheme now discounted.

During the course of the hearing, but in parallel discussions, the Fordes came to an agreement with Galway County Council regarding works which would be undertaken to the relevant section of county road and the observation was withdrawn. I refer to the observation and the response of the applicant for completeness only. The road upgrade agreed between the observer and the Council are outside the scheme and not relevant to the decision of the Board.

Agricultural lands

Finally, it is noted that while the scheme will reduce flooding of some agricultural lands that is not its main purpose. In fact between Ch0 and Ch1058 approximately the floodplain is to be retained as the embankment along the downstream stretch close to Kilcolgan Bridge will be discontinuous. Drawing 6408-2300 shows that the established patterns of flooding in this area will remain.

The scheme design provides for climate change in accordance with the Flood Guidelines. The channel widening and deepening are designed in addition to take the faster conveyance of water from the Aggard Stream and to cater for future works which might be undertaken upstream of Craughwell. There are no plans for any such works at this time and consideration of matters including Appropriate Assessment would be first required.

Conclusion

My conclusion is that the scheme benefits are significant in relation to Craughwell, Rinn Bridge, Dunkellin Bridge and Killeely Beg Bridge. Otherwise, the scheme due to its conservative nature will not alter the hydrological regime for much of the area and will not resolve many issues.

I note that the applicant presented a cost benefit analysis. The Board is referred to the document presented by Mr McDonnell during the hearing, which indicates a benefit to cost ratio of 1.26. The overwhelming financial benefit arises from residential benefit.

I do not consider that the adequacy of the scheme should be to the forefront of the Board's consideration. That is largely a matter for the scheme designers to consider in my opinion. However, the merits of the scheme are relevant in terms of the Board's decision insofar as the Board may wish to weigh the positive effects against any negative environmental impacts. The benefits of the scheme have also been queried by Clarinbridge Oysters. It is for these reasons and to give context that I have presented the above.

Marine Environment – Shellfish and other receptors

The Dunkellin enters Galway Bay at Dunbulcaun Bay which is part of the Clarinbridge/Kinvara classification under the EU Shellfish Waters Directive. The receiving environment includes European sites, a high value shellfish industry focused on oysterbeds and other habitats including *Zostera* beds and intertidal bird feeding areas which are specifically considered in the various submissions of the third parties and applicant. The dominant form of licensing of shellfish in the area is Oyster Fishery Orders, a map of which is in the 'Human Beings and Material Assets' Chapter of the EIS. Dunbulcaun Bay is influenced by the Dunkellin and Clarin rivers.

The direct and indirect benefits of the shellfish industry to this area and to the wider economy are well established in the submissions on file and are set out earlier in this report. The potential for impact on the industry and the adequacy of the applicant's assessment of this matter constituted the main issue of dispute in the hearing. The industry has been adversely affected by previous schemes and the existing water quality presents major challenges.

In considering the above I outline the likely effects on the receiving environment. This is relevant also to the Appropriate Assessment section below.

<u>Observers concerns</u>

A substantive issue in this application relates to dispute between the applicant and observers regarding the adequacy of the information presented.

For the Clarinbridge Oysters Co-operative / Michael Kelly Shellfish the substantive matters are:

- Disagreement over certain conclusions of the flow modelling
- Approach to salinity modelling
- Lack of any sediment modelling.

In the context of the above the scheme was considered to be detrimental to the shellfish industry due to exposure to less favourable conditions in terms of salinity, sediment and pathogens.

In relation to the marine environment the reports of DAHG refer to a stated deficiencies in the application details. The original submission notes potential for interaction with downstream European sites from the changed hydrodynamic regime and states that further information is required to examine potential interaction with Annex I habitats, which includes Mudflats and Sandflats not covered by seawater at low tide and the noted communities in the vicinity including Intertidal Sandy mud community complex and possibly Reef habitats. These are all considered later in relation to Appropriate Assessment but the discussion herein is also relevant as background. DAHG states that potential change to these habitats must be examined in terms of increased flow, potential greater throughput volumes and the changed constituent load of the exiting water including sediments and contaminants.

Bord Iascaigh Mhara identifies concern relating to siltation during the works phase and to additional volume and speed of fresh water entering the bay and reductions in salinity particularly in areas closes to the river outflow. The extra speed of influent fresh water will also facilitate the carrying of extra suspended solids leading to siltation in the inner bay. Input of *E.Coli* or norovirus is also possible, BIM states.

Assessment of Modelling

The report of the Board's consultant hydrogeologist should be read at this point.

Clarinbridge Oysters was represented at the hearing by Diarmuid Kelly, Dr Marcel Cure, Dr Tully and Mr Allison, all expert in matters relevant to the shellfish industry, for which the area is known and which are sensitive to changes in salinity and sedimentation. Dr Shannon, Mr McDonnell and Mr Massey presented the expert evidence on behalf of the applicant and referenced the written work of Dr Rachel Cave in support.

The applicant used HEC-RAS modelling to assess the hydrological aspects of major flood events (the November 2009 flood) with and without the scheme. Based on the conclusions of that work the applicant set out the parameters for assessment of salinity and sedimentation. On reviewing the results of the flow modelling the applicant decided that a comparative approach to salinity modelling was appropriate and that modelling of sediment was not required.

I consider that the conclusions of the **HEC-RAS modelling** may be summarised as follows:

- Over the flood event the freshwater discharge is predicted to be less than 1% increase on the 'do-nothing scenario' –the **peak discharge rate of flow** at Kilcolgan Bridge for the November 2009 event is 99.28 m^3/s without the scheme and 99.31 m^3/s with the scheme so an increase in peak flow of 0.03% is estimated

- The **total volume** of flood that passed through Kilcolgan Bridge between 17th and 26th November 2009 (8.6 day period) was 36,0004,356 m^3 while the modelled prediction with the scheme is a volume of 36,059,418m^3 – an increase of 55,062m^3 – less than 1%.

- **Velocity through Rahasane Turlough** will not change due to the large cross-sectional area of the flow in the turlough – the modelled rate of flow is 0.0316 m/sec with the scheme in place - 0.0312m/sec without the scheme

- The **flood level in Rahasane Turlough** will change by less than 5mm as the main controlling feature is the channel downstream of Rinn Bridge which is not altered

- **Time to peak** flow with the scheme in place would be slightly reduced from 95 to 93 hours

There is a level of agreement between the parties on many conclusions of the HEC-RAS model as noted by Ms Hayes. Dr Cure's main point of contention in relation to the above is that the increase in freshwater discharge (as a result of the scheme) has not been adequately considered for the period prior to the flood peak. The cumulative assessment is incorrect he states – it does not adequately reflect the fact that there will be an additional early contribution of freshwater to the bay. This large volume of water would have significant adverse effects on the shellfish.

Dr Cure states that the increase in discharge rate leading up to the peak flow (11th to 26th November) is significantly greater with the scheme in place. After the peak flow the reverse is true. He undertook some fairly rudimentary calculations based on the rating curves presented in the EIS (in the absence of access to the model) and concludes that the result would be a cumulative volume change (comparing the pre and post plan scenarios) before the peak flood level of 1.21 million cubic metres. This calculation is over a period of 14 days of the November 2009 flood. This is based on his calculation that the difference in discharge flow (delta Q) at peak (November 20th) is 7.5m^3/sec.

Mr McDonnell responded to Dr Cure's claim by further examination of the modelled results. He acknowledged that with the scheme in place there would be an increase in the pre-peak flow at Kilcolgan Bridge. However, there is a substantial difference

between his calculations for delta Q – his figure is 4m^3/sec. The volume change for the 8.6 day period which immediately precedes the peak flow was calculated to be 50,062m^3.

Ms Hayes notes that the two experts have assessed the difference in discharge over a different number of days; the applicant did not include the first 6 days. There is a large difference between the two experts in terms of the difference in discharge pre and post works.

The applicant was requested by the observer and Ms Hayes during the hearing to re-do the exercise to mirror the period considered by Dr Cure and the Board could still request that information. Based on Ms Hayes report I do not consider that this would be necessary. In this regard I would take the following into account:

- The applicant acknowledges a greater volume of freshwater entering the bay in the pre peak period – but assesses the volume as substantially lower than presented by Dr Cure

- Ms Hayes concludes that the cumulative discharge of freshwater during the pre-peak flow period for an extreme 122 year flood event (November 2009 flood event) is considerably closer to the 1% predicted using the HEC-RAS model as the applicant has considered the period during which the peak difference (greatest discharge of freshwater) between the pre and post works occurred (i.e. 8 days prior to the peak).

- She notes that Mr McDonnell's data comes from the HEC-RAS numerical model which shows good correlation with historic flow gauge data and concludes that its predictions for flow and velocity are accurate.

I am in agreement with Ms Hayes and concur that Mr McDonnell's findings, which are founded on complete availability of information should be accepted.

I emphasise the importance of this matter as it was the basis for the approach taken to salinity modelling. Dr Shannon who undertook the salinity modelling clearly stated that had the flow model produced different results then the salinity model would have been approached differently. Similarly the decision not to undertake sediment modelling is based on the results of the hydrological modelling.

If the Board is not persuaded that the applicant has undertaken adequate modelling of hydrological conditions then any deficiencies should be resolved by way of a request for further information, which should address not only the hydrological modelling but should also ask the applicant to re-assess the approach to salinity modelling and whether there is a need for sediment modelling.

I now move on to Dr Cure's critique of the approach to **salinity modelling** which was undertaken. The HEC-RAS modelling shows little variation in the pre and post

scenarios in terms of flows into the bay. Therefore Dr Shannon states it was decided to present a 'comparative model' as opposed to a calibrated model.

The main concern relating to the **oysterbeds and other marine species** is that the scheme would alter the hydrological conditions in such a way as to reduce salinity in the bay and extend the duration of periods of low salinity. The greater volume of freshwater combined with adverse environmental conditions could give rise to a situation whereby mixing of freshwater and seawater is slowed and shellfish are exposed for longer durations to low salinity conditions leading to delayed growth and possibly death. Delayed growth in one season not only has consequences in terms of the numbers reaching commercial size in a season but also in terms of increased mortality. The main concern relates to oysters – other shellfish including mussels and clams are more tolerant and/or at greater distance. There are other species in the marine environment which could be affected including maerl *and Zostera.*

It was stated that in relation to oysters the presence of the *Bonamia* virus makes the native oyster especially susceptible to environmental conditions. The scheme could also affect the shellfish by increased sedimentation and more rapid transfer of water from the upstream area leading to higher levels of *E.Coli / norovirus* in freshwater when it enters the bay. Further loading of pathogens at the very least leads to greater costs to the industry as treatment is required. At worst it could lead to closure of the shellfish beds given the already marginal water quality condition. The observer stressed the point that the effect on oysters would be from a combination of environmental and physiological stresses and that factoring out salinity is disingenuous.

There was some discussion during the hearing of the **duration of low salinity periods** and the consequences for growth and mortality of oysters. The evidence is that it cannot be easily determined how oysters would be affected in different conditions. Dr Tully[7] accepted that oysters are well adapted to salinity changes but the issue is one of commercial productivity and ensuring low mortality. There is a need to know more about the actual changes to juvenile oysters and to acknowledge that it's a highly variable environment. If the change in salinity is in the order stated by the applicant then, he agreed it would make little difference to productivity. The worst case scenario was noted by Mr Kelly to be a situation whereby salinity levels in the bay remain below 12 PSU over a number of tidal cycles during periods of neap tide and westerly winds. This he states is supported by Dr Cave's 2012 opinion. The November 2009 scenario was <u>not</u> the worst case as the tidal conditions were in fact optimum as long periods of low water allowed freshwater out while incoming tides were high enough to replenish the shellfish with saline water. Rapid transfer of water would reduce the die-off of *E.Coli* and norovirus – thus shellfish would require further costly treatment and water quality could be de-graded to below the level at which

[7] Dr Tully of the Marine Institute provides scientific advice on oysters and for the last 6 years has surveyed the inner bay and provided information to the oyster industry.

shellfish can be harvested. The existing water quality results are poor and one further bad result could wipe out the industry, it is stated.

Dr Cure's position is that potential impacts on the shellfish receptor have not been properly assessed as the salinity modelling is not predictive, is not based on thorough knowledge of baseline conditions and does not account for the significant changes to the environment, which the observer states will arise based on the HEC-RAS modelling.

Dr Cure's evidence is that the modelling undertaken has not been run for relevant scenarios to see the effects of tides and winds or increased flux. One scenario is insufficient, especially as in the observer's view it does not reflect the worst case. The modelling is inadequate in terms of its methodology overall including in terms of the number of vertical layers. Vertical mixing of the freshwater layer, which tends to sit on top of the seawater is an essential matter for modelling and the requirement would be that 20 layers would be suitable. The results presented he stated do not show variation in salinity in the bay – however there are variations in reality. There is no baseline data on which to validate the model. This should be provided and should include at least one winter of salinity, temperature and current measurements. Without this baseline data we are unable to test whether the models are accurate and whether any observed changes in mortality was due for instance to climate change.

In evidence Dr Shannon acknowledged the complexity of mixing of stratified freshwater flows. She repeatedly defended her approach to the salinity modelling. The methodology is acceptable in the circumstances due to the limited magnitude of changes in flow. She stated that there are inherent difficulties in collecting adequate data to allow for development of a calibrated (predictive) model and that there would be uncertainties within such modelling. Dr Shannon noted that Dr Cave considered that the approach is appropriate in view of the very small scale of the scheme in terms of alterations to the storm hydrograph and in view of the inherent difficulties in predictive modelling. These uncertainties would be of greater magnitude than the impacts that are to be quantified.

Section 6.2.1 of Ms Hayes' report sets out the type of modelling undertaken and the sources of data. Ms Hayes' comments on the salinity model can be summarised as follows:

- The lack of documented records of baseline salinity conditions on which to directly compare model predictions lead to a gap in confidence in the modelled prediction

- Assurance on the model is only provided by the opinion report of Dr Cave a reputable scientist who is recognised by both parties as a scientist with local knowledge of hydrology and salinity conditions in the bay

- Dr Cave confirmed that the modelling work is in agreement with the known circulation and salinity conditions in Galway Bay and under the same flood conditions as experienced in 2009 the scheme will not worsen conditions for shellfish in the bay
- The comparative model cannot predict every local variation due to topography, currents and wind impacts
- The use of the comparative model is unlikely to affect assessment of impact on European Sites or under the Water Framework Directive
- Under normal conditions there is no measurable difference in discharge between the pre and post plan and as such the risk of impact on shellfish arising from the additional freshwater is low
- Only in extreme floods is there a measurable difference (<1%) in the freshwater discharge between the pre and post plan
- For vulnerable conditions to exist the extreme flood would have to coincide with low salinity already in the bay and tidal and onshore conditions retaining low salinity condition. As such there is a low risk of the additional freshwater discharge in a storm event having a significantly negative impact on the salinity in the bay
- There is inadequate ecological knowledge available to identify what level of impact on the shellfish population might occur during a 2009 type flood event.

Ms Hayes further considers what would be required to prepare a calibrated model. She states that this would require a minimum period of two years to collect a reasonable dataset and a revised model. The splitting of the scheme by prohibiting works downstream of Rahasane Turlough could facilitate collection of data in the bay. While Dr Shannon referred to the need to include both normal and peak flood measurements Ms Hayes concludes that representative data could be collected within a 2 year timeframe to provide improved confidence in the model outputs.

Ms Hayes overall conclusion on this matter is that there is a low likelihood of the necessary combination of meteorological conditions occurring which could result in even a slight lengthening of the duration of low salinity in the bay due to the scheme and therefore there is a low risk of the additional freshwater discharge during a storm event having a significantly negative impact on salinity in the bay.

I have considered all of the submissions and the report of the Board's consultant and conclude that the applicant's approach to the salinity modelling was appropriate in circumstances. I do not recommend that the Board request additional information on this issue and consider that the applicant's conclusions should be accepted. I return later to the option of granting permission for Zones 1 and 2 only, which the Board

may wish to consider if it has reservations about the impact on the marine environment.

Of significant concern to the observer is the possible rapid transfer of **pollutants (particularly pathogens)** to the bay. The source of existing water quality problems in Dunbulcaun Bay was discussed during the hearing but was deemed to be unknown. The Clarin River to the north and Loughrea WWTP were mentioned by the observer as possible major sources. Ms Hayes states that the highest risk to water quality in the bay relates to agricultural run-off, septic tanks and overflow from wastewater treatment plans. These known impacts will be reduced to a minor extent as a result of the scheme but no major sources of bacterial pollution are affected. I note Ms Hayes' reference to Loughrea WWTP as a significant point source of bacterial pollution and the applicant's reference to likely upgrade by Irish Water. The applicant's submission is that water quality will improve as a result of the two-channel stage which will mean less overflow of septic tanks / farmyards close to the bay. As this water would rapidly enter the bay the pathogens would not have time to die off and the consequences for the water quality (including WFD and shellfish requirements) are intensified. In the context of the overall catchment however and particularly during a flood event the contribution of these sources might be considered to be minimal. Ms Hayes does note the fact that the two-stage channel will ensure that water does not flow overland onto sources which would include farmyards at Killeely Beg for instance. I agree with Ms Hayes conclusion that there will be no measurable change in bacterial loading as a result of the scheme and in this regard I note her comment that the bay already receives significant sediment influx.

Observers have queried the **absence of modelling of changes in siltation** in the bay. The concern is that increased flow rates will increase channel scouring thereby leading to transport of more suspended solids in when the scheme is operational. The long-term transport of suspended sediment is assessed with reference to the HEC-RAS modelling. In relation to the overall volume of water Mr McDonnell's response to Dr Cure is presented in document 20. This provides the figures calculated from the rating curve which support the conclusion that for an event similar to November 2009 and for a duration of 8.6 days the change in total volume of water passing Kilcolgan Bridge is modelled to be an additional 0.15%. The development would give rise to a marginal increase in the conveyance of water in a flood event. Channel velocity is predicted to increase marginally.

Dr Cure argued that the assessment of this matter required 3D hydrodynamic modelling with sedimentation transport. Sediment change should be modelled as the claim that the hydrodynamic regime is unchanged is incorrect. There will be a large increase in flow velocity he stated. As this is a two-stage channel until the second level is breached there will be an increased flow velocity and large increase in suspended sediment entering the estuary. The increase in sediments would be cause a much greater increase in re-suspension of sediment.

I note Ms Hayes' report on this matter and in particular the comments that increased sediment loading over the short period of a flood event is unlikely to be measurable against the natural high sediment loading which would occur in a flood in any case. Further she notes that the two-stage channel will reduce the land erosion in Zone 3. I conclude that the scheme would not give rise to significant additional sedimentation and that modelling of same is not required.

In relation to the potential impacts arising due to **construction phase sedimentation** and other pollutants I note that the in-stream works are at a considerable distance from the bay. I agree with Ms Kearney's statement that 'avoiding, controlling and managing sediment loss during excavation of the two-stage channel … is considered to be the primary issue in terms of mitigating potential effects on nature conservation, including marine and estuarine designated sites downstream'. There are considerable earthworks involved. There also are aspects of the scheme downstream of Rahasane Turlough which require dewatering including at Killeely Beg Bridge where a new structure will be constructed and the salmon counter re-located. These together with the construction of the two-stream channel, spreading of soil including placing of spoil heaps comprise threats to water quality which might affect the marine environment.

The applicant has presented a range of measures to mitigate the potential water quality impacts. The conclusion is that the works will not have a high risk of water quality impacts. As a general comment I refer to the relatively standard nature of the mitigation required in the construction phase. I consider that the applicant has presented in the Tobin report, the NIS and EIS, the additional information response and the Schedule of Environmental Commitments sufficient measures to ensure minimal impacts during the construction phase including

- Work direction for construction of two-stage channel to be towards the channel with a buffer zone between the excavation area and channel to prevent diffuse wash off and protection of flow paths to river with appropriate sediment control measures such as check-dams and silt fences
- Identification and protection with dams of preferential flow paths including after completion of floodplain and bank excavation works during wet weather in the two-stage channel section
- Design of workflow on each site to minimise damage by heavy vehicles
- Where karst rock is close to surface placement of geotextile under spread material
- Monitoring of long-term and short-term weather forecasts and of flows to predict adverse conditions and possible peak flows to prevent machinery entering the channel in periods of high flow

- Cease works in the event that water table rises to level of works area
- Install swale on down slope of working area to convey surface water run-off
- Timing of works to avoid fish migration and spawning periods and in accordance with the work programme phasing set out, which minimises potential conflicts with ecological receptors – risky out of river works will not take place between October and April
- Engagement of ecologist to engage in the process and input into further development the CMP[8]
- Environmental Officer to be on site for the duration of works to ensure implementation – daily environmental audits – power to instruct contractor to cease works and direct the carrying out of emergency mitigation / clean-up operations
- Fisheries monitoring to be undertaken in consultation with IFI under an agreed fisheries monitoring schedule to review pollution mitigation measures, incident reporting and water quality monitoring.

I concur with the conclusion of Ms Hayes that the draft CEMP together with the environmental commitments comprise a comprehensive methodology for reducing the risk of impact from sediment runoff in the construction phase. Having regard to the measures presented, which are now described I consider that mitigation can be achieved and that residual impacts will not be significant.

I note and share Ms Hayes concerns relating to the risk posed by the **timeframes**. However, I am also satisfied that the proposals will minimise this risk to acceptable levels.

I note that the applicant made a number of commitments relating to baseline monitoring of the marine environment and to construction phase and post construction monitoring. In this regard some of the request put together by Dr Tully during the hearing were agreed. Some of the requirements presented by Dr Tully would be considered to be not relevant to the scheme. I recommend a condition to emphasise this commitment as it is not set out in the Schedule of Environmental Commitments and is of particular importance to the parties.

In relation to the impacts of **previous schemes** the proposed works in this scheme are stated to be of far smaller scale than the 1992 works in particular and that they would be undertaken subject to a different control regime. Further I note the applicant's submission that the baseline for assessment should be pre-1992. That

[8] A commitment to engage with statutory bodies is also given. NPWS did not consider that such engagement should be necessary on the basis that all necessary details should be resolved prior to consent.

date would capture the conditions prior to the major scheme, which altered the flow regime. I do not agree that approach would be reasonable.

Conclusions In general the bay is demonstrated to mainly contain habitats and species which are not overly sensitive to changes in salinity or sedimentation[9], shellfish being the most vulnerable.

There are conflicting views between Dr Shannon and Dr Cure. I consider that both witnesses are demonstrated to be expert in the relevant field. The Board's consultant largely agrees with the conclusions presented by the applicant. The conclusion of the HEC-RAS model are accepted. It is considered that undertaking of a calibrated model for salinity is not warranted in view of the nature of the scheme, which minimises changes to flow and salinity affecting the bay.

In conclusion having regard to the limited effect of the scheme in terms of changes to flow as demonstrated by the HEC-RAS modelling and to the limited change in salinity levels predicted by the salinity modelling it is considered that there is a very low likelihood that the scheme together with prevailing wind and tides would give rise to natural conditions, which would give rise to significant adverse effects on the shellfish industry.

Consent for zones 1 and 2

In the event that the Board is not satisfied that the scheme would not adversely impact in a significant way on the shellfish industry the option of giving consent only for the eastern part of the scheme as far as Rinn Bridge could be considered. This matter was raised during the hearing and the applicant confirmed that if no works took place west of Rinn Bridge it would equate to a 'do nothing' scenario for that stretch of the river. I also remind the Board at this point of Mr McDonnell's description of Rahasane Turlough and the manner in which it provides natural attenuation. As such it may be concluded that the potential for negative effects on the oyster beds due to changes in salinity and siltation would be further minimised by omitting all works west of Rinn Bridge. Conditions more akin to those presently existing would remain. The purpose of any such restriction on the scheme could be simply to allow for further modelling of existing conditions in the bay and the undertaking of more refined modelling as suggested by the observers. Alternatively the restriction could be intended as a permanent limit. Any such condition should be first put to the applicant for comment and in the interest of natural justice would be appropriately subject to revised public notices.

The applicant indicated that if such change was made then the scheme would not be worth undertaking. Furthermore the benefits to water quality arising from the removal of potential sources of pollution would be eliminated. In this regard the

[9] The assessment undertaken in relation to the SAC and SPA within Dunbulcaun Bay is as discussed later considered to be robust.

applicant referred especially to the individual wastewater treatment units at houses and to agricultural premises. My conclusion is that the scheme impacts do not warrant further assessment and that the entirety of the scheme should be permitted.

The other potential alteration which the Board may wish to consider is that suggested by BIM. The BIM observation states that such measures are needed to ensure no extra pressures are put this environmentally sensitive area. This might include construction of holding ponds to divert fresh water away from direct entry into the bay at periods of high rainfall. These diverted waters could be released in a controlled way at periods when freshwater inputs were lower. The applicant's response to this suggestion is to rely on the limited changes to the flow velocity and to suspended solids volumes.

This would be a major alteration to the scheme. It would involve major and costly construction on third party lands. I do not consider that this proposal is feasible. In addition I note that the proposals for much of Zone 3 have the effect of slowing the release of water on the land as part of the floodplain is retained. Similarly the channel widening in Zone 3 acts to provide a larger storage area for floodwater prior to its discharge to the bay. On the basis of my conclusions above relating to the assessment of the potential impact on shellfish and the low likelihood of significant impacts I do not recommend that the Board explore this option.

The scheme presented in my opinion strikes a good balance between engineering measures (zone 1), retaining a flood regime where necessary under restrictions imposed by the Habitats Directive (Zone 2) and containing flooding in a wider channel and indeed retaining a floodplain close to the bay (zone 3). Apart from the social and economic damage, it must be acknowledged that flood events naturally carry increased loads of suspended solids and contaminants and also give rise to greater speed of freshwater input. It is in this context that any potential impacts on the shellfish industry must be assessed. I consider that the question for the Board is whether the scheme presented could be more appropriately designed to minimise impacts on the environment. I conclude based on the limited predicted effects in the construction and operational phases that no such alterations to the scheme are warranted.

ENVIRONMENTAL IMPACT ASSESSMENT

In this section I refer to the likely significant environmental impacts and consider these under the headings set out in legislation. The vast majority of the applicant's submissions including the EIS are devoted to consideration of a limited suite of impact. I am in agreement with the general thrust of the approach taken and will likewise focus below on a limited number of the more significant topics. I therefore structure this section of this report as follows:

- Alternatives
- Material assets

- Soils, Geology and Hydrogeology
- Ecology
- Cultural heritage
- Other impacts.

Alternatives

Mr McDonnell's report to the hearing outlines the main alternatives considered which included a Do-nothing scenario, protection of individual properties and implementation of a Flood Relief Scheme. The Tobin report sets out a range of alternatives to the scheme which were considered. Protection of individual properties was considered but discounted at an early stage as the development of flood barriers around individual properties did not consider the risk to infrastructure. In view of the significant potential risk to bridges arising from scouring in the case of more frequent extreme flooding, which may arise due to climate change, this option was deemed unsuitable.

The design team states that 11 no. variations of the scheme were considered. Mr McDonnell's evidence to the hearing summarises the four strategic flood defence schemes considered. Two of these would have resulted in the demolition of the old bridge in Craughwell, which is a protected structure and three would also have have reduced the water levels in Rahasane Turlough with potential impacts on the SAC. The selected scheme avoids impact on the predicted water levels in Rahasane Turlough and demolition of the old bridge, which is a feature of considerable architectural interest in the village and in use by pedestrians.

I am satisfied that the applicant has comprehensively considered the alternatives to the scheme design.

Material assets

I have referred earlier to the benefits arising from the scheme through maintaining access and prevention of damage to properties. These impacts would be positive and of local or, in the case of some infrastructure of regional significance.

The scheme design incorporates measures to prevent impacts on bridges. The impact on the Rack Stream Bridge at Kilcolgan is noted to be subject to no perceptible change in water level or velocities. In relation to the main Kilcolgan Road Bridge the applicant notes that no additional scour protection is required. A letter from TII to the applicant was read to the hearing indicating that initial reservations about the scheme impacts no longer apply.

By contrast the proposal provides for a range of measures at other bridges. The need for such measures arises partly as a result of the scheme – Table 4.2 of Tobin indicates no significant changes in channel velocity at the R446 / Pedestrian Bridge

in Kilcolgan for major events but there are relatively higher changes for 5 year and 2 year events. The protection of these structures arises in part due to natural forces related to climate change. Insofar as the scheme gives rise to higher velocity in the normal flood events, this may be deemed to be a negative impact but the impacts are mitigated through the proposed works.

Regarding the railway bridges I consider that the substantive issue raised by IR relates to site investigations for piling, which have in fact been undertaken. I consider it acceptable that detailed design of such works be undertaken at a later stage. A number of the other matters raised by IR would be reasonably described as matters appropriate to later agreement and in this regard I note the proposals for further engagement with IR and the requirement to obtain certain licences and agreements.

In overall terms the scheme gives rise to effects on material assets which are positive.

Soils, Geology and Hydrogeology

I consider it is reasonable to describe the design as one which minimises impacts on soils, geology and hydrogeology. Works involving channel maintenance along the Dunkellin and works to the Aggard Stream are reasonably described in the EIS as having an imperceptible effect on soils, geology and hydrogeology. The scheme has also been clarified as providing for the maintenance of a floodplain for the 350m upstream of Kilcolgan Bridge.

Nevertheless, the location of the scheme mainly within a Regionally Important Karstified Aquifer and the Extreme vulnerability of the aquifer together the nature and extent of earthworks over 11km of the Dunkellin and 7km of the Aggard means that the impact on soils, geology and hydrogeology is one of the most significant impacts.

Baseline soils and geology data presented includes site investigations to establish ground stability, geophysics and field walkover surveys to establish karst features and soils investigations to determine suitability of excavated material for construction of the scheme embankments. These have been reviewed by Ms Hayes who considers that the data collected and the interpretation by the project hydrogeologist as presented in the EIS and the hearing are sufficient to allow adequate mitigation to be undertaken during construction works. In terms of the baseline data available it is noted that while there are groundwater monitoring wells within Rahasane Turlough these have not been used for ongoing monitoring.

The deepening of the channel in Zone 1 is the source of a significant proportion of the 70,000m^3 of material which will be excavated. The estimate presented is that construction of flood embankments in Craughwell will require 14,000m^3 of material while 12,000m^3 will be used in the construction downstream of Killeely Beg Bridge. Thus an estimated 44,000m^3 will be surplus to the scheme.

In relation to the potential for 'burst up' which was raised in the request for additional information, the applicant's surveys show no cavernous limestone features in the area where embankments are proposed. In addition it is noted that the embankments to be constructed in Zone 3 would be needed to retain water for a matter of hours only, which has implications for their design and potential impacts. Detailed drawings of the location of karst features in the vicinity of the scheme including the lands where spoil spreading is proposed were provided in response to the request for additional information.

In Zone 1 the scheme involves significant in-stream earthworks along 950m and up to 1.5m in depth. The EIS states that during channel regrading significant groundwater inflows could occur where fractured limestone is exposed. Ms Hayes has reviewed the borehole records and geophysics profiles along the relevant stretch of river. Her conclusion that there is a low risk of impacting on the natural karst hydrological regime during excavation is based on this data which demonstrates that the excavation will be entirely in silt.

The applicant has identified lands for spreading of surplus material. The lands involved have been investigated as to the presence of karst features and where these are present buffer zones are set out and these will be fenced off. The site compounds identified are not within or adjacent karst features. This is appropriate including for reason of minimising the impact of possible spills. In relation to the potential impacts due to works close to hitherto un-identified karst features the applicant sets out further measures to be undertaken at detailed design and construction. In particular measures involving use of geotextiles will be undertaken to ensure that sediment does not enter karst features.

The scheme will impact the geological features at Killeely Beg Bridge (also known as Castlegar Turlough) and Dunkellin Turlough as part of the embankments will be placed on the area which is part of the turloughs. The scheme will not impact on the groundwater feeding these features – thus the applicant refers to the return of these features to more natural conditions.

Rahasane Turlough is referred to as a Geological Heritage Site. The turlough functions as an estavelle meaning that there can be an inward or an outward flow. On the northern side especially there are a very large number of estavelles of very different capacities. Under low water conditions it operates as a sink of the Dunkellin. The EIS refers to springs downstream of Rahasane Turlough which are connected to it but notes that as there is no significant effect on Rahasane Turlough there is likewise no impact on these springs. Springs which feed into Rahasane Turlough are noted in addition – the scheme does not impact these springs. The scheme is demonstrated not to impact on the hydrogeology of Rahasane Turlough as is discussed further later.

The scheme includes a range of other mitigation measures including post-construction monitoring to ensure that Rahasane Turlough in particular is not adversely impacted and sets out operation phase monitoring and remedial measures to address unforeseen consequences. Section 9.5 of the EIS refers and this information was supplemented in submissions to the hearing.

The acknowledged impact on the area of two karst features at Killeely Beg and Dunkellin (also known as Castlegar and Dunkellin Turloughs) can be construed as neutral as there is no impact on the hydrogeology. I am also satisfied that the baseline site investigations and construction methodology set out together with the nature of the scheme design are appropriate to the receiving environment. Overall, I consider that the applicant's conclusion that the impact on soils, geology and hydrogeology is 'low' is reasonable.

Ecology

Overview

Having regard to the written comments of DAHG and the material presented by the applicant and other observers I consider that the features of ecological importance in the immediate vicinity of the study area comprise:

- Rahasane Turlough cSAC (site code 000322)
- Rahasane Turlough SPA (site code 004089)
- Galway Bay Complex cSAC (site code 000268)
- Inner Galway Bay SPA (site code 004031)
- Fisheries including Salmon, Trout, Lamprey and Eel
- White-Clawed Crayfish
- Other turloughs which are Annex I habitats
- Bats
- Birds
- Semi-natural grasslands that support Annex II and IV species
- Wetlands
- Trees and Vegetation
- Shellfish and marine habitats.

I refer to the European Sites mainly under the Appropriate Assessment section of this report. Therein is the primary discussion also of species which are qualifying interests of a European Site and are to be found outside the designated area.

For the purposes of EIA under the heading of 'Ecology-General' I first address the species and habitats which occur mainly in and around the Dunkellin / Aggard channel but which are not qualifying interests of a European Site namely:

- Fisheries – Salmon, Lamprey, Trout and Eel
- White-clawed Crayfish
- Dunkellin and Castlegar Turloughs
- Other species and habitats.

The second section deals primarily with the impact on shellfish. This provides a basis also for considering species and habitats within the estuary / bay, which are not qualifying interests of European Sites.

Ecology

I consider that the applicant has demonstrated a thorough knowledge of the areas to be impacted by the in-stream works, which have the potential to negatively affect in a significant manner the aquatic ecological resources. The impact on ecology in the Dunkellin / Aggard was not subject of detailed debate at the hearing but has been the focus of some written submissions. I refer to the submission of DAHG and the responses of the applicant to same, including that of November 3rd at the hearing.

I consider that the detail of information presented by the applicant in relation to habitats, species, the impact of the scheme and the nature of mitigation measures is such that it is appropriate to present a brief summation.

Fisheries and White-clawed Crayfish– Salmon, Trout, Lamprey and Eels[10]

While the Dunkellin / Craughwell rivers are of value as migration routes for salmonids and lampreys the main spawning habitat is in the overall system is upstream of Craughwell village. The EIS in section 11.3.2 provides very detailed descriptions of all of the Dunkellin and Aggard stretches which would be affected by the scheme. The river and stream offer a wide variety of habitats for fish and crayfish. For instance:

- the section downstream of Rahasane Turlough has a notable lack of fine and medium gravels and the river mainly comprises an artificial channel cut into the limestone bedrock

[10] All of these species are protected either under the Habitats Directive, Wildlife Act, Fisheries Act or EU Regulation for Recovery of Eel Stock.

- in places in Zone 3 there is very high density of Eel including downstream of Dunkellin Bridge
- salmon redds have been found between Dunkellin and Rinn Bridges - about 10% of salmon redds in the system are downstream of Rahasane Turlough[11]
- upstream of the confluence with the Aggard is an open area with mixed habitats much of it very suitable for juvenile salmon and crayfish were in evidence
- a pool upstream of Craughwell is popular with anglers
- the Aggard is described in detail in section 11.3.4 of the EIS and contains a range of habitats including areas suitable for lamprey, trout and salmon and crayfish.

In general the area affected by the scheme does have good juvenile salmonid nursery habitat. However, the fisheries habitat is deemed to be overly shaded by terrestrial vegetation and to be lacking gravels and finer substrate. In addition the scheme has the potential to have significant negative impacts particularly as a result of channel deepening.

The applicant presents a range of measures to be implemented in the construction phase to protect water quality. Works are scheduled for the May to September period which observes the fisheries restrictions. In Zone 3 potential impact is stated to be temporary moderate negative depending on the levels of soils washout and standard of construction site management. Similarly the construction of a new salmon counter, which could lead to cement washings could be significantly negative, but is a low risk on a well-managed site. Design of the salmon counter is critical especially for lamprey passage and will be agreed with IFI.

Channel deepening works in particular are of significance. In the absence of mitigation there is potential for significant construction and operation phase impacts on fish and crayfish including during the cofferdam construction. Rescue and relocation of crayfish in Zone 1 is also critical and is proposed; mortality is however unavoidable, even with involvement of specialist personnel. This aspect of the scheme requires a licence from DAHG in addition, which if granted will ensure impacts are minimised[12].

As mitigation the scheme incorporates an Environmental River Enhancement Programme prepared in conjunction with IFI and detailed in the Tobin report. This is stated to ensure that measures are incorporated into the design of the scheme that

[11] The Dunkellin / Craughwell catchment has 160 redds in all.

[12] Ms Kearney advised the hearing in response to comments of DAHG that the licence would be time and location specific and therefore could not be sought in parallel with the planning consent process.

will protect and enhance fish populations. It will be put in place with the construction of the scheme thus ensuring that optimal habitat conditions are quickly available.

In addition there will be pre-works consultation between OPW and IFI to identify sections of the Aggard which are to remain untouched. Lamprey are likely to be abundant in the Aggard and an ecologist will supervise any rescue work.

Timing restrictions are presented as a core mitigation measure throughout the scheme. However it is stated in section 11.4.7.2 of the EIS that there is likely to be some increased releases of sediment affecting the area upstream of Rahasane Turlough within the first few hundred metres downstream of the work. Avoidance of this impact is considered likely due to the rapid implementation of the EREP. The EIS discounts the likelihood of sediment reaching the Dunkellin downstream of Rahasane Turlough.

Long-term angling activity is facilitated by the incorporation within the scheme embankments of access steps for anglers.

I accept the applicant's conclusion that the residual effects of the scheme are likely to be neutral or slight negative in general. In this regard I note the commitment to undertake post construction monitoring.

Dunkellin and Castlegar Turloughs

Turloughs are Annex I habitats under the Habitats Directive. There are two downstream of Rahasane Turlough namely Dunkellin Turlough and Castlegar Turlough. I have referred earlier to the fact that there is a loss of habitat area due to the location of the embankment. At Castlegar Turlough upstream of Killeely Beg Bridge the surface water flooding in terms of extent and duration will be reduced. However, groundwater discharge will be maintained. The EIS describes this as a positive impact insofar as the vegetation could be influenced more by groundwater. Thus a more representative flora could result.

Dunkellin Turlough is noted to be potentially affected by indirect effects only due to alterations to the flood regime as a result of the channel widening. Ms Kearney's evidence is that the turlough will return to a more natural flood cycle more characteristic of baseline conditions. Thus there is a slight positive impact she states. There are no works proposed which directly impact on that turlough. The hydrogeology of the feature is not affected.

I consider that the case presented by the applicant in relation to the impacts on the turloughs is generally acceptable. I conclude that the development would not give rise to significant negative effects on these Annex I habitats.

Other species and habitats

I note that the submissions of DAHG raised issues relating to bats, birds, semi-natural grasslands, wetlands and trees and vegetation. I consider that all of the matters raised are thoroughly addressed in the EIS, NIS and / or the presentations by the applicant to the oral hearing.

I consider that adequate survey of birds and bats have been undertaken. This included targeted breeding bird surveys and a bat and bird assessment of bridges. Bird protection will involve avoidance of works which might impact on wintering birds as discussed under the Appropriate Assessment section of this report. In addition standard measures relating to tree removal will be followed. Killeely Beg Bridge, Dunkellin Bridge and old Craughwell Bridge were all suitable for roosting bats but none were found. A further survey of bridges will be undertaken before works. Trees will be retained where possible and a location for replacement planting has been identified. The location of potential nest sites for Kingfisher were identified but these are not within any works zone. I consider that the potential impacts on bats and birds are capable of mitigation as proposed.

The scheme also result in removal of 0.3 hectares of Wet Grassland, 0.8 hectares of Marsh and 0.3 hectares of Dry Calcareous and neutral grassland. In reply to queries by DAHG on these habitats the applicant indicates that the footprint and immediate environs of the two-stage channel will correspond to wet grassland and marsh and support the relevant species. Over time the embankments and spoil deposit will colonise with assemblages similar to the semi-natural dry grasslands. I consider that the applicant has demonstrated that the lost habitat will be reinstated in time.

Sections 5.1.1.2 and 5.1.1.4 of Ms Kearney's submission to the hearing on 3rd November addresses the loss of trees and hedgerow. There is a cumulative loss of 0.27 hectares of oak-ash-hazel woodland and scrub within the footprint of the two stage channel. None of the woodlands habitats affected correspond to Annex I habitats. She noted some ecological benefits for in-stream ecology and identified locations suitable for replanting as mitigation. I conclude that there are permanent negative impacts, which are mitigated in time.

Cultural heritage

Architectural Heritage The scheme has the potential to have significant impact on architectural heritage. Two bridges are recorded on the NIAH and are protected structures namely the Craughwell old (pedestrian) bridge and Dunkellin Bridge. Dunkellin Bridge is a seven arch structure built around 1820. The old road bridge in Craughwell is of archaeological importance as well as architectural. Dating to about 1600 it was widened in the late seventeenth century and again in 1780. Its interest lies in part in its complex history but also in the detail of the structure, which reflects the various additions. Both are assessed as being of regional significance. These structures will be negatively impacted. Changes to the arches of Dunkellin Bridge involving the introduction of larger square shaped openings constitute a significant

intervention. Work to Craughwell Bridge involve underpinning and piling only but this structure is of greater interest.

The applicant has committed to undertaking full conservation assessments of both protected structures including complete recording of elevations and to consultations during detailed design with the historic buildings expert or conservation architect. As the structures are to be retained and having regard to the involvement of a conservation architect for detailed design purposes, I submit that the impact on the protected structures, which is significant and negative is nevertheless acceptable. A condition discussed regarding the design of works is attached.

The scheme also requires demolition of the old stone bridge at Killeely Beg Bridge which is not a protected structure, but is of local architectural interest. This will be recorded. Underpinning works at Craughwell Railway Bridge which is of local interest (not a protected structure) will be undertaken with consultation of IR and with input from the historic buildings expert.

I am satisfied that while the scheme will give rise to significant negative impacts on certain features of architectural interest including protected structures none are of such significance as to warrant alteration to the scheme or withholding of consent. The works to be undertaken in part will address the potential for increased scouring which arises in flood situations in any case and which is likely to increase under climate change predictions. Residual impacts are acceptable subject to full implementation of the mitigation measures presented.

Archaeological Heritage The scheme has the potential to result in significant negative impacts on the archaeological resources. These include parts of townland boundaries and archaeological features or deposits which may be identified during the works at the bridge, along the length of the river banks and river bed and in areas where other works are proposed. The scheme works may impact also on a number of recorded archaeological sites, which include a recorded medieval settlement at Dunkellin, a *fulacht fiadh* at Killeely Beg and remains of weirs and site of a corn mill.

Mitigation measures are set out in section 13 of the Schedule of Environmental Commitments and the EIS. This will include a full underwater survey, monitoring and if necessary full archaeological resolution by licensed excavation.

During the hearing I queried whether the resolution of archaeology could militate against the achievement of the timelines set by the applicant, which are already acknowledged to be tightly constrained. The applicant referred to the undertaking of investigations prior to commencement of the scheme. Where that is possible it will ensure that there are no conflicts between archaeological investigations and the project timelines.

Subject to archaeological mitigation to include archaeological monitoring as described in the submissions of DAHG, to which the applicant has committed, the development would not be likely to have a significant adverse effect on archaeology. I do not consider that conditions are needed to address this matter. I am satisfied that the development is acceptable in terms of its archaeological impacts.

Other impacts

Air quality, climate and noise

The EIS identifies the baseline conditions and the potential sources of impact which are related to traffic and construction machinery. Residential receptors in the vicinity are considered not to be adversely impacted provided adequate mitigation measures are undertaken. Greenhouse gas emissions were calculated and are considered negligible.

The noise chapter of the EIS identifies as a potential source of noise the need to upgrade roads for delivery of material. I agree with the conclusion presented that subject to mitigation there will not be significant negative impacts on sensitive receptors during the construction phase.

Measures to minimise air and noise impacts are set out in sections 11 and 12 of the Schedule of Commitments. The finalisation of a Construction Management Plan will ensure that air, climate and noise impacts are adequately mitigated.

Landscape and visual assessment

No works take place in the area of high sensitivity (downstream of Kilcolgan Bridge) or moderate landscape sensitivity (Rahasane Turlough). The scheme affects a landscape of low sensitivity where there will be temporary and permanent impacts. No protected views are affected.

Arising from the removal of bankside vegetation and from works to bridges and in the vicinity of bridges and from construction in Zone 3 of the embankment the scheme will give rise to temporary and permanent impacts. There is no loss of landscape features of value. I note and agree with the applicant's conclusion that the most likely impacts would result from the temporary construction works along the banks of the river and at bridge crossings and the deposition of excavated material on riverside lands. Mitigation measures include retention where possible of bankside vegetation and replacement planting provided it would not interfere with flood conveyancing.

I accept the applicant's conclusions that the completed scheme will blend with the landscape and will not be prominent. There will in addition be no significant loss of views.

Human beings

Regarding potential impacts on Human Beings the EIS considers components of the environment and material assets which if impacted could affect human beings in terms of 'quality of life'. A number of the chapters of the EIS and many aspects of submissions to the hearing are of direct relevance to human beings. In considering the effects on Human Beings other sections of this report are pertinent. In the interest of avoiding repetition I refer the Board to other discussion of matters, particularly flood relief, shellfish industry, air quality, noise, traffic and landscape and visual impacts.

Regarding economic impacts the scheme will provide employment in the construction phase. Mitigation put in place will minimise any possible construction phase impacts on the shellfish industry.

On completion the scheme will have a significant positive impact to the local community through relieving of flooding and will reduce emergency costs and improve recreation opportunities including angling. Permanent alteration of land use arises but the scheme is deemed to have local support and many affected landowners have consented to the works. The scheme will give rise to minor changes under normal operating conditions, which are deemed to be unlikely to impact the shellfish industry.

Traffic

The scheme involves significant earthworks including likely excavation of 70,000 m^3 of material, of which an estimated 44,000m^3 is surplus to the scheme. The surplus will be retained within the study area to be spread on nearby lands, which have been identified. No issues have been raised by third parties including in relation to compounds and access points which are identified. Temporary closures in the vicinity of bridges will be required as is outlined in Mr McDonnell's evidence.

I consider that the likely impacts of the scheme are well understood and potential adverse effects are minimised. As the scheme takes place in an area served by a narrow road network and close to national and regional roads, impacts will be local and short-term. Much of the traffic will be on local roads with the wider road network being used for delivery of aggregates and machinery as well as by scheme workers. I am satisfied that mitigation through construction phase traffic management will ensure avoidance of significant impacts in the area. There are no residual impacts.

Interactions and Cumulative Impacts

Impact interactions are listed in Table 18.1 of the EIS. I agree with the applicant's conclusion that as mitigation measures will eliminate the possibility of effects then interactions are also avoided or significantly reduced.

In view of the likely completion of the N18 works near Dunkellin Bridge prior to commencement of the scheme there are no significant cumulative effects. In relation

to cumulative effects arising from planned or permitted schemes within the Bay including the Galway Port scheme these are not predicted to occur as Dunbulcaun Bay is primarily influenced by the rivers and by waters from the Clarin and Kinvara Bay.

APPROPRAITE ASSESSMENT

Overview and Adequacy of Information

The purpose of this section is to advise on appropriate assessment under Articles 6(3) and 6(4) of the Habitat Directive 92/43/EEC, which require an appropriate assessment of plans to prevent significant adverse effects on Natura 2000 sites. Broader ecological impacts are addressed above under EIA.

In preparing the foregoing I have had regard to the Site Synopsis for the relevant Natura 2000 sites, copies of which are attached to this report, to the conservation objectives for the Natura 2000 sites, the NIS, the submissions of third parties and prescribed bodies and to the entirety of the application documentation submitted including the further information and the oral hearing submissions.

Regarding the adequacy of information presented I am satisfied that it is sufficient to enable the Board to conclude an Appropriate Assessment for this scheme. I note in particular that the applicant has provided detailed response to a number of items raised in the submissions of DAHG including in relation to the extent of the project site compounds, spoil disposal, temporary storage, access routes, details of site investigations and river enhancement works, which I consider are the significant elements of the project. In addition throughout the application process Galway County Council has presented a number of mitigation measures which will be further refined. This is addressed further below under the discussion of individual European sites.

Stage 1 - Screening

Figure 1.2 of the NIS shows the Natura 2000 sites within a 15km buffer zone.

The Natura 2000 sites are:

- Lough Corrib SAC (000297)
- Lough Fingall Complex SAC (000606)
- Castletaylor Complex SAC (002034)
- Ardrahan Grassland SAC (002244)
- East Burren Complex SAC (01926)
- Cahermore Turlough SAC (002294)
- Caherglassaun Turlough SAC (000238)

- Coole-Garryland Complex SAC (000252)
- Coole-Garryland Complex SPA (004107)
- Peterswell Turlough SAC (000318)
- Ballinduff Turlough SAC (002295)
- Carrowbaun Newhall and Ballylee Turloughs SAC (002293)
- Lough Coy SAC (002117)
- Sonnagh Bog SAC (001913)
- Lough Rea SAC (000304)
- Lough Rea SPA (004134)
- Moninvea Bog SAC (002352)
- Lough Cultra SAC (000299)
- Drummin Wood SAC (002181)
- Cregganna Marsh SPA (004142)
- Rahasane Turlough cSAC (site code 000322)
- Rahasane Turlough SPA (site code 004089)
- Galway Bay Complex cSAC (site code 000268)
- Inner Galway Bay SPA (site code 004031).

The scheme for which consent is sought comprises in-stream works and works along the banks of the Dunkellin River as well as minor works along the Aggard Stream. I consider that the scheme has the potential to impact on the European sites by changes to hydrological regime, water quality changes in the operation phase and during the construction phase by siltation and other potential pollution.

A number of the European sites are outside of the area of the works and have no evident hydrological or other connection with the scheme in the operational or construction phases. However, the location of the site within a regionally important karst aquifer with groundwater connections over long distances (and contrary to topographic gradients) is identified in the submissions on file. The potential for impact on European sites through groundwater pathway therefore has to be considered.

The applicant's submissions include specific groundwater modelling. This demonstrates that the effect on groundwater levels as a result of the scheme is

restricted to a zone which is a short distance from the Dunkellin. Within 10m of the river corridor the influence on the groundwater environment is likely to be reduced to negligible levels. In addition the effect of the scheme occurs only during the flooding events which are short-lived.

In view of the above I consider that it is demonstrated that the development, which is situated in a fissured karst environment will have a localised impact on groundwater. There are no other pathways between the scheme and a number of European sites. As such I consider it reasonable to conclude on the basis of the information available on the file that the proposed development, individually or in combination with other plans or projects would not be likely to have a significant effect on the following sites:

- Lough Corrib SAC (000297)
- Lough Fingall Complex SAC (000606)
- Castletaylor Complex SAC (002034)
- Ardrahan Grassland SAC (002244)
- East Burren Complex SAC (01926)
- Cahermore Turlough SAC (002294)
- Caherglassaun Turlough SAC (000238)
- Coole-Garryland Complex SAC (000252)
- Coole-Garryland Complex SPA (004107)
- Peterswell Turlough SAC (000318)
- Ballinduff Turlough SAC (002295)
- Carrowbaun Newhall and Ballylee Turloughs SAC (002293)
- Lough Coy SAC (002117)
- Sonnagh Bog SAC (001913)
- Lough Rea SAC (000304)
- Lough Rea SPA (004134)
- Moninvea Bog SAC (002352)
- Lough Cultra SAC (000299)
- Drummin Wood SAC (002181)

Therefore, I consider it appropriate that the NIS relates to:

- Rahasane Turlough cSAC (site code 000322)
- Rahasane Turlough SPA (site code 004089)
- Galway Bay Complex cSAC (site code 000268)
- Inner Galway Bay SPA (site code 004031).

The report of DAHG refers to Cregganna Marsh SPA (004142), which has a connection to Rahasane Turlough in terms of shared use by birds. Alterations to the habitat at Rahasane Turlough could therefore be deemed to have potential impacts for Cregganna Marsh SPA. I will consider this European Site in my assessment.

The Board is referred to the Screening report attached as Appendix C to the original application submission. This report eliminates a number of sites from further consideration on the basis that they do not lie within the Dunkellin / Kilcolgan River catchment. That report does not consider in detail whether there could be groundwater connections and does not address Creganna Marsh in relation to the matters raised by DAHG. However, the Screening report contains large amounts of information which I have considered and it comes to reasonable conclusions in my opinion namely that Stage 2 assessment is required for 4no. European Sites and that the remainder considered in some detail (Castletaylor Complex cSAC, Lough Rea cSAC/SPA, Ardrahan Grassland cSAC, Creganna Marsh SPA, Lough Fingall Complex cSAC And Kilternan Turlough cSAC would not be significantly affected. Apart from Creganna Marsh SPA I agree with that conclusion.

In the foregoing consideration of each of the European sites I note in terms of 'in-combination' effects that this matter has been addressed in the various submissions made by the applicant. The greatest potential for in-combination effects in my opinion would relate to the ongoing construction of the M17/M18 Tuam Gort Road Scheme. This involves construction of a clear span bridge close to Dunkellin Bridge. Works are at an advanced stage on this scheme. I am satisfied that the applicant has adequately considered other plans and projects in the assessment of effects and I agree that there will no potential for cumulative impacts arising in combination with any other plans or proposals taking into account the standard best practice and the specific mitigation measures applying.

On the basis of the information provided with the application I consider that the Board cannot be satisfied that the proposed development individually, or in combination with other plans or projects would not be likely to have a significant effect on European sites Rahasane Turlough cSAC (site code 000322), Rahasane Turlough SPA (site code 004089), Galway Bay Complex cSAC (site code 000268), Inner Galway Bay SPA (site code 004031), or any other European site, in view of the site's Conservation Objectives. A Stage 2 assessment is therefore required.

Stage 2 – Appropriate Assessment

Rahasane Turlough SAC

Conservation Objectives

The qualifying interest is 'Turlough'. The conservation objective is to maintain or restore the favourable conservation condition of the habitat 'Turlough'. The submissions describe the habitat and species and note the permanent nature of the main basin and the seasonal nature of the smaller basin Rinn basin. Overflow to Rinn basin occurs at a level of 14.7mOD

Detailed conservation objectives have not been prepared for Rahasane Turlough SAC. The approach taken by the applicant, which is in line with the advice of DAHG is to consider the detailed conservation objectives for Galway Bay Complex SAC, which is considered relevant.

The targets which shall be achieved therefore, to ensure maintenance of integrity of Rahasane Turlough are set out in Table 3.8 of the NIS. In the next section of this report I present some of the available information relating to the impact of the scheme on the likely achievement of that target.

Target - Habitat area – the aim is to maintain a stable area at 203.3 hectares or increasing / changing subject to natural processes

The potential for impact on habitat area relates to the operational phase. The target set requires regular flooding up to 16.5mOD. Mr Goodwillie noted that while the turlough habitat has no defined edge, each year being different, the level of 16.5mOD is that at which signs of flooding become evident in the vegetation. It is at this location that the zone of interaction between wet and dry communities was defined on the ground. This level therefore is the clearest marker for the edge of the turlough. It is the top height of regular flooding from vegetational evidence.

This target was a major driver for the scheme design selected. Other schemes which would have relieved flooding to more properties were rejected by the applicant on the basis that they would not minimise predicted changes to flooding up to 16.5mOD.

The critical control namely the channel between Rahasane Turlough and Rinn Bridge is not altered by the scheme and the hydrological evidence presented is that the ground out to 16.5mOD will continue to be inundated. The effect of the scheme will be to more quickly remove water above the 16.5mOD level. There will be no change to the inundation period at the level of 16.5mOD.

The effect of the scheme arising from the HEC-RAC modelling is that the water velocity through Rahasane Turlough will not change and that the flood level will change theoretically by 5mm, which is difficult to perceive on the ground. Evidence

presented also indicates that the bypass culvert at Rinn Bridge could have some effect on Rahasane Turlough. On this point the applicant has proposed a comprehensive operational phase monitoring strategy as well as remedial measures comprising effectively a reversal to the works at the bridge[13].

The modelling undertaken including the model type, inputs and assumptions is validated by Ms Hayes in section 2.3 of her report. The model correlates well with historic data as verified by the OPW during the hearing. I am satisfied that it is demonstrated that the scheme will have not result in measurable change in water levels in Rahasane Turlough. I conclude therefore that in the operational phase the target is met. I am satisfied that the objective to maintain flood duration and extent at this level of 16.5m thereby maintaining the turlough vegetation communities is relevant to the conservation objectives for the site and is achievable.

Habitat Distribution – target is to ensure no decline subject to natural processes

As it is demonstrated beyond reasonable doubt that the development will not affect the hydrological or hydrogeological regime in Rahasane Turlough then it can be concluded that the turlough habitat will be maintained throughout as stated in the NIS.

Maintain the natural hydrological regime necessary to support the natural structure and functioning of the habitat

Changes to baseflow, flood duration, flood frequency, flood area, flood depth and the flooded areas are noted to be not significant – the natural structure and functioning of the habitat will be not be affected.

Ensure that variety, area and extent of soil type supports vegetation, ensure soil nutrient status, sufficient wet bare ground, appropriate $CaCO_3$ concentration in soil

Soil type is largely determined by geology, morphology and hydrology. Potential changes to flood duration and regime could give rise to affects in the operational but will not occur.

In the construction phase a significant release of sediment could impact on the eastern end of Rahasane Turlough and impact on soil nutrient status, depending on flood conditions at that time. Section 9.2.1 of the NIS and other submissions presented in relation to mitigation of construction phase refer. I am satisfied that subject to mitigation as proposed the target specified is achievable.

[13] The scheme involves installation of two flood eyes at Rinn Bridge, which is stated to be the main risk in terms of the future alteration of water levels in the turlough. A remedial strategy is advanced by the applicant – in the event that it is necessary to mitigate against a reduction in water levels it is proposed that the two flood eyes would again be altered. Suggested approaches include provision of mechanical weirs / flood gates or removable stop logs. Through such mechanisms the Council would be able to maintain the water levels in the turlough.

Ensure appropriate water quality to support the natural structure and functioning

Changes to the flood regime, which are reasonably described as not perceptible are not likely to affect nutrient levels, colour or biomass.

In the construction phase localised sedimentation or turbidity will occur at the eastern end of the turlough even after mitigation. The nature of turloughs is such that routine flood events accompanied by increases in nutrients occurs naturally from time to time. Section 9.2.1 of the NIS and other submissions presented in relation to mitigation of construction phase refer. Subject to mitigation as proposed the target specified will be achieved.

Maintain area of sensitive and high conservation value vegetation communities and maintain vegetation mosaic and maintain vegetation sward height

Sensitive habitats have been identified as being distributed throughout Rahasane Turlough. Sward height relates to grazing which would be altered if flood duration was reduced. As there is no change in flood levels and duration the current area of sensitive communities are unlikely to be affected by the scheme.

In the construction phase a significant release of sediment could impact on the eastern end of Rahasane Turlough and impact on vegetation communities, depending on flood conditions at that time. The communities of highest conservation value are not located at this end. Section 9.2.1 of the NIS and other submissions presented in relation to mitigation of construction phase refer. Subject to mitigation as proposed the target specified will be achieved.

Maintain typical species and maintain marginal fringing habitats that support turlough vegetation, invertebrate, mammal and/or bird populations

Woodland ground layer communities could be influenced by routine or continued flooding influencing plant species composition with knock-on effects to invertebrate community and in turn some mammals. The scheme will not give rise to such effects.

In the construction phase a significant release of sediment could impact on the species composition. Section 9.2.1 of the NIS and other submissions presented in relation to mitigation of construction phase refer. Subject to mitigation as proposed the target specified will be achieved.

Comment on some of the information presented

The applicant's early submissions included a number of statements which would militate against satisfactory completion of Appropriate Assessment. These include comments such as 'the hydrogeological conditions controlling the water level fluctuations are poorly understood' and there is reference also to groundwater monitoring for the purposes of 'future calibration of the model'.

The applicant has clarified during evidence to the hearing that the habitat is not in fact poorly understood. I note and accept Mr Baker's evidence. Further as noted in submissions there is no need for groundwater monitoring for review of the model as it is not calibrated using such data.

In addition Mr Goodwillie's evidence was that the scheme would change the inundation period. This statement was retracted when he informed the hearing that he had mis-read the engineering report and construed a reference to Zone 3 as being applicable to Rahasane Turlough.

Finally I refer to the construction phase management measures which I discuss further elsewhere in this report. The Board in carrying out its assessment should be satisfied that these are feasible and sufficiently robust. My conclusion is that the mitigation measures, which in this case are intrinsic to the scheme design or are set out in detail proposals and commitments and subject to further refinement are demonstrated to be adequate. In this regard I note the comments of DAHG and consider that the requirements set out in relation to the information required prior to consent is met in this instance.

Rahasane Turlough SPA

The conservation objective is generic. It is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA. These are Whooper Swan, Wigeon, Golden Plover, Black-tailed Godwit and Greenland White-fronted Goose. The NIS provides information on the conservation status (at site level) of these species which is 'favourable' for all except Whopper Swan. The latter is in long-term decline at national level and the site trend is one of decline.

In carrying out its Appropriate Assessment the potential for construction stage impacts needs to be considered. The potential for impacts arising from increased suspended sediment result in changes to the turlough have been considered above. Spillages are another source of potential impact on birds. Subject to appropriate construction phase mitigation measures significant impacts on bird species within the SPA are unlikely.

The western end of Rahasane Turlough is often used by Whooper Swans and Black-tailed Godwits, the former feeding in areas of deeper water, the latter on the spoil banks near the Dunkellin. Black-tailed Godwits are stated to disperse through the entire turlough and thus may be considered to be more adaptable to construction phase impacts. Regarding the construction phase the Board may wish to have regard particularly to the scale of the European site, to the limited nature of works at Rinn Bridge and in the vicinity of Rahasane Turlough and to the applicant's commitment relating to the timing of works in these areas which shall be outside the period of 1st September to 31st March. Potential for localised disturbance to bird species within the SPA can thus be eliminated as a concern.

In the operational phase the scheme could affect the relevant species by changes in the hydroperiod and alteration of turlough habitat on which the birds depend. Changes in water depths may alter usage by different species, favouring some and discouraging others. I consider that the applicant has demonstrated beyond reasonable scientific doubt that the implementation of the scheme will not give rise to changes in the habitats in the turlough and that the changes to the hydrological scheme would not be perceptible. Therefore it is reasonably concluded in the NIS that there will be no change to habitats in the turlough and consequently no change to usage by bird species. The evidence presented to the hearing refers to the monitoring program for Rahasane Turlough which will include continued consultation with the official Birdwatch Ireland IWeBS recorder for Rahasane on the species distribution and abundance.

Finally I note that the NIS refers to the river downstream of Rahasane Turlough being the main flightline and to the avoidance of construction works outside of the winter bird season. I refer again to the importance of the mitigation measures presented by the applicant.

Cregganna Marsh SPA – comment

I refer at this point to the stated connection between Rahasane Turlough SPA and Cregganna Marsh SPA. This matter was raised by DAHG in observations. The position of DAHG is that there are linkages between these two sites as the population of Greenland White-fronted Goose that uses Rahasane Turlough also uses Cregganna Marsh. The NIS[14] also notes this connection. The species is considered to be particularly vulnerable to habitat degradation at Rahasane Turlough as it has only one alternative feeding site which is Cregganna Marsh SPA. The applicant indicates that the sites are within suitable commuting distance of each other (7.5km).

I am satisfied that direct effects on Cregganna Marsh SPA will not result from the scheme. There will be no impact on the suitability of the habitat in Rahasane Turlough SAC for Greenland White-fronted Goose as a result of the scheme before the Board. During construction or operational phases the scheme will not give rise to barriers to migration of these birds - there will be no works within the commuting corridor between the two European sites.

Finally, in relation to the construction phase it is pointed out in the NIS that if works at Rinn Bridge have to be undertaken during the winter bird season then the importance of the western end of Rahasane Turlough for particular birds would need to be assessed. Greenland White-fronted Goose is known to favour the north-eastern end of the turlough, which is some distance from Rinn Bridge. Any such departure from the overarching commitments in applicant's submissions, that works

[14] I refer to section 6.2.3.2 which is quoted in the evidence of Paula Kearney to the hearing on 29th October.

would not occur in this area in that period, would in my opinion have to be subject to Stage 1 Appropriate Assessment at minimum.

Galway Bay Complex SAC

This is a large site. The applicant notes the site specific conservation objectives. The overall objective is to maintain or restore the favourable conservation condition of the Annex I habitats(s) and / Annex II species for which the SAC has been selected.

Having regard to the nature of the scheme design, the proposed mitigation measures and likely impacts I support the conclusion presented in the NIS which is that the qualifying habitats and species which may be impacted are:

- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1410 Mediterranean salt meadows
- 1330 Atlantic Salt Meadows
- Otter
- Common seal.

The written submission of DAHG indicates that Reefs, which are a qualifying interest may be impacted. The submission in the NIS is that the nearest identified reef is 2km downstream of the N18 Bridge. On this basis and having regard to the hydrological and water quality impacts, I am satisfied that there is no need for further assessment of this habitat.

I note Dr Tully's reference to seagrass and maerl. These are not listed as qualifying interests within the zone of influence of the scheme. Seagrass / *Zostera* and maerl are within *large Shallow* Inlets and are keystone communities for this habitat but that habitat is not found in the vicinity of the scheme.

Another comment of Dr Tully's is also noted at this point. He refers to the Native Oyster being listed as a constituent species of Sandy Mud to Mixed Sediment Community Complex, one of 12 community types identified in the 'supporting document'[15]. I have considered this matter and conclude that it is is not a qualifying interest for the SAC which identifies two other community types (intertidal sandy and

[15] I refer to the Galway Bay Complex SAC (site code 00268) – conservation objectives supporting document – Marine habitats and species – Version 1 March 2013. Table 1 and table 6 refer. A copy of this is attached together with the Galway Bay Complex SAC 00268 Conservation Objectives dated 16 April 2013.

community complex and Intertidal sand community complex) as being relevant to the Annex I habitat 1140[16].

Dr Tully refers in his written submission to the role of Native Oyster in the marine communities including in relation to the stabilising of sediments which may reduce shoreline erosion. I consider that taking the totality of the evidence presented in relation to the scheme and its effect on oysters there is no reasonable likelihood that the scheme would give rise to increased shoreline erosion to which the nearby qualifying habitats would be exposed.

For the purposes of Appropriate Assessment in relation to Otter I will include at this point consideration of impacts which might arise along the Dunkellin, i.e. beyond the designated area.

Regarding the potential for direct effects I note that no works are proposed within Galway Bay Complex SAC. Works do take place in the river corridor traversed by Otter and the Mudflat habitats in particular are very close to the works area as they extend almost to Kilcolgan Bridge. Direct effects are described by the applicant as being extremely unlikely, which is reasonable in my opinion, insofar as it relates to the designated area.

There is potential for indirect effects during the construction and operational phases particularly. The scheme may affect the qualifying interests (habitats) by increased sedimentation / run-off of pollutants in the construction phase, by changes to salinity and sedimentation in the operational phase and by impacts on Otter including direct and indirect effects such as removal of riparian habitat, in stream works and infilling of land.

Mudflats and sandflats not covered by seawater at low tide

The targets identified in relation to this habitats are to ensure that the permanent habitat area is stable or increasing. This relates only to operations to permanently remove the habitat from the site, which does not apply.

A second target relates to conservation of two community complexes of area 513 hectares and 232 hectares in natural condition. These are Intertidal sandy mud community complex and Intertidal sand community complex. The applicant indicates that any release of suspended sediment is unlikely to significantly impact on the estimated area of these intertidal community complexes. Continuous disturbance of communities is not proposed. The slight increase in peak discharge which is predicted is extremely unlikely to result in changes to the natural condition. No long term effects are considered likely. Subject to mitigation smothering could occur or short-term changes in sediment granulometry.

Regarding the possibility of long-term release of sediment resulting from the scheme this matter was raised by observes in the context of the oyster beds. As discussed earlier this is not considered likely in view of the scheme design and impacts.

Occasional salinity changes would arise but only during extreme flood events and the effects would be limited in duration and intensity[17].

In relation to the above habitat, I agree with the conclusion presented by the applicant that there is no residual effect arising from the short-term changes to salinity in Dunbulcaun Bay and no effect that interacts with the conservation interests of the European site.

1410 Mediterranean salt meadows and 1330 Atlantic Salt Meadows

The objective of restoring the favourable conservation condition of these habitats is considered in relation to targets related to area, range and structure and function.

Neither the area nor the range of these habitats are likely to be impacted by release of suspended sediment according to the NIS. I accept this submission. Again I refer to the scheme design and impacts and to my earlier assessment of the predicted impacts.

The potential for increased sediment supply outside of natural levels is identified as a potential risk in the event that the release occurred when salt meadow habitat is submerged. I accept the applicant's submission that such an event would be short-term and unlikely to result in long-term consequences. Short-term changes arising from suspended solids release in addition would not be likely to result in a change in the identified structure and functions including vegetation zonation or cover.

Regarding the possibility of long-term release of sediment resulting from the scheme this matter was raised by observers in submissions relating to the impact on shellfish and is addressed in the NIS. Ms Hayes concludes following her review of the model predictions of velocity in the river channel in the operational phase and following discussion at the hearing, that while slightly more sediment may reach the bay in an extreme flood this will not have a significant impact on the receiving habitat which already receives significant sediment influx in flood conditions.

I agree with the conclusion presented by the applicant, which is supported by Ms Hayes' assessment that there is no residual effect arising from the short-term changes to salinity or from sedimentation in Dunbulcaun Bay and no effect that interacts with the conservation interests of the European site.

[17] This is discussed earlier in this report wherein the identified changes are described as being less than 1PSU at most – the modelled difference is 0.15PSU and this occurs immediately following the peak flow during a flood event and lasts for a few tidal periods. The discussion and my conclusions on this matter in relation to shellfish are relevant.

Otter

Likely effects on Otter are set out in section 6.2.1 of the NIS, which notes the undertaking of specific surveys of the main channel of the Dunkellin and Aggard including on both sides of the watercourses in 2011. Additional checks were undertaken in 2014 and 2015.

Direct effects relate to in-stream works and removal of habitat and foraging vegetation or resting location. The applicant's submission is that such effects are likely to be temporary and negative.

Indirect effects identified in the applicant's submission relate to alteration of flow, interruption of food chains, removal and degradation of suitable habitat. These are temporary negative effects.

The applicant's conclusion is that without mitigation there would be impacts of a local scale and for a short-term. Pre-construction surveys are proposed at least along the length of channel between Dunkellin Bridge and the N18 and Holts, if found will be excavated under licence.

In view of the phasing of the works, the mitigation measures and the availability of other habitat, I consider that the Board can be satisfied that the development would not adversely affect the integrity of the SAC having regard to the conservation objective relating to Otter.

Common seal

Common seal are identified as using a range of known breeding sites, moult haul-out sites and resting haul-out site which are identified on maps in the site specific conservation objectives. The target for the species is to conserve these sites, avoid artificial barriers and prevent human disturbance. None of the sites known to be used by seals are within the vicinity of the estuary influenced by the Dunkellin and there are no works in the immediate vicinity of the bridge. Food sources will not be affected.

Having regard to the predicted impacts of the scheme I am satisfied that there will be no impact on the Common Seal.

Inner Galway Bay SPA

The conservation objectives for Inner Galway Bay SPA are to maintain the favourable conservation condition of the waterbird Special Conservation Interest species for the site and to maintain the favourable conservation condition of the wetland habitats as a resource for the regularly occurring migratory waterbirds.

I refer to earlier comments regarding the potential for direct impacts on any species which would migrate along the Dunkellin between Rahasane Turlough and the Bay or forage or roost in the vicinity of the scheme. Temporary impacts on a number of

species is anticipated. These are mitigated by measures set out in section 9.2.2 of the NIS which refer to avoidance of construction works in the vicinity of Rahasane Turlough in the over-wintering season. There are no works downstream of Kilcolgan Bridge and works of a limited nature in the zone immediately upstream of the bridge. Avoidance of works during the over-wintering season appears to be achievable.

The potential for indirect effects by increased sediment flow or spillages during the construction phase arises particularly in the event of any uncontrolled releases. The distribution of waterbirds within the SPA is most likely to be influenced by significant changes to habitats 'Intertidal sand mud community complex' and 'Intertidal sand community complex' the location of which are shown on the 2013 NPWS map.

Mitigation to ensure best possible control of sediment and to limit other disturbance including as a result of phasing of the timing of construction will ensure that potential construction phase impacts on the conservation objectives of the European site are minimised and avoided where possible.

The slight increases in operational phase peak discharge by 1% and reduction in time to peak flow together with changes to salinity have been discussed above in relation to other nearby habitats within the Galway Bay Complex SAC. I accept the applicant's conclusion that there are no residual effects and no effect that interacts with the conservation interests of this European site.

European Sites – overview and conclusion

Details of mitigation are set out in this report and in my opinion they are well thought out and will be subject to further refinement. I note the comments of DAHG in relation to the requirement to ensure all measures are identified prior to consent and consider that this is achieved insofar as is appropriate and feasible.

I consider it reasonable to conclude that on the basis of the information on the file, which I consider adequate in order to carry out a Stage 2 Appropriate Assessment, that the proposed development individually or in combination with other plans or projects would not adversely affect the integrity of the European sites 000322, 004089, 000268, 004031 or any other site, in view of the sites' Conservation Objectives.

MITIGATION, MONITORING AND CONDITIONS

In the foregoing I refer to certain conditions which the Board may wish to attach in the event of a grant of permission.

Earlier I referred to the option of limiting the scheme to Zones 1 and 2. I do not recommend this for the reasons and considerations previously presented.

I refer below to my recommendation regarding operational phase monitoring which relates to Rahasane Turlough.

I refer also to my recommendation on foot of the requirements presented by Dr Tully during the hearing – these relate to baseline and other marine water monitoring.

Operational phase monitoring

The dynamic nature of turloughs has to be acknowledged. It is important that there is available evidence to distinguish natural changes from changes which might relate to unforeseen effects of the scheme. For this reason in particular operational phase monitoring is worthwhile.

I am satisfied that the applicant has presented sufficient evidence for monitoring in the operation phase including terrestrial, aquatic, hydrogeological and hydrological monitoring. This is described in detail in written submissions including in section 1.3 of the response to the request for further information wherein the importance of monitoring of Fairy Shrimp and Water Beetles and the proposal for such monitoring is set out. In addition post-construction monitoring of flow gauge water levels up-gradient and down-gradient of the turlough will be undertaken. No monitoring of the three groundwater wells is proposed and I note and accept the conclusion of Ms Hayes that the ongoing monitoring of flow gauge water levels would provide the necessary data to confirm any impact on groundwater. All of the monitoring to be undertaken will produce information which will assist in future management plans for the SAC and provide the basis for implementation if necessary of the remedial measures at Rinn Bridge. Ms Hayes' recommendation that the monitoring programme include field assessment of swallow holes is noted and I consider that this is appropriate. That information would contribute to a better understanding of the turlough and would assist in identifying the source of any changes which may occur as a result of natural collapse or infilling. I also note that Ms Hayes recommends that a monitoring report covering a period of at least two years post-construction be available on the planning file for public inspection.

Marine Environment

I refer to Dr Tully's list of requirements for baseline and other monitoring in the marine environment. The applicant has agreed to a number of these measures and I recommend that they be subject of a specific condition. As they are not contained within the Schedule of Commitments I recommend that a specific condition be attached and condition no. 5 refers.

CONCLUSIONS AND RECOMMENDATION

The scheme generally achieves its aim of providing flood relief in the Dunkellin River / Aggard Stream catchment and as such addresses a long standing and persistent flooding problem. The limitations to the scheme are acknowledged. However, the scheme will benefit a number of houses and infrastructure in the area. The scheme presented in my opinion strikes a good balance between engineering measures (zone 1), retaining a flood regime where necessary under restrictions imposed by the Habitats Directive (Zone 2) and containing flooding in a wider channel and indeed retaining a floodplain close to the estuary (zone 3).

The development is likely to give rise to a number of environmental impacts of which I consider the most significant residual effects relate to material assets. Alternatives have been thoroughly examined. Cumulative effects are not likely. In overall terms I consider that the scheme would be beneficial and would not give rise to significant adverse environmental impacts.

My conclusion is that the assessment of the impact of the scheme on shellfish and on ecology in general is adequate. There is a low likelihood that the scheme will have significant consequences for the shellfish industry or marine ecology. No further modelling is required and no significant modification to the scheme is warranted. The Board may wish to consider limiting the consent to the area between Craughwell and Rinn Bridge, to allow for a period of monitoring for the undertaking of calibrated salinity modelling. This is not recommended.

I consider it reasonable to conclude that on the basis of the information on the file, which I consider adequate in order to carry out a Stage 2 Appropriate Assessment, that the proposed development individually or in combination with other plans or projects would not adversely affect the integrity of the European sites 000322, 004089, 000268, 004031 or any other site, in view of the sites' Conservation Objectives.

I therefore recommend that the proposed development be approved for the reasons and considerations set out in Schedule 1 subject to conditions set out in Schedule 2.

SCHEDULE 1

REASONS AND CONSIDERATIONS

Having regard to:

(a) the provisions of the European Communities (Environmental Impact Assessment) Regulations 1989 – 1999 (as amended), and the European Communities (Birds and Natural Habitats) Regulations, 2011,
(b) the provisions Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive)
(a) the provisions of the Galway County Development Plan 2015-2012
(b) the nature and frequency of the flooding which occurs in the catchment of the Dunkellin River and Aggard Stream
(c) the report of the Board's consultant hydrogeologist
(d) submissions on file, including the Environmental Impact Statement and the Natura Impact Statement and associated documentation and the submissions made in connection with the application at the oral hearing and the range of mitigation measures set out in the documentation received.

It is considered that, subject to compliance with the conditions set out below, the proposed flood relief scheme would not have significant negative effects on the environment, would not give rise to a risk of pollution, would not have a significant effect on the environment of any designated Natura 2000 site or site of ecological interest, would not have a significant impact on soils and geology, would not have a significant impact on fisheries including shellfish beds, would not have a significant impact on any protected species, would not have a detrimental impact on archaeological and architectural heritage, would not give rise to significant visual or landscape impacts, and would not seriously injure the amenities of the area or of property in the vicinity. It is considered that the proposed flood relief scheme, which would constitute an improvement to the area by reason of the relief of serious and frequent flooding, would be in the interest of the common good and would be in accordance with the proper planning and sustainable development of the area.

The Board agreed with the screening assessment and conclusion carried out in the Inspector's report that European sites Rahasane Turlough cSAC (site code 000322), Rahasane Turlough SPA (site code 004089), Galway Bay Complex cSAC (site code 000268), Inner Galway Bay SPA (site code 004031) are the European sites for which there is a likelihood of significant effects.

The Board considered the Natura Impact Statement and all other relevant submissions and carried out an appropriate assessment of the implications of the proposed development for European Sites in view of the sites' Conservation Objectives European sites Rahasane Turlough cSAC (site code 000322), Rahasane Turlough SPA (site code 004089), Galway Bay Complex cSAC (site code 000268), Inner Galway Bay SPA (site code 004031). The Board considered that the information before it was adequate to allow the carrying out of an Appropriate Assessment.

In completing the assessment the Board considered, in particular
i) likely direct and indirect impacts arising from the proposed development both individually or in combination with other plans or projects, specifically the Gort to Tuam Motorway,

ii) mitigation measures which are included as part of the current proposal,

iii) Conservation Objectives for these European Sites,

iv) the view of the Department of Arts, Heritage and the Gaeltacht.

In completing the AA, the Board accepted and adopted the Appropriate Assessment carried out in the Inspector's report in respect of the potential effects of the proposed development on the aforementioned European Sites, having regard to the site's Conservation Objectives.

In overall conclusion, the Board was satisfied that the proposed development would not adversely affect the integrity of European sites in view of the site's Conservation Objectives.

SCHEDULE 2

CONDITIONS

1. The proposed development shall be carried out in accordance with the plans, drawings and documentation submitted with the application on the 9th day of October 2014, as amended by information submitted to An Bord Pleanála on 10th July 2015 and at the oral hearing on 27th and 28th of October and 3rd of November 2015, including the Environmental Impact Statement, Natura Impact Statement and supporting documentation, except as may be otherwise required in order to comply with the condition set out below.

Reason: In the interest of clarity.

2. The local authority and any agent acting on its behalf shall implement in full the mitigation measures contained in the Environmental Impact Statement and in the Natura Impact Statement submitted with the application and in the verbal and written submissions to the oral hearing including the Schedule of Environmental Commitments.

Reason: In the interest of clarity and the proper planning and sustainable development of the area and to ensure the protection of the environment.

3. The results of all baseline, construction and operational phase monitoring shall be made available as part of the planning file which shall be retained in the offices of the Planning Authority for a period of at least five years.

Reason: To ensure availability of information to interested parties.

4. For a period of five years after completion of all works the local authority shall undertake annual monitoring at Rahasane Turlough to include:

   (a) field assessment of swallow holes and recording of natural collapse of conduits or infilling of swallow holes

   (b) monitoring of water level at existing river gauges up-gradient and down-gradient of Rahasane Turlough

   (c) monitoring of vegetation and indicator species at Rahasane Turlough as described.

Reason: To ensure optimum understanding of the turlough including any future naturally occurring changes to the SAC, to provide a record of same and to verify that the scheme has no significant impact on water levels in Rahasane Turlough.

5. The commitments given at the oral hearing regarding baseline, construction and post construction monitoring of a single point in the estuary shall be undertaken. The collection of data shall be undertaken following consultation with the Environmental Officer to be engaged by Galway County Council, who shall have delegated powers to stop works and direct the carrying out of emergency mitigation operations if necessary.

Reason: To provide for monitoring and protection of water quality in the river and bay to ensure that the scheme does not give rise to effects which might adversely impact on the environment and the shellfish industry.

Mairead Kenny

Senior Planning Inspector

12th February 2016

APPENDIX - ORAL HEARING

The following is an account of the oral hearing. In the foregoing I have provided brief summations where written statements were used as the basis for the oral presentation. In the absence of written statements and where the nature of the discussion was particularly technical or relevant, I have provided a longer summary. The recording of the entire hearing is available to the Board.

Day 1 - 27th October

After preliminary statements and introductions **Mr Esmonde Keane** commenced the presentation on behalf of Galway County Council. He noted that the letter from TII to GCC indicates that TII is satisfied with the clarifications presented by the applicant and will be making no further comments.

Mr Sean Langan outlined the **need for the scheme**. He noted the complex environmental, geological and hydrological nature of the area. He referred to the long history of flooding in South Galway including the extreme flood events of November 2009 and January 2010, leading to the preparation of an outline design for a scheme prepared by Tobin Consulting Engineers and the commissioning of RPS in 2011 to prepare an EIS and NIS. Submissions received were discussed at great lengths by the team. The scheme addresses a 100 year return flood event. Due to environmental constraints around the Rahasane Turlough there is no feasible solution to protect six homeowners. Future drainage maintenance will be undertaken as the need arises.

Ms Lauren Williams presented on **Aquatic Ecology.** She prepared detailed fisheries and crayfish habitat assessments of the affected reaches of the Dunkellin River and the Aggard Stream. She describes aspects of these waters in terms of importance for salmonids, lamprey and white-clawed crayfish. Baseline monitoring of a suitable group of aquatic invertebrates in the two basins in Rahasane Turlough has commenced and will continue till post-works. The Fairy Shrimp in Rinn Basin requires maintenance of the flooding level and hydrological regime for breeding. Deepening of 950m of channel has the potential for significant negative construction and operational phase impacts on fish and crayfish. Due to the fisheries enhancements proposed the long-term effects will be neutral. Mitigation including periods of working and sediment control and monitoring surveys and rescue and re-location under licence will ensure no significant negative impacts on fish and crayfish during channel deepening. No significant impact is predicted for aquatic flora and fauna of Rahasane Turlough.

Mr Roger Goodwillie described his background work on turloughs going back to 1991. His involvement in the scheme between 2012 and 2015 has included comment on a number of schemes produced by Tobin and commenting on their potential effects on ecology. Part of this work was to establish the top height of regular flooding from vegetation evidence and to find suitable places for monitoring. He corrected an aspect of the RFI noting that the water speed change of 1% refers

to the system below Rinn Bridge only. He stressed that the level of 16.5mOD is indicated by vegetation and is the most useful marker for the boundary of the turlough. While there will be an impact on extreme water levels the flooding pattern in normal years will not be altered significantly to change the vegetation. There will be no significant ecological impact on the turlough caused by the project nor on the integrity and functioning of the habitat.

Ms Paula Kearney presented evidence on **terrestrial ecology** and provided an **addendum and errata to the EIS and NIS**. She noted the vegetation community survey completed within Rahasane Turlough which aimed to verify the vegetation communities mapped and described by Goodwillie (1992). In all 166 reveles were surveyed within Rahasane Turlough.

Ecological receptors within the study area include 23 European Sites of which 4 no. were considered might be affected due to being hydrologically connected.

Regarding Rahasane Turlough she noted the additional surveys undertaken in June 2015 with Mr Goodwillie and the availability of LiDAR mapping further validates the ecologically critical water level of 16.5m OD. Overflow from the channelised river into Rinn basin occurs at 14.7m OD.

Indirect effects on Galway Bay Complex SAC through increased sediment flow and changes to flow volumes in the estuary may occur during construction and there is potential for direct and indirect effects to otter and birds which use or migrate along the river.

Although the proposed works are considered to reduce surface water flooding in extent and duration at Dunkellin Turlough they will not impact on its hydrogeology. Removal of 0.05ha of Castlegar Turlough (6.4% of its extent) results and there may be indirect effects. The hydrogeology of the feature is predicted not to be impacted.

The model shows that the scheme will not materially alter flood regimes in Rahasane Turlough and thus will avoid impacts to the in-situ vegetation community and to the roosting, foraging and feeding of avifaunal species.

Mitigation measures proposed are set out in section 1.8. The Construction Management Plan prepared will be further developed by the appointed contractor. Construction phase impacts on Rahasane Turlough can be readily mitigated.

Regarding the statement that the hydrogeological conditions controlling water level fluctuations in Rahasane Turlough being poorly understood it is noted now that there have in fact been a number of detailed studies on the hydrogeology and hydrology of turloughs in this area, which are now listed.

A copy of 'Expert Opinion report on the results of environmental modelling for the Dunkellin Flood Alleviation Scheme' prepared by **Dr Rachel Cave** on 27th February 2012 was presented, in her absence. It examines how the scheme would affect the

salinity of the inner Dunbulcaun Bay and whether this would pose a hazard for shellfish mortality in the bay over and above any natural hazard from low salinity induced by flood discharge at present. The conclusion is that the results of the RPS modelling exercise indicate that implementation of the scheme will not increase the natural hazard to shellfish mortality in Dunkellin Bay as it will not prolong the discharge period for the flood waters. However, if these or related works lead to a prolonging of the period over which flood waters are discharged to the bay, even if peak discharge rates are lower, this will increase the hazard to shellfish.

Mr Michael McDonnell's presentation on the engineering evidence for the scheme set out the need for the project, the options considered, the design standards, the civil engineering works proposed, the envisaged construction methods and the programming constraints that will apply for the construction stage. Scheme 4 (the preferred option) avoids impacts on the predicted water levels in Rahasane Turlough, achieved by not altering the width or depth of the channel connecting the Rahasane Turlough to Rinn Bridge. The HEC-RAS modelling has shown that the width and depth of the channel downstream of the turlough is the primary hydraulic restriction which impedes the conveyance of flood water to the lower catchment.

The selected scheme has the potential to impact on the volume of water passing through the system, the velocity of flow in parts of the system and the level of water resulting from events similar to the November 2009 event. Velocity of flow through Rahasane Turlough will not change. The bypass culverts at Rinn Bridge have the potential to impact on the SAC.

The design flow of 97.7cumec at Craughwell exceeds the November 2009 event which has been estimated to be 84.4 cumec or a return period of 1 in 122 years. The input of the Aggard and an allowance for climate change is also incorporated in the scheme. The Benefit to Cost Ratio is 1.26 and the Cost Benefit Analysis is presented.

Section 6.0 refers to the potential hydraulic impact. At Kilcolgan Bridge there is less than a 1%increase in peak flow 99.31 cumec compared with 99.28 cumec. The flood hydrograph at this location which has been extracted from the HEC-RAS model is presented in Appendix 3. There is no change to the estimated flow velocity in Rahasane Turlough for a major event. Flood level will change by 5mm. Rahasane Turlough could be affected by the works at Rinn Bridge only.

Section 7.0 addresses the civil engineering. Two stage channel works will commence at a location 300m upstream of the N18. River bed levels are altered for 950m around Craughwell but are unchanged otherwise. Image A1.1 indicates the existing flood plain which will continue to act as it currently does.

Section 8.0 outlines construction methods. Between the N18 and Dunkellin Bridges there is no excavation within the channel and excavation will be undertaken along

the left bank with minimal interference. The undertaking of works in the dry minimises risk of sediment entering the river. At Killeely Beg works at left and right banks are required. The bridge will be of precast beams resting on new concrete abutments. Material will be re-used in the embankment and in permanent spoil heaps, which are not water retaining structures. Riverside layer of the embankment will be of recycled stone material with low silt content. Geotextile curtain and 1 in 3 slopes proposed. Dewatering is required at a number of locations and will involve use of construction pumps, temporary interceptors, settlement ponds at silt traps – settlement ponds at or adjacent to construction compounds at Killeely Beg Bridge, Dunkellin Bridge, Rinn Bridge and Craughwell are proposed. Detail of the in-channel works near Craughwell are described in section 8.3 including use of cofferdam.

Regarding timing and phasing the most significant matter is the constraint on work in-river or adjacent the channel only between May and September to protect fish and crayfish.

Responses to written submissions by IFI, TII and IR are presented. Regarding the N18 bridges the volume of water passing the N18 bridges or the associated velocity of water in the Dunkellin will not change significantly therefore no works on the N18 are proposed. IR will be consulted throughout. Amended drawings are included.

In discussion during the day Mr Goodwillie indicated in response to questions that the level of 16.5m OD is that at which the effect of the floods appears in terms of soil and vegetation impacts. He noted that it is a graduated effect and that there is no actual indicator for that level. Protecting the mosses which are present at 16.5m OD would be part of any management plan for Rahasane Turlough in his opinion.

Dr Fossitt of DAHG noted that there had to date been no consultation with the Department on the matter of Crayfish licence and that this should not be taken as a foregone conclusion. Regarding Annex IV species (otter and bats) granting of a licence can only be considered in limited circumstances. It is critical she stated that the implications of the scheme for Rahasane Turlough and the Bay (the SAC in particular) be understood. In terms of Rahasane Turlough there needs to be a full assessment of impacts of hydrological and hydrogeological effects as well as ecological. Regarding the bay questions previously raised in relation to flow rates and the potential effects on mudflats, sandflats and salt marshes in the area needs to be considered.

Dr Naomi Shannon of RPS referred to her 15 years post-doctoral experience in computational modelling and her previous work including numerous projects relating to estuarine hydrodynamics and sediment transport.

In evidence she noted that the 2009 event caused a significant decrease in salinity in the bay and raised concerns regarding impact on shellfish and oyster populations in the event of a similar floor reoccurring. The purpose of the salinity modelling was to

determine the change in flow and salinity as a result of the scheme rather than to carry out a detailed study into the stratified flow in the bay.

The complex nature of the flows arise from tidal flow, wind and wave climate and stratified flow as a result of riverine discharges and flow through karst features.

Unlike previous works carried out in 1992 which aimed to increase conveyance of floodwater to the bay the scheme has very little impact on the hydrograph downstream of the works. Due to the small change in the storm hydrograph it was proposed that the model needed only to recreate tidal and stratified conditions such as those found within the bay and to distinguish the changes due to the revised inflow at Kilcolgan. This approach was agreed under auditing by NUIG.

In response to written submissions it is noted that the modelling report in the EIS was an overview and did not contain details. Details supplied on model setup and implementation were submitted as part of the RFI.

Regarding the model application and scope it should be re-iterated that the modelling methodology was proposed to reflect the scale of the anticipated impacts. Sediment transport modelling was not required in the bay as the hydrological study and the river modelling anticipates no discernible changes to sediment transport as a result of the works – the modelled changes in flow velocities are minimal.

Sedimentation as a result of the works will be mitigated. As a result of the proposed works water will be effectively restricted to the main channel reducing the risk of contamination of water by diffuse sources. Thus water quality will improve and water quality modelling was not required in the bay. The effect of the scheme on the oyster beds would be a sporadic reduction in salinity of less than one PSU over the course of several tides should the 2009 event re-occur.

Ms Maeve Walsh presented information on EIA. She presented summary information relating to the impacts on **Air and Climate, Noise and Vibration, Cultural Heritage, Landscape and Visual, Human Beings and Material Assets, Traffic and Interactions and Cumulative Impacts.**

Day 2 - 28th October 2015

Mr Gerry Baker gave evidence on the **soils, geology and hydrogeological** aspects of the EIA. Surveys undertaken specifically for the project are listed. The undertaking of works in a Karstified limestone bedrock environment is noted and the numerous karst features in the area are listed.

The scheme design minimises impacts on geology and hydrogeology. The two-stage channel profile ensures no perceptible alteration to the river flow flows which are derived principally from groundwater baseflow to the river. A slight neutral impact on groundwater regime may occur where the river bed is lowered. No cavities have been identified that would be susceptible to collapse.

The embankment will encroach on the boundary of the unnamed turlough directly upstream of Killeely Bridge. There will be no impact on deeper fissures feeding the turlough. The statement that the hydrological conditions controlling the water level in Rahasane Turlough are poorly understood is refuted in detail in section 3.1.1. No significant residual impacts negative impacts are expected.

In response to a question he indicated that any karst located during construction (e.g. in the river bed / under soil) then the measures regarding geotextiles and buffer zones would be applied. Regarding the river channel works near Craughwell and how this could be dealt with he noted that the depth of rock is over 6m while the depth of excavation is around 1.5m. Excavation will occur in the alluvial layer, but some bedrock could be exposed. Local dewatering within the coffer dams was referenced.

Mr Tim Joyce OPW introduced himself as a Chartered Engineer with 36 years' experience in OPW. He presented data from hydrometric stations at Craughwell and verified the applicant's position that the impact of the scheme would be very small at Rahasane Turlough. Upstream of Rahasane Turlough an area of floodplain of 38,808 m^2 would be removed but at Rahasane Turlough while there will be an effect it would not be measurable.

Dr James Massey gave evidence on marine ecology. There will be no measurable effect on the downstream marine ecology and the receiving waters of Galway Bay SAC and Inner Galway Bay SPA.

There will be no discernible changes in sediment transport as a result of the proposed works. Mitigation in the construction phase is noted. In the post-works in normal conditions there is no change to conditions and in the flood event only a change in flow of short duration at peak occurs. The modelling shows that there is a virtually undetectable impact on the shellfish beds, *Zostera* beds or in areas of importance for feeding birds. No marine fish or fisheries impacts are identified. No interaction with the oyster beds or any habitat or species below the N18 Bridge is predicted.

The hearing was adjourned to enable the applicant to address two submissions which the applicant indicated had not been received prior to the hearing. Those submission were the responses of Clarinbridge Oysters and DAHG to the further information submitted by the applicant.

Day 3 – 3rd November

The **hearing was re-opened on 3rd November.**

A letter was handed in which indicated that the **Fordes' objection was withdrawn.**

Mr McDonnell and Dr Shannon responded to matters raised in the hearing and the Further Information submission of Clarinbridge Oysters.

The applicant noted that Dr Cave was brought in by RPS in response to matters which arose on foot of the consultation phase. She felt that the approach to modelling was appropriate as the scale of the scheme is very small in terms of the alterations to the storm hydrograph and because of the difficulties inherent in predictive modelling. A full wide ranging study would be disproportionate to the scale of the scheme and uncertainties would in fact be of greater magnitude than the impacts which are to be quantified. The modelling is not intended to predict the salinity at a specific location but to identify potential changes due to the scheme.

The Shellfish Directive has now been subsumed into the Water Framework Directive. The scheme reduces the risk of pollution. The only identified interaction with commercial shellfish is in flood situations where there is a 0.15 modelled reduction in salinity immediately following the peak flow during a flood event and only for short periods over a few tides at some locations in the embayment.

Regarding sediment transport there is no change to normal flow and no change to conditions downstream of the N18 Bridge. The scheme will not convey floodwater significantly faster into the bay but channels flood waters. The containment of water will ensure that interaction with diffuse contamination sources is decreased.

The authors are aware of the conditions and impact of the 2009 flood event and the tidal state leading up to it which meant there was a very real danger of significant shellfish mortality and for this reason the event was chosen.

The scheme differs from earlier approaches as its purpose is to re-locate extreme river flows and not to simply convey water away more quickly. It is not a drainage scheme and it will not deal with any additional flow.

In response to the comments of Numerics Warehouse the model did include stratified saline conditions within the bay as a warm up period of 6 weeks was used. During that time four major freshwater sources discharged into the bay. A response on the additional technicalities of the model was provided and the approach to grid scale reduction, vertical descretisation, grid scale diffusion, vertical mixing, wetting and drying and sediment flux is provided.

Ms Kearney responded to the Further Information submission of DAHG and matters which had been raised during the hearing. DAHG was not present.

The scheme will not result in habitat degradation or disturbance at Creganna Marsh SPA as it is not connected to it. It will not result in impacts or barriers to migration of Greenland White-fronted Goose population between Rahasane Turlough SPA and Cregganna Marsh SPA. Feeding regimes at Rahasane Turlough are not affected.

Additional ecological information is contained within the RFI including a breeding bird survey, surveys of vegetation at Rahasane Turlough and Macro-Invertebrate survey.

The scheme is comprehensively described and mitigation measures are detailed in submission made, which are referenced. This includes the identification of suitable indicators for monitoring of potential future changes to Rahasane Turlough.

Regarding cumulative effects the M18 crossing will be completed by April 2016. Hydrographic conditions are largely influenced by the input from the Dunkellin and Clarin rivers - there are no anticipated cumulative impacts related to Galway Harbour.

Residual effects are exhaustively described in the EIS. Clarifications relating to the primary issue of two-stage channel construction and silt and sediment management are contained in the Schedule of Environmental Commitments.

The implications for European sites subject to implementation of all mitigation are:

- Localised sedimentation or turbidity effects at Rahasane Turlough
- Localised disturbance to bird species feeding within the extremities of SPA/SAC
- Salinity changes in the event of a major flood, the effect of which would be of short duration and have no detrimental effect on Annex I habitats.

There are no implications for the conservation objectives of the European sites. There will be no significant changes to the size, structure and function of Rahasane Turlough.

Regarding the effects on protected Annex II species and / or Annex V species inside and outside of designated areas, appropriate detail was employed in scrutiny and mitigation. Impacts on crayfish, salmon and habitats are described. Tree and woodland impacts are noted – overall there is 4.05 hectares of habitat loss.

Clarinbridge Oyster Co-op Society Limited and Michael Kelly Shellfish were represented by a team lead by **Mr Diarmuid Kelly.**

Mr Kelly contended that the consultation process did not adequately address the concerns of the Clarinbridge Oyster Co-Op or Michael Kelly Shellfish. At one meeting we were told of Dr Rachel Cave's opinion dated 27th February 2012. Her opinion highlighted the complexities of the freshwater movements within Galway Bay and its influences on Dunbulcaun Bay. These complexities were not taken on board when the applicant revised their modelling in 2014. Also 2009 is not the worst case scenario.

The worst case scenario was highlighted by Dr Cave and I quote 'but (salinity) may remain below 12 (psu) over entire tidal cycles if discharged during periods of neap tides and / or north-westerly / westerly winds'.

Dr Cure referenced his 21 years post-doctoral research including 4 years studying mixing process and 15 years on hydrodynamic and wave modelling studies.

Regarding the applicant's comments about how the hydrodynamic regime will not change he noted statements like there is only 1% change in the peak value of freshwater flux and the overall volume of freshwater is the same. He accepted this.

However, he had digitised the RPS rating curves and measured the pixels - the vertical distance between the two curves gives you the change in the volume flux. The volume flux difference is up to about 7.5 cumec. That doesn't any groundwater contribution which the fire brigade would be adding maybe that's an additional 5 or 6 cubic metres. The additional flux is about 10% of the pre-work situation, which is not to be dismissed. The cumulative volume of freshwater in the days preceding the peak is up to 1.2 million cubic metres. As the estuary is quite small, roughly 1 kilometre square, this results in an additional 1.2m depth of freshwater, which floats on top of the seawater.

The purpose of the salinity model is to examine how this additional freshwater is mixed away and he has serious reservation with the modelling methodology. The effect of the freshwater added will depend on the pre-existing situation. We have not been advised of initial conditions or origins of the baseline data for temperature and salinity. Such data is not available for inner Galway Bay. RPS have only presented one scenario – a reproduction of the 2009 event. That model cannot predict the actual salinity of the oyster beds they have claimed. The effect on the freshwater on the oysters critically depends on the salinity they experience and duration of exposure.

RPS does not demonstrate understanding of vertical mixing. Water does not easily mix across different densities. Freshwater tends to sit over seawater. A model must resolve the freshwater layer which typically is only 1 metre thick. You have to have enough vertical layers to model velocity sheer and then the mixing process.

RPS has not clarified the value of the horizontal mixing co-efficient and the correct mixing coefficient should be very small indeed (close to zero). If it is too large then they will artificially mix up freshwater and increase the salinity. The conservative approach would be to leave out the horizontal mixing.

Regarding salinity in Dunbulcaun Bay, the applicant showed no evidence of variation. He stated that indicates the model isn't functioning correctly.

Dr Cure claimed there is a need for model validation and identification of the error in the predictions. RPS say that there model is a comparative model but this is simply expedience in the absence of data. Without such data the model cannot be judged. This is the only evidence presented relating to the impact on oysters. Baseline data should include at least one wet winter's worth of salinity temperature and current metre measurements. Without this baseline we would never know if RPS's models are accurate whether any observed changes e.g. increased mortality was due for instance to climate change. We are unable to judge whether the model has been set up correctly without data.

Dr Cure referred to the need to model extreme conditions including for instance spring tides. A large tide will hold up freshwater in the Bay and then as the tide goes out big pulses of freshwater are will enter the Bay and hold their integrity for quite a long time. The situation would be different for neap tides. Strong onshore winds acting on the sea surface will hold up the freshwater in the bay. It would be appropriate to simulate the 50 year return period west wind.

Regarding sediment modelling, Dr Cure stated that the hydrodynamic regime is not unchanged. There is an increase in the freshwater flux. That will increase the flow velocity in the river channel. It is a two stage river channel so until the second level is breached there will be an increased flow velocity resulting in a large increase in suspended sediment entering the estuary. The re-suspension, sheer stress of sediments is proportional to the square of the velocity. Hence a 10% increase in velocity has a much larger effect on the re-suspension of sediment in the channel. On the basis that there is not an increase in flow rate, which he disputed, RPS have discounted the possibility of large increase in suspended sediment.

Dr Rachel Cave is a scientist but doesn't do numerical modelling. The salinity model presented is the only basis for the argument that the scheme will not damage oysters.

The effect of the 1990s scheme was next described by Mr Kelly. Modelling should have been completed on pre 1992 data which should be considered the baseline.

Mr James Allison next gave evidence. He outlined his qualifications as including a Masters in Water Chemistry and referred to previous work experience in including monitoring of the shellfish water quality. In the Clarinbridge area four sites are monitored on a monthly basis for *E.Coli*. Water quality improved from 2004-2008 and from 2008 onwards it has declined year on year. The origin of the pollution is not known. One more bad result from the inner bay would degrade it to a C class which means you can't harvest any oysters there for human consumption without them going through treatments. The scheme will result in the flood arriving down on the estuary six hours earlier. Research says that the time it takes for 90% of the population of *E.Coli* to die is between 1 and 8 hours. Loss of six hours retention is very significant.

Retention is also relevant for the suspended solids as the *E.Coli* travel with them. The scheme will affect a tiny number of houses in the context of the 12,500 in the catchment. The applicant did not address including DOs, the new road, heavy metals etc. Retention is the critical thing. The scheme will not improve water quality.

Mr Kelly noted that prior to 1992 the Rahasane Turlough retained water for much longer, acting like a kidney. He called Dr Oliver Tully of the Marine Institute.

Dr Tully is employed at the Marine Institute and advises the government on oysters. Has recently sampled oysters in Dunbulcaun Bay where there is good juvenile

population, millions of them. Sediments are clean shell and sand and suitable for oysters. Juvenile Pacific oysters are quite abundant - there are other shellfish.

Oysters are adapted to low salinity he acknowledged. The issue is commercial viability and the balance between growth rate and mortality. Native oysters' response to changes in salinity is not exactly known – there could be 100% mortality if low enough.

Dose response curves need to be produced. Extreme rainfall events in Dunbulcaun Bay affects production. The balance between growth and mortality is on a knife edge. We need to know more about the changes of juvenile oysters, to acknowledge that this is a highly variable environment and that increases to variability are problematic.

Mr Kelly in conclusion noted that there needs to be no scientific doubt, which has proven not to be the case. The fishery in the inner bay has previously been wiped out. The models should have been based on the pre-1992 baseline. The applicant has not shown that there will not be adverse impacts. EPA reports highlight the problem of orthophosphates in the area, the transport of which will be exacerbated by the scheme. That would give rise to closure of fisheries.

Dr Massey next addressed a number of issues relating to the matters raised in the hearing and **marine ecology and sensitivity to *E.Coli*.** Dr Massey stated that when oysters are exposed to low salinity they cease feeding hence there should be reduced in-take of *E.Coli*. He has not seen any evidence of an increase intake in such situations. If when they feed again there is silt and *E.Coli* then there could be an increase. Mr Allison gave the reference for his statement noting that at the time of closure (cessation of feeding) there would be a spike in the *E.Coli*.

There was a discussion between the experts about the die-off time for *E.Coli.* Mr Allison noted research that would indicate that the T_{90} could be from an hour to eight hours, the norm being about 2 hours. Mr Keane noted research indicating up to days.

Mr Keane referred to the evidence for flow presented by his team and by Mr Joyce of OPW. He noted that the Rahasane Turlough fills over a very large area. Dr Cure noted that the water could conceivably flow through the Rahasane Turlough in the channel and that the applicant is assuming mixing in the turlough. Mr Kelly noted the applicant's statement that there is no difference between what is coming in and out but queried the speed of water into and out of the Rahasane Turlough. Mr Keane noted the applicant's submission is there is a small difference in velocity only.

Mr Allison stated that the only evidence is that the flood event comes down six hours earlier, so that water has lost six hours retention. Mr Keane noted that water which has passed through the Rahasane Turlough will have taken more than six hours.

Most of the 12,500 houses in the catchment are upstream of the SAC. Mr Keane refuted any suggestion that the post-scheme scenario would increase *E.Coli* being carried at speed to the bay. The confining of water in the two-stage channel will reduce the *E.Coli* picked up from lands. Thus the scheme would reduce the contamination in the water which will quickly enter the bay.

Dr Massey returned to points made relating to the current state of native oysters in Dunbulcaun Bay. Mechanisms relating to mortality and growth rates are still not fully known. In terms of the oysters biology the effect of low salinity on oysters have been researched and relatively well understood since the 1950s and 1960s. The tolerance and the effects of oysters to low salinity for the EIS and for the brief of evidence were taken from criteria from peer reviewed publications including one which has classified the tolerance to changes in salinity as a low tolerance - from the FAO themselves. The change we are looking at is below measurable levels.

Dr Cure noted that the observer disputes the salinity changes that were predicted as the model is not well-founded. Mr Kelly asked whether Dr Cave's comment was considered to be the validation of the model.

Dr Massey stated that oysters for example will close in variable salinities say 19 to 16 PSU (Hawkins 1992) as long as outside temperatures do not exceed over 20 degrees. Dr Cave's expert opinion, Dr Massey noted provided a statement which made comments on the modelling but also made some comments including about the 12PSU. She also commented that there is survivability at those levels.

Dr Tully noted that if the modelled salinity change is 0.15PSU, it is unlikely to have very significant effects on oyster survival but if the critique of the model as presented by Dr Cure / ourselves is correct and there are much more dramatic changes in salinity predicted, then growth rate will be reduced and productivity compromised.

Dr Massey made further points relating to the floodwater and the 6 hours that we were talking about earlier. He noted that the volume of water has not changed. Mr Kelly noted the volume over the period of time of the flood in 2009 has not changed from the beginning to the end but queried whether the volume pre-peak is larger.

Dr Massey noted the final attachment regarding ortho-phosphate. He referred to the location of stations 100 and 400 one of which is upstream of Loughrea WWTP, one 5km downstream of the WWTP. The graph shows significant decrease downstream of the Loughrea WWTP – levels diminish by the time they reach Craughwell. Irish Water have announced a capital investment which includes the Loughrea WWTP.

Mr Keane referred to historical and potential future classifications for the sections given relating to category B results, which have varied. Ms Hayes whether any positive water quality impacts would be measurable in the inner bay. Dr Massey

stated that perhaps not measurable in the Bay but at the N18 Bridge, yes he would expect so.

Mr Keane noted the very important difference between the facts that the peak discharge may come down 6 hours earlier does not mean that water that currently takes 10 hours to travel a distance is suddenly going to travel that distance in 4 hours. The observer did not pursue any suggestion to that effect.

Dr Massey noted that the works that are referred to in the 1990s was conducted privately, was not remedial flood works as we understand them and was not conducted by Galway County Council or the OPW or with the controls and approaches that would currently be employed. Mr Kelly noted the huge difference in the flow rate from the Rahasane Turlough after works carried out in the 1990s.

Later Mr Keane re-called Mr McDonnell to address the rating curve and the volume flux. Mr McDonnell stated that the hydrographs for various events have now been re-examined. He has looked at the actual mathematical model and based on calculations from the graphs and knowledge of the 2009 event he concluded

- just over 36 million cubic metres of water passed the N18 bridge in November 2009
- in the same scenario with the scheme in place the volume increases by 55,000 cubic metres
- in the 2009 event flooding of the N18 occurred 24 hours after Craughwell
- depending on the mathematical approach there could be an argument that the water would come down in between 12 and 24 hours but no faster
- while there is a small increase in depth at Rahasane Turlough, it offers significant retention time and the scheme ensures that large volumes are not let down into the catchment
- at Killeely Beg the scheme provides for channelling of the water in the two-stage channel instead of breaching the banks
- water will come down slightly quicker to the bridge rather than slower because you move it into a straight channel rather than a longer channel
- the peak is arriving two hours earlier than previously experienced and on top of that the peak of the flood event itself is only changing by less than 1%
- if Rahasane Turlough was to be lowered then he would accept the figure of 1.2mill is correct but the figure presented is an over-estimation based on counting the pixels and the error follows in other calculations.

Dr Shannon read a written response to Dr Cure's presentation. She acknowledged the complexity of the situation but in the context of a 1% change the modelling approach was correct. RPS has a suitable suite of models, power supply, hardware and personnel. It is acknowledged that there is not sufficient baseline conditions for predictive modelling of salinity but again it is noted that this was not necessary given

the small scale of changes to the predictive flows. Similarly the design indicated no change to hydrodynamic characteristics so sediment modelling was not necessary.

In response Dr Cure noted the figures that are provided. He referred to integrating the figures between the 17th November and 26th November. The graph from Dr Shannon's brief of evidence includes the peak it also goes way beyond the peak. The final date is 26th November. By that time there is no difference in the downstream flow. He has never argued that the total volume would change. It is the volume change up until the peak that has changed significantly. After the peak in fact the post-work scenario is a lesser flow down the river. He stands by the graphs in his document. He requested that the applicant present the mathematics to An Bord Pleanála.

Dr Cure further noted his method of calculations. He stated that it is the volume flux before the peak that matters as that increases volume flux. 1.2 million cubic metres implies a much higher downstream velocity and a completely different hydrodynamic regime without increased volume flux before the peak. He reiterated points regarding the need to model extreme conditions of sediment dynamics.
There was considerable further discussion regarding the volume flux and the cumulative impact with both parties standing by their positions. The applicant was requested to undertake an exercise to parallel the days of concern to Dr Cure but that was not available at the close of the hearing. Dr Massey stood by his calculations and Dr Cure argued that the 1% change was not correct and there is a considerable difference before the peak. Thus the salinity modelling approach is flawed.

Ms Hayes later queried whether there is data available that could be used really to confirm the mixing and which might help to validate the applicant's report. The applicant responded that Dr Cave for example would have a lot of experience but there is not a lot of collective data for specific events in different regions over the Bay so you have a lot of snap shots only. Dr Cave examined our model and confirmed the results conform to her knowledge. The purpose of her review was to assess their report against her knowledge of the local area where she has been working for 10 to 15 years. Ms Hayes noted Dr Cave's references to the Bay naturally having salinity level of 12 for a number of tidal cycles. The applicant noted that in the past there has been issues and such events have occurred.

The applicant stated that, when the Spring tide comes in it does hold water back for a long period of time but when the tide goes out it goes out an awful lot of further. There is give and take and there is scenarios somewhere between the two that could exacerbate things. If you did a full wide ranging study which was deemed to be un-necessary at this time you could identify the scenarios.

In terms of construction works and a time of significant risk the applicant noted that there would be several points in the year which are critical from either a natural conservation point of view but also from a commercial point of view. Dr Tully noted that the sensitive period is late summer and maybe all of September, for a period of two months anyway he stated. The duration of any sensitive period he stated it depends on the temperature regime of the particular year. Traditionally sale of native oyster stopped between the end of April and 1st September as once water gets to 16 degrees they will start to go into reproduction mode, which could go on for the summer.

Regarding potential mortality Dr Tully noted that if salinity is below 15 PSU but water temperature over 25 degrees we start to see mortality of native oysters after seven days. In colder condition the metabolic rate is reduced so they are able to open long periods associated with storm runoff in winter months so they are designed to survive within these conditions. It was clarified that the highest water temperature we have ever recorded would be 19 degrees in the middle of the hot summer. At 11 or 12 PSU they are not feeding as the low salinity causes them to close so for anything over a period of 3 to 5 days you can see there is no growth over that period and obviously over an extended period you can get mortality purely because they are not feeding.

Dr Tully referred to other shellfish noting that mussels are much more tolerant to those kind of conditions and can survive extended periods of low salinity although dwarfing does result after several weeks.

Dr Tully commented on commercial size. Once salinity levels rise normal feeding resumes. If such events happen several times over a season they might not reach commercial size. He referred to actual overall survival (where they are not feeding) as being possibly as long as 24 days. He stressed that survival is not commercial growth.

He clarified that the tidal situation that Rachel Kane referred to with neap tides and westerly or north westerly can take a week or ten days sometimes depending on the tidal cycle. He discussed a scenario whereby there could be three weeks of unsuitable conditions in which case you are not going to have any oysters left. Unfortunately there isn't enough, the science isn't there to tell us more about mortality.

The observer was requested to consider whether there were any matters relating to phasing or monitoring which the Board might consider relevant to attach by condition in the event of a grant of permission. Dr Tully later handed in a submission in response which related largely to monitoring requirements and the applicant indicated a number of these could be facilitated.

After a short break Dr Cure queried at what rate of discharge the (two-stage) channel would overflow and the response was that this would occur at mean flow. Dr Cure

also referred to a peak flow of 80 cumec compared with 99 which was presented this afternoon. Mr McDonnell noted that the difference between the two numbers are related to the inclusion of the Rack Stream. The modelling was undertaken for the 99 cumecs. Dr Cure asked for the graphs at the N18 Bridge. Mr Keane indicated that there might be time constraints. The decision was made to proceed with the available data at that time. The green and red lines on the graphs were described and the applicant noted that it was necessary to compare like with like. Dr Cure stated that he is working from the data in the EIS (Figure 2.8 of Appendix E) while there is 20 cumecs of a difference between the applicant's figures.

Mr Kelly queried one of the comments in one of Dr Cave's papers in response to which Mr McDonnell stated that the 2014 report refers to earlier schemes, which is not before the Board. The 1% increase is at peak while the 10% is prior to peak.

Ms Hayes referred to Dr Cave's 2012 report which appears to refer to an earlier model. Dr Shannon indicated that the earlier schemes gave rise to increased peak discharge and a faster through put of water and a change in salinity of up to 2 PSU. The scheme was changed in response to consultation. From memory she agreed that a 13% increase in peak discharge gave rise to a maximum of 2 PSU change in salinity.

Dr Tully in response to further questions stated that the interpretation of a change of 1-2 PSU depends on what the starting position is. Regarding low salinity conditions he did not know how often these occur (and they would change every year) but if there is an increase in frequency of such event there is a deterioration. The 12 PSU is not even specific in relation to oyster.

Mr McDonnell noted that the mean flow is 6.7 cumec at which time the second channel comes into play. So 40-50% of the time the two-stage channel will operate – he agreed that when the flow is over 6.7 cumec there will be water in the second level.

Mr Kelly noted that the system is designed as a flood relief scheme – Ms Hayes noted that perhaps the overflow capacity would not be full. Mr Kelly queried did that mean that there would be an increase flow of freshwater into the system – would it come out faster with the new regime. Mr McDonnell noted that a November 2009 event could happen next year and on a probability the two stage channel will be used more frequently. But that did not mean that it would release water quicker into the bay as when it hits the two-stage channel it is coming down slower – on average it is incorrect to state that it will be coming down quicker.

Dr Massey noted that research indicates that low salinity conditions could be reached a number of times over a few years. The issue is the duration however. Under the scheme as the volume of water is not changed the worst case with north-west winds following heavy rainfall, while he did not have the information he noted that all of those factors would have to come into play to make a difference. It is

when those events correlate that there would be impacts. Dr Tully noted that the majority of rainfall coincides with westerly winds.

Ms Hayes queried Dr Shannon about what constituted the worst case and how wind was considered in the modelling. Dr Shannon noted that for a very small change in flow then it was considered wind would not have a large effect.

Dr Massey noted that the level of 12PSU is based on information which is relevant to oysters as well as other shellfish. Dr Cave refers to data from the 1980s referenced in Byrne 1995 which notes salinity regularly reached 12 or less. The modelling is done on the post 1990 data.

Mr Allison noted that if 12PSU is the critical threshold and there are very frequent low salinity events then juvenile oysters would not be present in such numbers. Dr Massey noted that there is a good crop of oysters and that oysters are adapted to living in low salinity environment. The expectation would be for long durations of exposure there would be evident changes. Short duration episodes do not affect them. The Byrnes paper refers to reaching 12 PSU of less in periods of high rainfall in Spring – there are tidal and seasonal variation to which they are adapted. Inputs from Kinvara direction may extend the duration.

Ms Hayes questioned the availability of data to calibrate the model to show the mixing is correct. Dr Shannon stated that there is not specific data relating to the 2009 event and what we have done in the review of paper by Dr Cave who has done monitoring – her audit gives us confidence that the model is working. She clarified that the monitoring at point 1 in the paper gives confidence in the output of the model – Dr Shannon referred to the graph on page 37 for example and the top figure A which demonstrates that she has been out there and has knowledge and experience of the conditions.

Dr Shannon clarified that baseline information would mean knowing the conditions for the duration of the event and having an understanding of the event. Dr Cave has a baseline but not a completely prescribed one. We have some information but not enough for a fully specified baseline for our work. She measures salinity and temperature but only at specific locations – the points she uses are of interest but more data would be needed including data from a longer duration and including if possible a flood event and including tidal heights and currents and so on. A flood event would be required to be included as that is what you are trying to model.

Dr Cure considered that the arguments presented is weak. Dr Cave's feelings about whether the model is correct or not is not very specific. Mr Kelly queried did she assess the figures or validate the model. He noted that she is a chemical oceanographer. Dr Shannon stated that in terms of the output her view is important. RPS has 40 years of experience in modelling and in terms of the setup and so on that was their role. Dr Cave was not asked to look at model type etc. just to feedback on the results.

Mr Kelly in conclusion noted that there is no change in the position held by the observer Clarinbridge Oysters Co-op / Michael Kelly Shellfish. Correct modelling with correct baseline data is required.

Mr Rob Lynch archaeologist in response to questions relating to site investigations noted that at the time of the walkover some areas were flooded and they have not returned to them. Other data indicates that there are no features in that area. The possibility of excavation and potential impact on the scheduling of a scheme which is already on a tight timeline was noted. Mr Lynch referred to the recommendation for advanced archaeological works at the *fulacht fiadh* and the medieval site which would be undertaken within a week possibility. Underwater surveys would be in advance of construction to ensure that any issues are resolved prior to works. If features are uncovered in situ in the river then that would be subject to underwater excavation and the work would require a licence which would take 3 weeks. As the majority of the riverbed is channelised this is a factor in terms of the archaeological potential.

Regarding the bridges which are protected structures the Craughwell bridge in particular and its very old nature is noted. The applicant was queried as to whether extraordinary measures would be required. The underwater archaeological assessment would identify any possible earlier bridge footings. The detailed design of underpinning would be assessed by the conservation architect to ensure that the best practice is used including for the temporary works during construction. The negative effects would include the flood relief arches at Dunkellin Bridge. There would be a loss of fabric and an impact on the appearance. In the absence of detailed design at the moment the works would be commissioned by the local authority for undertaking by the contractor. A condition to that effect would be acceptable.

Regarding potential cumulative impacts Ms Kearney noted that by early 2016 the major road scheme would be completed thus eliminating concerns about cumulative impacts including in relation to birds at Rahasane Turlough. Regarding the exact alignment of the M18 the exact route has now been clarified at the end of the submission.

On invitation Dr Tully read out a list of requirements which would be suitable for the construction phase. This included continuous recording at three points of currents, salinity and other factors, increased monitoring of shellfish, an additional sampling point for E.Coli. Ideally this data would be incorporated into a fully calibrated model. During the works if monitoring data shows poor results and if the model predictions are incorrect then what will be done and who is responsible. Other synergistic effects including for example the control of cattle upstream. The full requirements are presented in a written submission.

The Inspector asked reminded the applicant that in the event that any of these matters were to be subject of condition the standard requirement would be that the condition be strictly relevant to the development.

The applicant responded to Dr Tully's requirements. A pre-construction baseline would be established for three months minimum prior to works (a single monitoring point) which would be at the most suitable point below the scheme in the vicinity of the N18 bridge or just downstream of it. That would include a turbidity monitor of the type suggested. The monitoring would be in place for a minimum of three months post construction. The monitoring would be with a logger which would be checked and downloaded by the Council's Environmental Officer which would require checking every month. New data will not be collected and a new model will not be generated. Regarding increased monitoring of shellfish this would be subject to other influences. *E. Coli* monitoring would be undertaken. Sediment modelling is not required. The CMP indicates that the works will be stopped if a negative effect is identified and the Environmental Officer who will report to GCC will be responsible.

Mr Kelly indicated that a baseline through the winter period would be appropriate. The critical time is October. Mr McDonnell noted that by the time contractors are procured the start-time would be May 2016. Mr Kelly noted that the oysters are at the end of the estuary and that monitoring would be needed at that point. Mr Keane indicated again that the monitoring would be restricted to an area which would be affected by the scheme only – a point further down would have other influences. Mr Kelly again indicated that the effect of the works is felt down in the estuary and it is there where the monitoring is needed. The Council was queried whether there is other ongoing monitoring to which this programme might be attached. Dr Shannon affirmed that there is some water quality data collection at stations but they would need an upstream and downstream point and the sites also would need to be calibrated properly. Mr Kelly noted that in relation to the shellfish monitoring it would still be within the Dunkellin catchment. Mr Keane re-iterated the earlier point about the other influences in the bay which impact the oysters.

Mr McDonnell was asked what would be the effect of undertaking the scheme if the works downstream of Rinn Bridge was not undertaken. Protection of the houses at Killeely Beg Bridge and improvement of water quality as a result of the two-stage channel would not then happen. The possibility of silt entering the river from the works at and below Killeely Beg Bridge would be eliminated. However, these are low risk as most will be undertaken in the dry and behind a berm to be removed at the last minute. In terms of the impacts into the bay it would have a virtually unchanged effect on the flow entering the bay – Rahasane Turlough is a massive retention pond which holds the water in place. The peak flow would mainly be retained in Rahasane Turlough and there would in his view be no change in the peak flow downstream of Rinn Bridge – it is effectively a 'do-nothing scenario for the lower part of the scheme – there are also about 9 houses at Dunkellin on septic tanks and farmyards which would still flood and could rapidly bring *E.Coli* to the bay.

Dr Shannon was queried in relation to the Schedule of Commitments and whether data could be collected over a 3 to 6 month period and used to confirm or support the mixing in the model – an 'in-between' scenario in terms of the amount of data. Dr Shannon stated that the model could be reviewed with additional data without re-designing the model but the measurement period would have to be quite specific for the purpose – this was not done as it was not deemed necessary.

When pressed on this matter she indicated that more data could be collected and compiled with Dr Cave's data. However, Dr Cave had the resources of the whole institute and was happy with the way it was carried out. If it was to be done you would have to collect enough data to ensure that you caught an event – technically you could put the monitors out for 100 years and not get an event – one winter would not suffice. Ms Hayes again questioned on the matter of salinity. Dr Shannon stated some work could be done to strengthen Dr Cave's report. Regarding the statement that we are overestimating the mixing in the vertical that is refuted – the approach is conservative. Responding to a question regarding further data collection it would have to capture a large event – as Dr Cure said earlier each event is very different and there is an ever changing baseline effectively. You don't in normal circumstances get the same type of mixing that you get in an extreme storm event. Ms Hayes again requested whether there is any value in modelling normal winter storms. Dr Shannon stated that you would need to present a different type of model which the applicant re-iterates is unnecessary.

Closing statements were taken and the hearing was closed.